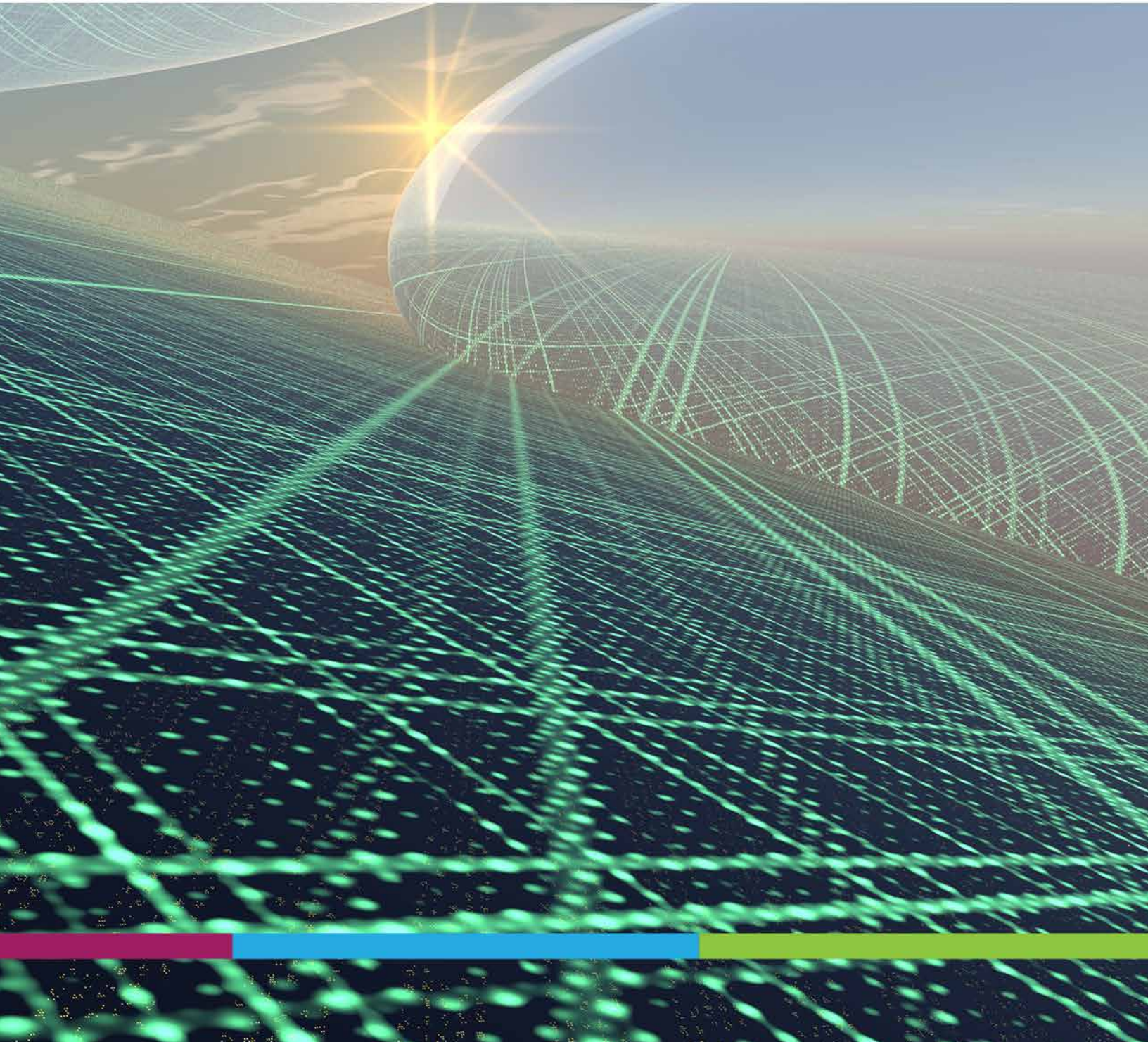
Pacific Northwest
SMART GRID
DEMONSTRATION PROJECT

2013 ANNUAL REPORT



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Introduction

Greetings! From the Rockies to the Pacific Ocean, the Pacific Northwest Smart Grid Demonstration Project (PNW-SGDP), the largest effort of its kind in the nation, continued its progress in 2013. Over the past four years, we have achieved one exciting milestone after another—and now the finish line is coming into view. Even so, much work remains, and we recognize that the completion of this project does not represent a conclusion; rather, our outcomes will inform new phases of activity across America that will help advance the nation to the ultimate destination of a more efficient, sustainable and resilient power system. Everyone involved in the PNW-SGDP should be very proud of their efforts and excited about what this project means for the country.

The complexity of our undertaking has been challenging. In 2013, we deployed and tested the new transactive control technology. During this time, our focus has shifted to collection of data from thousands of smart grid enabled assets, such as smart meters, smart transformers and distribution automation equipment. We're beginning the challenging process of examining this data, identifying issues, working toward solutions and building understanding of the look and feel of a smart grid on a wider scale. Along with our successes, we have learned many lessons, which have helped to correct our course. Clearly, the advances of the past year could not have been possible without the dedicated, outstanding efforts of the entire PNW-SGDP team.

