Pacific Northwest
SMART GRID
DEMONSTRATION PROJECT

Pacific Northwest Smart Grid Demonstration Project

2012 ANNUAL REPORT

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Introduction

Greetings and Happy New Year!
The Pacific Northwest Smart Grid Demonstration Project, or PNW-SGDP, can look back on a successful year full of accomplishments and lessons learned. Our project completed its infrastructure design, development and deployment phase and is now well into end-to-end testing of transactive control in the crucial data collection and analysis phase. We are proud to say that due to the diligent work of our team including the project participants across the region, technology providers across the country and our colleagues at Battelle, we are making good progress in meeting the project's objectives.

The PNW-SGDP kicked off its five year journey in February 2010. With a budget or $178 million including $89 million of funding from the U.S. Department of Energy with the rest coming from project participants (meeting or exceeding a 50% cost share), and 60,000 participating consumers across five states (Washington, Oregon, Idaho, Montana, Wyoming), the PNW-SGDP is the largest smart grid demonstration project in the nation.

During the past year, we've had the opportunity to share information about our project with others around the world. The Federal Energy Regulatory Commission invited the project director to participate in their U.S. China Smart Grid Dialogue held last June in Shenzhen, China. In addition, the DOE Office of Electricity has identified the project as one of their innovative U.S. smart grid projects and selected the project as the U.S. project to participate in the International Smart Grid Action Network (ISGAN) meeting last September in Nice, France. From those interactions we can also state that this is the only smart grid project in the world integrated across multiple utilities to provide a regional benefit.

This fall, we passed an important milestone by moving into the data collection and analysis portion of the project. This is the PNW-SGDP's third phase, during which data from the participating utilities and technology partners will be archived and analyzed. We also get the chance to modify and enhance the transactive control system.

Phase three's two-year period is maybe the most important part of the project. Initially, we will examine the performance of our transactive control system and improve the algorithms affecting the behavior of approximately 12,000 smart grid-responsive assets, which include solar panels, water heaters, smart appliances, battery storage units, plug in hybrid vehicles and backup generators. We are also collecting data about the benefits of approximately 80,000 smart grid enabled assets, such as smart meters, smart transformers, and distribution automation equipment. We will be able to draw a few preliminary conclusions about how a smart grid on an even wider scale could look like.

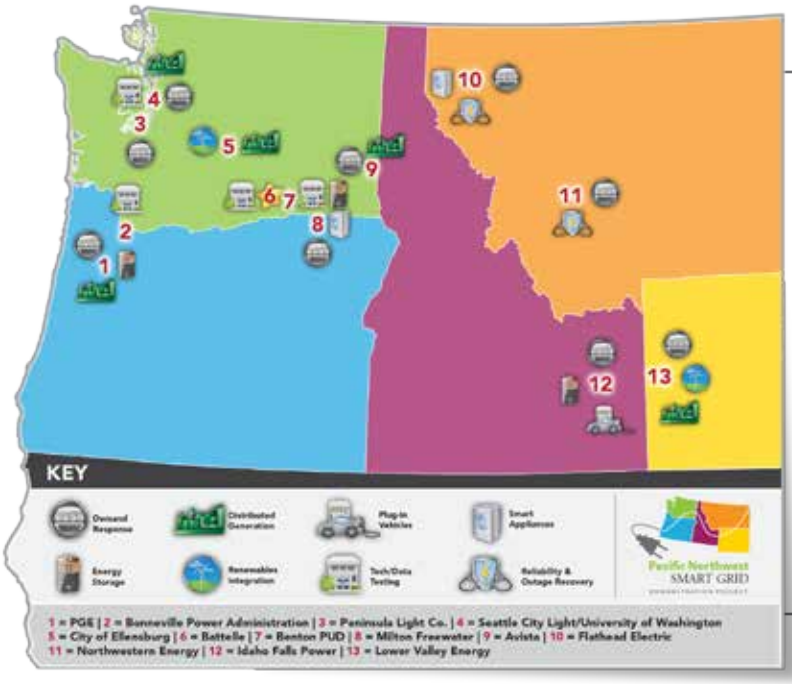
On October 26th, we celebrated the start of phase three with a media event at the University of Washington, where the project and a group of participants showcased the transactive control system and some of our participants' work. Washington State's U.S. Senators Patty Murray and Maria Cantwell were among several high profile guests to launch the "light up" of this important phase of our project.