One of the highlights of 2013 was the May 31 opening of Portland General Electric's Salem Smart Power Center in Salem, Ore. The 8,000-square-foot facility, partly funded by the U.S. Department of Energy (DOE) via the PNW-SGDP, is a showcase of innovation. The center's large-scale energy storage system and other capabilities create a microgrid for about 500 businesses and residential customers. Through this facility and the data it provides, we're going to gain valuable insights into energy storage, demand response, renewable energy integration, transactive control and other areas. A number of prominent smart grid advocates, including U.S. Sen. Ron Wyden of Oregon and Patricia Hoffman, Assistant Secretary for DOE's Office of Electricity Delivery and Energy Reliability, were on hand at a ceremony to open the center. I was honored to be one of the speakers at this event, and am excited about the

Speaking at the opening of the Salem Smart Power Center.

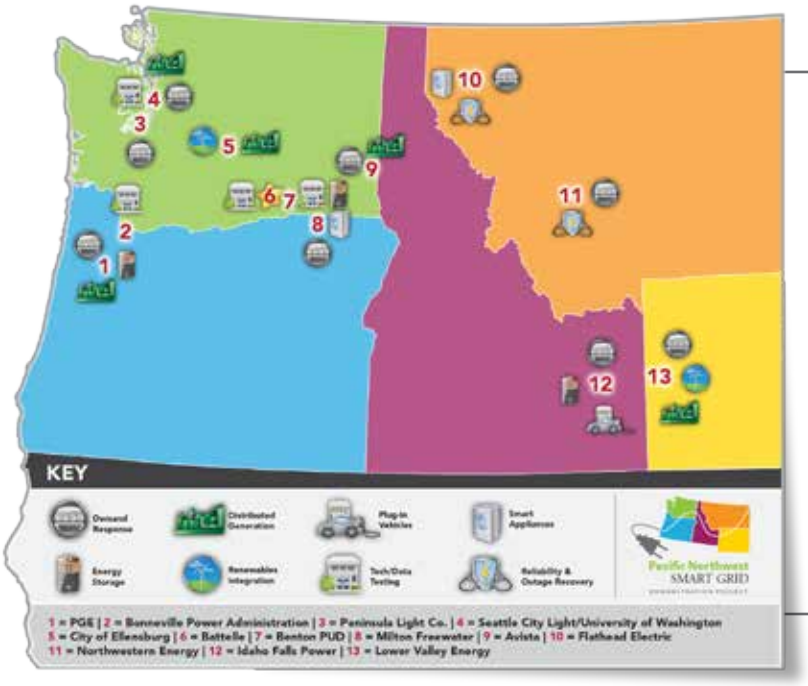
facility and its capabilities. You can read more about the center in PGE's project report in this document.

Outside of the region, the PNW-SGDP continued to generate national—and international—interest in 2013. The project was a focal point of a panel session on DOE smart grid demonstration projects at the national IEEE Innovative Smart Grid Technologies Conference in February in Washington, D.C. And, we continue to be one of the projects that DOE highlights in its participation in the International Smart Grid Action Network. Our project has also been invited to discuss our experiences and lessons learned with other smart grid projects. For example, the Center for the Commercialization of Electric Technologies, a Texas-based group, asked me to share the PNW-SGDP story at an October 2013 wind integration event in Lubbock, Texas.

Looking ahead, the demonstration project's focus on data collection and analysis will come to fruition during the course of 2014. As this work concludes, we will begin to prepare for the end of the PNW-SGDP and post-closeout activities, always with an eye toward maximizing the investments made in this project to advance national smart grid objectives in the future.

In the next few pages, you will find selected PNW-SGDP highlights from our participating utility and technology partners that demonstrate the investments of the past year. You can continue to follow our progress on the PNW-SGDP website, www.pnwsmartgrid.org, and on Twitter, @PNW_SmartGrid.

Ron Melton, Project Director



The Project, by the Numbers

- Runs five years and involves **60,000** metered customers across five states
- Involves the Bonneville Power Administration, 11 utilities, six technology partners and is engaging responsive electricity system assets of approximately **80 megawatts**
- Budget of **$178 million**, with a 50/50 split between U.S. DOE funds and project participants.
- Includes participation from the University of Washington and Washington State University.

Our Objectives

1. Develop communications and control infrastructure using incentive signals to engage responsive assets;
2. Quantify smart grid costs and benefits;
3. Advance standards for interoperability and cyber security approaches; and
4. Facilitate the integration of wind and other renewables.

One of the PNW-SGDP highlights of the year was the May 2013 opening of the Salem Smart Power Center, which was partly funded through the PNW-SGDP. The photo shows a bank of batteries being tested at the center. Read more about this facility on page 9.

Transactive Control

Transactive control is a distributed system that uses signals communicating the current and expected state of the grid, so that electricity users and energy resources can adapt to reduce strain on the power system. The technology will allow consumers to benefit from adjusting their electricity consumption while improving overall system efficiency, reliability and reducing operating costs for utilities.
In aggregate, application of transactive control by our nation's utilities should help reduce the need to build costly thermal resources, reduce the country's carbon footprint, smooth out peaks in electricity use, help integrate intermittent renewable resources—like solar and wind—and help keep future costs from rising as quickly as they otherwise would.

2013 PNW-SGDP SUBPROJECT PROGRESS REPORTS

3TIER

Providing renewable energy forecasts

3TIER delivers real-time wind forecasts, as well as technical expertise to meet project objectives for renewable energy integration.

3TIER is participating in the PNW-SGDP as a project-level infrastructure partner (PLIP). The PLIPs are responsible for designing, building and testing the infrastructure needed for the transactive control system. 3TIER's role in the project is the renewable energy forecast provider.

For the majority of wind assets in the Pacific Northwest, 3TIER is tasked with providing wind energy production forecasts on an hour-, day- and week-ahead timeframe, and on a project specific and regional basis. In addition to delivering forecasts, 3TIER is responsible for providing technical expertise in support of meeting the project objectives, particularly the objectives related to successfully integrating renewable energy into the system.

3TIER has met all of the deliverables to date as described in the scope of work and current project schedule, with the caveat that Battelle has decided to forego the use of the solar forecasts, which were in the original scope of work. 3TIER is currently providing real-time individual wind forecasts for the majority of the wind assets in the study region, as well as a forecast for the Bonneville Power Administration region. 3TIER has actively been involved in collaborating with project participants with regard to integrating the renewable energy forecasts into the signal and meeting the renewable energy project objectives.

For more information, please contact Amy Vandervoort at avandervoort@3tier.com.

Alstom Grid

Creating the project's power system "reality" through real-time data and forecasts

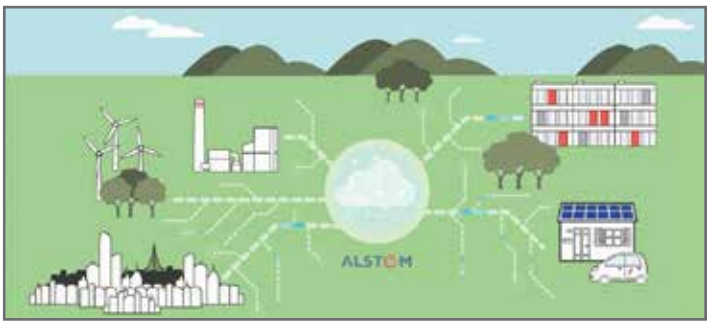
Alstom Grid provides sophisticated power systems software to model regional behavior in a transactive control environment.

Alstom Grid is a worldwide leader in smart grid technologies, participating in more than 50 smart grid demo and pilot projects around the globe. The company's Global Center of Excellence for its Network Management Solutions business is based in Redmond, Wash., making its team of over 500 energy information technology experts proud residents of the Pacific Northwest. From Redmond, Alstom employees develop software that controls over 70 percent of the generation capacity in the United States. And, the majority of the largest grid operators around the world are using Alstom's e-terra energy management solutions to monitor and control their networks.

Alstom's e-terra software constructs the power system "reality" in which the PNW-SGDP operates. It receives real-time information about the state of the regional power system and produces forecasts for the future state of the system. This is done using actual data from the Bonneville Power Administration and 3TIER, including wind forecasts, fuel costs and consumption patterns. The current and future state of the grid is used by the demonstration project to construct the transactive control signal that many of the experiments are based on.

Notable milestones accomplished in 2013 included:

- Completion of expert reviews of resource functions
- Tuning and updates to supplied toolkit functions
- Deployment of Alstom's **e-terra***vision* visualization tool and associated training to the Electricity Infrastructure Operations Center.



Alstom Grid's part of the project starts by gathering as much raw data as possible—wind forecasts, fuel costs, energy levels, consumption patterns and more—before sorting and filtering it for details.

The objectives the PNW-SGDP aims to achieve—integrating renewable generation, enabling consumer choice and improved grid efficiency—are at the heart of why Alstom continues to invest research and development in smart grid demo and pilot projects.

Looking forward, the Alstom team is eager to learn from the ongoing sub-project experiments to glean intelligence about this active market with dynamic pricing adjusted to the various incoming data.

The PNW-SGDP is very important to Alstom and serves as an invaluable opportunity to test and refine technology in a modern grid environment, from right in Alstom's own backyard.

For more information, please contact Gayle Wooster at gayle.wooster@alstom.com.

Avista

Building a foundation for the future in Pullman

Avista modernizes grid, improves reliability and enhances the customer experience.

Through the Smart Grid Demonstration Project, Avista has created the region's first "smart city" in Pullman, Wash.

Avista has modernized its grid with upgraded substations and new software, sensors and switches that allow operation of its distribution system in new ways.

Avista installed smart transformers to help improve the efficiency of its distribution system in Pullman.

As a result, Avista is improving reliability, reducing energy losses and automating activities that have been performed manually. Equally important, customers will experience fewer and shorter power outages and save money on their electric bills. They'll gain access to information to make more informed decisions about how they use energy.

2013 milestones in Pullman include:

- Feeders fully operating in automated mode with voltage optimization, achieving an average energy savings of approximately 2.5 percent.
- Rolled out real-time energy savings calculator to validate distribution efficiency gains (voltage optimization).
- Started remotely adjusting the temperature for 75 smart thermostat pilot participants. Very few people are over-riding the temperature changes.
- All assets at Washington State University totally functional and available for demand response adjustments.
- Automation capabilities result in enhanced customer satisfaction while reducing truck rolls for service connections.

During the first quarter of 2014, Avista will install fault indicators and will pilot texting capabilities to notify customers about their energy usage. All the lessons Avista learns from Pullman will inform future system upgrades.

For more information, please contact Laurine Jue at Laurine.Jue@avistacorp.com.

Bonneville Power Administration

Leading the smart grid business case

The Bonneville Power Administration focuses on developing a business case for a smarter grid, while also contributing data feeds and conducting outreach for the project.

Over the past year, the Bonneville Power Administration (BPA) completed significant deliverables for the PNW-SGDP.