2012 also saw advances in defining and studying transactive control, the technology at the heart of the PNW-SGDP. (see box on next page) In parallel with our project, there is steadily growing interest in the broader topic of transactive energy. This year, organizations, such as the GridWise® Architectural Council, or GWAC, held workshops on transactive energy and the topic was a primary focus at the annual Grid-Interop meeting. Our efforts on the PNW-SGDP have been well represented in the different meetings and have provided an important example of the application of transactive energy techniques.

In the next few pages, you will find selected PNW-SGDP highlights from our participating utility and technology partners. Please follow our exciting journey that will move the nation closer to a more efficient, sustainable and resilient power system by subscribing to our newsletter on our website, www.pnwsmartgrid.org, and by following us on Twitter @PNW_SmartGrid.

Ron

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, five technology partners and will engage system electricity assets exceeding **112 megawatts**
- Budget of **$178 million**; split between U.S. DOE funds and project participants
- Includes participation from the University of Washington, Washington State University and Central Washington 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.

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.

2012 PNW-DEMO SUBPROJECT PROGRESS REPORTS

University of Washington

A smart grid campus for the 21st century

The University of Washington was selected to kick off Phase Three of the PNW-Demo.

On Oct. 23, the University of Washington launched the data-gathering phase for its smart grid project, one of 11 in the region designed to make the electric grid more reliable and efficient.

The event, which drew both of Washington's U.S. Senators, was held in one of the UW's newest residence halls, signaling the critical role that students will have in the UW portion of the Pacific Northwest Smart Grid Demonstration Project.

"The UW is recognized as a national leader in sustainability within the higher education community," said UW Provost Ana Mari Cauce. "The Smart Grid Project provides an exciting opportunity for testing how 21st century technology can reduce energy consumption. Given our students' keen interest in the environment, it is appropriate that much of the research on smart grids will occur within our residence halls and conducted by students in our Program on the Environment."

> *The UW estimates that it will save annually over $1 million through the project and avoid 8,000 metric tons of carbon dioxide emissions.*

The university has installed more than 200 smart meters across campus in nearly every building, providing detailed information on energy consumption to the university's central power distribution system in near-real time. The meters are also two-way devices, allowing managers to fine-tune the mix of energy sources automatically in response to energy needs and market prices.

Smart grid research on campus is beginning with the work of UW students. They will be assessing how energy users – students in UW residence halls – respond to having detailed information about their energy usage, environmental impacts and costs. Students in selected residence halls will be provided with high-tech personal energy dashboards. Floor-by-floor energy use displays, smart plugs, web-based education tools, social media and opportunities to participate in energy conservation education.

The UW has invested nearly $10 million in the project. The UW estimates that it will save annually over $1 million through the project and avoid 8,000 metric tons of carbon dioxide emissions.

For more information, please contact Bob Roseth at roseth@u.washington.edu.

Bonneville Power Administration

Leading the smart grid business case

The Bonneville Power Administration is participating in the project with a key focus on developing a business case for a smarter grid.

Over the past year, the Bonneville Power Administration, or BPA, completed significant deliverables for the PNW-SGDP, including providing data (1,296 files each day), support for transactive control hydro and demand charge functions and leading discussions on the transactive control system. We increased our outreach efforts for the project, including presenting at the National Town Hall Meeting on Demand Response in June and sponsoring GridWeek in September. Both of these prestigious events were held in Washington, D.C. BPA also produced the project's quarterly newsletters, with stories about individual utility successes, the project's overall progress and, of course, the exciting kick-off event held at the University of Washington this fall.