BPA continues to provide near-real-time data feeds to the project's regional modeling effort (1,296 files per day), which supports the

BPA data helps inform visualizations of regional energy generation at the Electricity Infrastructure Operations Center in Richland, Wash.

transactive control system calculations with regional hydro generation, wind generation and balancing area load data feeds. As a major partner in the project, BPA contributed greatly to outreach and communication efforts, briefing many entities in the region, including power planning organizations, legislative committees and many regional conferences. The agency also helped share success stories from participating utilities at well-attended forums such as Efficiency Exchange, BPA's joint conference with the Northwest Energy Efficiency Alliance, where industry groups and efficiency researchers share experiences and learn about the latest energy-saving innovations and programs.

In 2013, BPA continued to focus on its development of regional business cases for investing in both smart grid and demand response infrastructure and technologies. With lead consultant Navigant, BPA is creating a rigorous, risk-informed evaluation of smart grid costs and benefits. The agency is also reviewing an update to its regional business case, which in 2013 concentrated on demand response. These efforts will continue in 2014, leveraging the computational model created by Navigant, with an emphasis on obtaining the project's test data and analyses provided by Battelle. This will help Northwest entities—energy organizations, electric utilities and other interested parties—better evaluate the opportunities and challenges of future smart grid investments.

Furthermore, BPA is spearheading a significant effort to align the demonstration project's four primary goals in the project's final 18 months. This alignment will continue into 2014, and include BPA, Battelle and participating utilities. The transactive control system and its potential in the Northwest will remain an important area of interest in this process.

For more information, please contact Lee Hall at ljhall@bpa.gov.

Ellensburg

Ellensburg sheds light on solar and wind energy options

City's project provides insights into viability of renewable energy sources.

At the City of Ellensburg's Community Renewables Park, installation of 40.5 kilowatts of additional thin-film nanotechnology solar panels and nine different wind turbine models surfaced new information about the benefits of centralized and distributed renewable energy for the utility and its customers.

Results from the solar panels generally were positive. The devices produced energy even on cloudy days, maintenance costs were low, and the actual amount of electricity generated was greater than the city's estimate.

Results from the nine wind turbines--selected to be compatible in size with what residential and small commercial customers would likely install on their own—were uneven. Of five operating turbines, three produced electricity—though at a higher cost than wholesale power rates and city retail residential rates. Four of the wind turbines proved inoperable. Along these lines, one of the city's key challenges in launching the project proved to be identification of wind turbine technology that was commercially ready, efficient and safe.

The city continues with operation of the solar panels, including credits to customers. The wind turbine study has been completed and the turbines have been removed.

For more information, please contact Beth Leader at leaderb@ci.ellensburg.wa.us.

The City of Ellensburg tested solar panels and wind turbines.

Flathead Electric Cooperative

Empowering consumers in their use of energy

Flathead is advancing new technologies, analyzing data and sharing its experiences with other utilities.

Flathead Electric Cooperative (Flathead) continued to work diligently to meet the requirements of the scope of work in the PNW-SGDP. Flathead has consistently presented and maintained a positive perception of the project with members and regional stakeholders despite delays in project implementation that have affected member attention spans. In 2013, Flathead was able to measure the relative impacts of test events in the three comparison groups—Home Energy Network, In-Home Display, and Water Heater Demand Response Unit. Preliminary results indicate there is more positive impact on household usage for the Home Energy Network than the other two groups, however, the water heater units did show a good expected response and continue to be the most reliable traditional technology for residential demand response. Flathead has maintained a 95 percent participation rate, with the highest loss of participants continuing to be in the In-Home Display group. As of November 2013, Flathead's volunteer count was 317.

As previously reported in 2012, Flathead completed communications work and the Advanced Metering Infrastructure (AMI) system upgrade in the Libby and Haskill substation areas, which enabled additive technologies such as Water Heater Demand Response Units and In-Home Displays to be demonstrated within the project, and enabled Flathead to utilize Wi-Fi metering available from Aclara. Flathead has also made available to members another avenue for viewing and assessing usage in their homes with the National Information Solutions Cooperative (NISC) Meter Data Management (MDM) System. MDM allows members to view meter reading and spending information, average daily usage, the current day and day-before usage, as well as to-date and last billing periods. In addition, MDM also provides an analysis section where the member can view time of day, monthly, and day-of-the-week average usages.

All members whose meters were on hourly data collections in the Libby, Kootenai and Haskill substation areas, and who had an active e-mail billing account with Flathead, were activated in MDM. These members were sent a targeted e-mail with information and instructions on navigating and using the program, as well as contact information for assistance when needed. Outreach was conducted to recruit participants among Flathead's employees and Board of Directors. Training was provided to all customer service staff who potentially may work with a member who had MDM available to them. This has been well received and is being utilized by both members and staff.

Flathead also took advantage of opportunities to represent the demonstration project at several key events in 2013. Russ Schneider presented at "Face to Face Meeting Subproject Presentation," June 12, in Portland, Ore. He also gave presentations on the "Flathead Demand Response Pilot and Smart Grid Experience," at the Montana Electric Cooperatives' Association, June 19, in Shelby, Mont., and "Residential Demand Response and Home Energy Network Experience," at the Montana Electric Cooperatives' Association, October 1, in Great Falls, Mont. Ross Holter, Energy Services Supervisor, presented to the Northwest Power & Conservation Council, June 12, in Missoula Mont., and at the Montana Economic Development Summit in September in Butte, Mont., that highlighted Flathead's general innovative approach to energy issues in Montana.

Using hourly data collected over the last two years, Flathead continues to analyze data, utilizing various methods to determine load changes during critical peak periods, as well as to calculate potential member rebates as detailed in the project and plan for future potential demand response options, which were presented to Flathead's board recently. Flathead's trustees are considering future programs as part of the normal budget process. Flathead's sub-project continues to be on schedule, within budget and progressing to completion in August 2014, with reporting to be wrapped up in January 2015.

For more information, please contact Teri Rayome-Kelly at t.rayome-kelly@flathead.coop.

Idaho Falls Power

Evaluating technologies for peak power demand reduction

In 2013, Idaho Falls Power tested water heater load control switches and programmable thermostats, explored new renewable energy approaches and held community smart grid informational forums.

Idaho Falls Power (IFP) serves more than 22,500 residential customers and 3,500 commercial and industrial customers. The utility's

participation in the PNW-SGDP is multi-faceted, yet geared toward improving reliability while maintaining low rates for its customers.

In addition to testing automation and Battelle's transactive control capabilities on the city's 450-mile transmission and distribution system, IFP's efforts in 2013 focused on vetting technology aimed at reducing the peak demand for power. The utility targeted electric water heaters and heating and cooling systems in the homes of volunteers to test this technology via demand response events.

Load control switches were installed on electric water heaters in the homes of approximately 240 volunteers, allowing the utility to remotely cycle off the water heater during periods of peak electric consumption. Hour-long demand response events began in late July, every weekday except holidays, and will continue for one year.

Programmable thermostats proved a harder sell in the cold climate of southeast Idaho, but approximately 40 customers volunteered to install the devices in their homes. These demand response events also took place on weekdays during the summer, when the demand for electricity peaked. The events resumed in December and are expected to continue through March 2014. The events consist of adjusting the temperature up or down by three degrees.

Collection and evaluation of the data generated through these events has been slow to materialize, but IFP now is performing data analysis to determine whether demand response is a viable option for its customers and, if so, whether the technology employed is adequate.

Data-gathering also continues throughout the year on IFP's Battery/Solar/Vehicle Test, which is intended to develop a better understanding of renewable energy. The test consists of four Chevrolet Volts, a 10-kilowatt battery system and a 1.5-kilowatt tracking solar array.

An automated data collection system has allowed the utility to measure the impact of renewable resources in its portfolio, and to better understand the impacts of cold weather on battery life.

Meanwhile, IFP's outreach efforts intensified throughout 2013 with a series of public forums. The purpose was twofold: To educate customers about the PNW-SGDP and help inform them about the Elster Advanced Metering Infrastructure meters the utility began installing city-wide in July.

The "Get Smart about Smart Grid" series was hosted by IFP and three partners—Idaho National Laboratory (INL); the Center for Advanced Energy Studies, a research and education partnership between INL and three state universities; and the Partnership for Science and Technology, a local nonprofit.

The series consisted of four meetings, each addressing a different topic:

- What is Smart Grid?
- Securing the Smart Grid
- Smart Grid and Your Health
- Idaho Falls Power and the Smart Grid.

Turnout was good, particularly at the third and fourth meetings. The third meeting focused on potential health effects and featured presentations from two researchers, while the fourth delved into IFP's smart grid-related plans.

For more information, please contact Matt Evans at MMEvans@ifpower.org.

Milton-Freewater

City taking demand response activities to new levels

The City of Milton-Freewater builds on its historic, innovative energy management approaches by advancing demand response strategies.

Milton-Freewater City Light & Power is the smallest utility in the PNW-SGDP, with about 4,600 customers. However, the utility has extensive experience in demand response projects, having been a Northwest leader in this technology since 1985.

As part of the demonstration project, the city continues to make progress and provide new insights into demand response. Examples include:

- Milton-Freewater used a one-way communications system on its load management program before the PNW-SGDP, and has replaced those one-way devices with two-way units.
- All of Milton-Freewater's load management demand response units were released to transactive control in November 2013. There are approximately 800 demand

response units in the program. With these, the utility controls electric space heat, electric water heat and air conditioning in customer homes. Customers receive a discount on their utility bill for participating in the program. The demand response project is used to lower the utility's system peak demand.

- Voltage sensing demand response units were released to transactive control in September 2013. Currently, the city has approximately 100 voltage sensing demand response units on electric water heaters in the Grid Friendly Appliance test case. In this project, which is another peak shaving activity, the water heater will shut off when it senses lower system voltage.
- Milton-Freewater's Conservation Voltage Reduction (CVR) test cases—CVR Peak Shaving and CVR Conservation—were released to transactive control in September 2013. The CVR peak shaving test case will lower distribution system voltage a total of 4.5 percent during the times of the utility's peak demands, which will lower the demand of all resistant loads. This program will reduce an average of 1.5 megawatts of load. The CVR Conservation test case will lower the voltage on four of Milton-Freewater's distribution feeders by 1.5 percent. The energy usage of those customers will be monitored to prove energy savings. The goal is to prove the theory that for every one percent in reduction in voltage there is a one percent reduction in kilowatt hours.
- The city was involved in project outreach in several ways. In April, utility representatives presented information about the Milton-Freewater demand response system to BPA, the DOE Richland Operations Office, the City of Richland, Wash., and the Oregon Trail Electric Cooperative. In December, a representative from the utility gave a presentation on demand response to PNGC Power. Additionally, the city was featured prominently in a BPA-developed flier about demand response in the Pacific Northwest that showcases efforts, including Milton-Freewater's involvement in the demonstration project.

The City of Milton-Freewater's team is looking forward to its continued participation in the project. The team is eager to see the outcome of the experiments that they have been involved with. The city sees this as an invaluable opportunity to be a part of the smart grid future.

For more information, please contact Barbara Chadek at Barbara.Chadek@milton-freewater-or.gov.

Helena, Mont., homeowner Ryan Wilkinson holds a device that transmits power usage from a specified outlet to his in-home display, which allows him and NorthWestern Energy to monitor his electricity usage. Wilkinson's home was the first house in Helena to be equipped with the technology, which was installed as part of the PNW-SGDP. The photo and an article appeared in a March 2013 edition of the Helena Independent Record newspaper. Photo by Eliza Wiley, Helena Independent Record.

NorthWestern Energy

Charting new territory for the smart grid

Integration, testing, and data collection activities proceed in Montana

NorthWestern Energy is completing year four of its five-year Smart Grid Demonstration Project as part of a larger region-wide effort. NorthWestern and the other partners and utilities in the PNW-SGDP completed the first half of project data collection.

During 2013, all activities have been initiated and tested in distribution automation. Substation and line equipment installations were completed in Helena and Philipsburg, Mont. Control software and systems were purchased and installed, and the system acceptance test was completed in the first and third quarters of 2013. Energy Efficiency (Volt/VAR) substation and line equipment installations were tested in Helena and continued to be tested in Philipsburg during 2013. All activities in Helena that relate to the customer side of the meter are complete and testing continues through 2014.

Integration of the State Capitol building in Helena continued in 2013 and testing will commence in 2014. Integration of NorthWestern's assets into the regional control scheme also were completed in the last quarter of 2013. Data collection will continue into 2014 and will be complete by year end.

For more information, please contact Claudia Rapkoch at Claudia.Rapkoch@northwestern.com.

Portland General Electric

Testing smart grid technologies to build a more efficient, sustainable grid

Portland General Electric opens smart grid demonstration facility in Salem, Ore.

Portland General Electric (PGE) and its project partners are demonstrating a more reliable, sustainable electrical grid at the Salem Smart Power Center, an 8,000-square-foot facility that opened in Salem, Ore., in May 2013.

At the center, PGE, the U.S. Department of Energy, the state of Oregon and other partners are testing several smart grid technologies, including energy storage, dispatchable standby generation, remotely operated power line switches, demand response, renewable energy integration and transactive controls.

What's more, industry, business and school groups can get a unique insider's view of the working smart grid demonstration facility, including a massive bank of batteries, the inverters, and educational exhibits that describe the technologies.

Outfitted with a large-scale energy storage system, the Salem Smart Power Center is helping PGE test how to store and better integrate variable renewable energy sources into the electrical grid, along with other smart technologies. These technologies will work together to create a highly reliable micro-grid—an area able to generate and sustain its own power for optimal reliability--serving about 500 business and residential customers in southeast Salem.

The $25 million project was built in collaboration with Eaton Corporation and EnerDel, Inc., and received DOE matching funds as part of the PNW-SGDP.

"This project is designed to help PGE and our demonstration partners learn how to integrate new technologies that could improve the efficiency of the grid," said Jim Piro, PGE's President and CEO. "Building a more efficient, sustainable grid is important for our customers, our economy and the environment."

U.S. Sen. Ron Wyden of Oregon, chairman of the Senate Energy and Natural Resources Committee, attended the May 31 grand opening and toured the new center.

"Increasing renewables, reliability and storage moves our country toward a low-carbon, more sustainable energy future," Wyden said. "This Smart Power Center and the Pacific Northwest Smart Grid Demonstration Project show that when it comes to energy innovation, Oregon takes a back seat to no one."

The center is equipped with a 5-megawatt, lithium-ion battery system designed by EnerDel. Eaton Corp. provided engineering expertise and two-way inverters to manage and operate the energy storage system. The system works with State of Oregon standby generators to create a high-reliability zone to reduce service interruptions for PGE customers. The Oregon State Data Center, Oregon Military Department and the Anderson Readiness Center also are participating in the project.

Salem-based Kettle Brand, pioneer of the kettle-cooked potato chip and an industry leader in sustainability, is providing solar data from its 616-panel rooftop solar installation to help test how storage can help solar energy benefit the grid when it's needed most.

To test demand response technologies, several PGE business customers are volunteering to cycle their heating, cooling and other systems on and off throughout the day or shift their use to off-peak.

PGE is performing ongoing tests of its own Smart Power® software that uses transactive control technology to look at current and forecasted energy prices and bring resources online at the optimal time to ensure customers receive the most benefit from energy resources at the least cost. For example, PGE stores energy at the center when energy market prices are low, and then pulls from this energy storage, rather than buying power, when market prices are high.

U.S. Senator Ron Wyden (right) celebrated the opening of PGE's Salem Smart Power Center. Joining the senator (left to right) were Dave Robertson, PGE Vice President of Public Policy; Elliott Mainzer, Administrator of the Bonneville Power Administration; Carol Dillin, PGE Vice President of Customer Strategies and Business Development; Patricia Hoffman, Assistant Secretary, DOE Office of Electricity Delivery and Energy Reliability; and Anna Peterson, Mayor of Salem, Ore.

View the Salem Smart Power video and learn more about PGE's smart grid programs at www.PortlandGeneral.com/SmartGrid.

For more information, please contact Patty Farrell at Patty.Farrell@pgn.com.

QualityLogic

Providing transactive data quality, interoperability and contributions to national smart grid standards

QualityLogic helped the PNW-SGDP ensure data accuracy and completeness, document interoperability challenges and contribute to transactive energy evolution.

QualityLogic is a provider of testing products and outsourced quality assurance and engineering services, specializing in the development of conformance and interoperability testing solutions for the smart grid industry.

As the PNW-SGDP's testing and certification partner, QualityLogic developed the interoperability section of the project's proposal to DOE. In this past year, QualityLogic ensured that the data being collected from the more than 95 smart grid demonstrations is accurate and complete; documented the interoperability experiences and lessons learned for the 11 utility partners; made major contributions to the evolving transactive energy national dialogue and contributed further to the standardization of transactive control. Establishing interoperability through the right technical standards is a vital requirement that helps all the pieces of the smart grid fit together. Technical standards help guide investment decisions and ensure ease of communication between electronic devices, appliances, software and signals.

The company is responsible for functional conformance and interoperability testing of the project's transactive control system, which allows the project to coordinate the responses of smart grid assets, and monitor and manage various operational objectives and conditions. The project is a pilot test site for the application of the Gridwise Architecture Council (GWAC) Smart Grid Interoperability Maturity Model (IMM) and is an early implementation of GWAC's Transactive Energy Framework (TEF). QualityLogic is a key contributor to developing the IMM and TEF.

Together with scientists and researchers from IBM and Battelle, QualityLogic developed conformance and interoperability test suites and programs to confirm end-to-end transactive signal interoperability for the project's three release cycles in Phase 2. Partner utilities needed a convenient way to test their implementations, and QualityLogic developed an easy-to-use, web-based test system for doing so. QualityLogic also developed the transactive node application to support testing transactive signals, system management and data collection.

As the project utility partners commissioned their new smart grid assets in 2013, the collection of experimental data became a critical factor in documenting the project's success. QualityLogic took on the role of developing and implementing a set of data quality procedures and tools to ensure accuracy and completeness of the information collected.

Through direct involvement and participation in smart grid standards activities, QualityLogic has assisted the development, evaluation, and promotion of standards to be used by utilities in the project. QualityLogic executives and technical staff are deeply involved in DOE's work on smart grid interoperability through the efforts of GWAC, the Smart Grid Interoperability Panel Test and Certification Committee supported by the National Institute of Standards and Technology, and through a number of technology alliances and standards development organizations. QualityLogic is actively contributing to the MultiSpeak, OpenADR 2, IEC 61850, and Smart Energy Profile 2 standards. As transactive control matures, QualityLogic will be informing these standards to interface with transactive control.

QualityLogic co-chairs the project's Standards Working Group, which was created to assess and recommend smart grid standards to achieve the interoperability goals and objectives that are part of the PNW Regional Project Narrative and the Interoperability and Cyber Security Plan submitted to DOE. In Phase 3, QualityLogic is leading the project work to standardize transactive control, establish standards for interfacing transactive control to other smart grid standards and inform project members about emerging standards to assist them in judicious adoption.

QualityLogic is proud of its achievements and contributions to date and will continue its leadership in the project's conformance and interoperability testing, as well as standards-related activities in Phase 3 and beyond.

For more information, please contact Laura Posson at lposson@qualitylogic.com.

Spirae

Fostering transactive control for optimum grid management

Spirae contributes critical technical leadership, expertise and support for the implementation of transactive control by PNW-SGDP participants.

Spirae, Inc., a Fort Collins, Colo., based company, implemented transactive control for the asset systems of multiple program participants, including Flathead Electric Cooperative, Avista Utilities, Idaho Falls Power, the University of Washington and Northwestern Energy. Spirae also provided project-level support by testing Battelle's transactive control algorithms and provided assistance to other subprojects.

Using its BlueFin® platform, Spirae coordinated control of distributed assets ranging from residential thermostats, water heater Demand Response Units and Smart Appliances, to commercial Building Management Systems and chillers, natural gas, steam and diesel power generation, in order to accomplish participant and project goals. To support and enhance participant response, Spirae led efforts to test the various asset systems, implement automatic data collection of transactive and non-transactive data, provided load prediction and forecasting tools and provided validation of transactive control algorithms.

Spirae's BlueFin platform is a state-of-the-art active distribution management technology comprised of software and hardware that optimizes grid management and performance by controlling and orchestrating distributed and renewable energy resources. BlueFin's distributed technology, capabilities and flexibility were leveraged for this project to allow the diverse set of asset systems in the PNW-SGDP to respond to transactive control dynamic pricing signals.

The BlueFin control system supports the utilization and integration of distributed and renewable energy into the power grid. BlueFin Applications range from high-penetration renewable microgrids to its distributed energy resources management systems capabilities for the integration of distributed and renewable energy in utility distribution systems.

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Spirae's Mike Fanning studies the system screens from two sites—load predictions from the Flathead Libby substation, and the UW system overview.

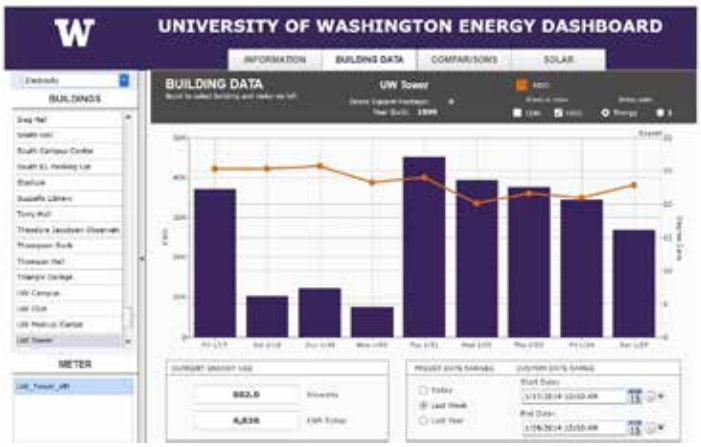
University of Washington

Progressing toward a smart grid campus

The University's Energy Dashboard and other advances are illuminating energy use in buildings—and opportunities for cost savings.

It was a terrific milestone year for the University of Washington (UW) Smart Grid Team!

One of the highlights has been the full implementation of UW's Energy Dashboard. The dashboard, drawing data from smart meters installed in 178 campus buildings, makes it possible for the UW to see campus electricity consumption at the individual building level for the first time. The dashboard displays consumption data for each building, as well as building-to-building comparisons and correlation to real-time weather conditions.



This tool has been extremely effective in communicating energy consumption information to University decision makers, and has raised awareness of the energy impact of campus behavior trends that were previously invisible to building users.

Other exciting developments:

- First year operational measurement and verification statistics show the demonstration project's modifications and near-real-time monitoring of heating, ventilation and air conditioning systems in 23 buildings have resulted in an eight percent reduction in utility consumption among participating facilities—and more than $312,000 in avoided utility costs. Discussions are underway to expand the program to additional facilities.
- The near-real-time energy consumption data deposited in the project's "data warehouse" is being made available to UW faculty and students for use in follow-on research. Already the project data has generated three research projects involving more than 70 faculty and students in both undergraduate and graduate levels of study. The research is broad and interdisciplinary, dealing with aspects of public policy, building energy efficiency, sustainable design and information technology.
- The project's smart technology that provides automated meter reading, remote outage management, automated utility billing process improvements and near-real-time performance benchmarking has resulted in operational and maintenance efficiencies for the UW.

The UW's implementation of active energy management in the PNW-SGDP has also yielded valuable "lessons learned." One such lesson resulted from an effort to leverage the UW's historical consumption data to track variations in current usage that may reflect operational issues that need attention. Reports generated from this trending data have been extremely beneficial in determining occupied/unoccupied and weekend operating conditions, as well as identifying variations in electricity usage patterns. However, without more information about the sources of current energy use, it is difficult to pinpoint and fix operational issues.

Check out the University of Washington Energy Dashboard at: http://dashboard.mckinstry.com/uw/

For more information, please contact Norm Menter at nmenter@u.washington.edu.

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The Road to a Smart Grid is Full of Challenges, Learning

During the past four years, the PNW-SGDP has experienced its share of management, technical and logistical challenges, and has learned many lessons. These lessons covered numerous domains, and ranged from effective planning and budgeting to customer participation, data quality, vendor relationships, and technology integration. The following are selected examples of the project's "lessons learned"—some of which have evolved into best practices.

- **Organizational involvement**—One of the participating utilities reported that the PNW-SGDP touched virtually every area of their organization—engineering, operations, legal, customer care, contracting and many more. As a result, and early on in the process, steps were taken to involve personnel from across the organization in the project. The inclusive approach proved beneficial, helping to alleviate concerns and serving to motivate staff to address challenges and work toward project success. Another utility found that one of the benefits of the PNW-SGDP was that it forced their staff to better coordinate and communicate with each other—and with vendors—to ensure effective system configuration.
- **Public communications**—In most cases, the project has found there is no effective "one size fits all" approach to communicating with the public about the project and its objectives. Methods tended to depend on the location, customer demographics, and the type of utility. Each utility's understanding of its customers was key in crafting and tailoring messages that met customer needs.
- **Vendors**—Vendors provide a variety of technologies and services to the PNW-SGDP. Over the course of the project, several vendor-related challenges have emerged—perhaps not surprising, considering that the smart grid marketplace is not yet well-defined and a number of technology products are early-stage in nature. Managing the challenges proved to be a valuable learning experience that yielded important information for the PNW-SGDP and utilities, and that will inform future smart grid efforts. Along with occasional issues, there also were a number of examples of highly positive partnerships with vendors. One utility noted that sometimes its vendors were faced with factors outside of their control—but remained committed partners. Another utility found that identifying a technically astute individual to serve as a "coordinator" between the utility and vendor is a key step toward achieving positive outcomes.
- **Standards**—Interoperability standards are important to developing cost-effective systems and platforms. The focus of the PNW-SGDP, relative to these standards, has been on the development of transactive control technology and considerations for how to make the technology highly interoperable. Across the project, there have been mixed results in standards application—a situation that is of concern, but that also provides the PNW-SGDP with key insights into the standards application challenges that will be faced nationally and internationally as the smart grid progresses.
- **Data access**—The smart grid depends on access to a strong flow of information. In this project, one of the challenges proved to be identification of sources of data and information for use in simulations. Various proprietary and regulatory concerns prevented the project from obtaining all of the data it originally planned on using. This has underscored the importance of data to smart grid efforts, and that attention must be paid to developing a balanced approach that increases transparency and access to information, while protecting proprietary information and privacy.

PROJECT PARTNERS