> *On the Smart Grid Regional Business Case, we have completed a 'computational model' with data and asset mappings.*

On the Smart Grid Regional Business Case, we have completed a 'computational model' with data and asset mappings, and are now ready to collect data over the next two years as the project enters the implementation phase of the project. Data will be populated into the model as it becomes known – and this will be the bulk of the work in fiscal year 2013,

sending test case results from Battelle and the utilities to the computational model as inputs. BPA is looking forward to the data collection phase of the project, which will help inform the business case and eventually provide regional guidance for smart grid investments.

For more information, please contact Katie Pruder at kpruder@bpa.gov.

IBM

Advancing Transactive Energy Management

IBM has advanced the project's transactive control system, ensuring participants can send and receive signals with the Netezza technology.

IBM Research has been a core partner in the PNW-SGDP from the very beginning, focusing on system integration, interoperability architecture, transactive signal and algorithm design and cyber security.

In addition to a large, multi-disciplinary team from multiple departments across the IBM Research organization (including Industry Solutions, Business Analytics and Math Sciences, Security and Privacy and Design Automation), IBM's Software Group and Storage and Technologies Group have both invested in the PNW-SGDP with key software components and servers, including the Netezza analytics appliance being used as the data collection repository and analysis for the demonstration.

> *IBM Research has primary responsibility for the system integration and interoperability architecture.*

In 2012, Release Cycle 2 was completed and the project entered the final portion of the development phase – Release Cycle 3, or RC3. Emphasis shifted to completing the Transactive Toolkit algorithm implementations and testing of the system's transactive control components. The last part of 2012 saw the project enter phase three, and IBM Research has worked closely with Battelle on the transition to full-time continuous operation at the Energy Infrastructure Operations Center (EIOC) at Pacific Northwest National Laboratory in Richland, Wash., and has also supported the project's utilities as they bring their transactive nodes online.

Notable milestones accomplished in 2012 included:

- Completion of the Transactive Node Object Model (TNOM) and Transactive Node Model Algorithm (TNMA) framework that serves as the basis of the Transactive Node reference implementation.
  - Based on the ISO/IEC 18012 standard implementation called iCS (Internet-scale Control Systems) from IBM Research, and an alternative integration model based on a RESTful web services interface to the ISO/IEC 18012-based EIOC environment.
- Implementation of the Transactive Toolkit functions used by the majority of the subprojects.
- Implementation of timing simulations used to provide pre-phase 3 validation that the transactive signal timing model and relaxation algorithms would converge as required.

Looking forward to phase 3, the IBM Research team is starting the definition and development of emergent behavior detection techniques that we believe will be crucial to operating such complex, loosely coupled systems of systems. This work will leverage IBM's InfoSphere Streams software to perform real-time analytics to identify if the system is becoming unstable, or is under attack in subtle ways.

For more information, please contact Fabienne Guildhary at fguildhary@us.ibm.com.

Ellensburg

Ellensburg's Community Renewables Park is ready to mitigate fluctuations in regional generation

The City of Ellensburg is demonstrating the benefits of centralized versus dispersed small renewables for both customers and utilities.

The PNW-SGDP bolstered the City of Ellensburg's plans of expanding its renewable energy footprint. With 58kilowatts of poly-crystalline solar panels and 13.5 kilowatts of thin-film nano-technology panels already installed at the nation's first community solar park, Ellensburg leveraged project funding to expand its renewable energy facility to add more solar panels and to introduce wind turbines. Since becoming involved with the demonstration project, Ellensburg

has installed 40.5kilowatts of additional thin-film nano-technology solar panels and nine small wind turbines sized to be compatible with what residential and small commercial customers would likely install on their own.

The Renewables Park also includes a 105 foot meteorological tower which collects temperature, humidity, solar intensity, wind direction and wind speed at four different elevations which correlate to the elevations of the wind turbines. Meteorological data and data from each of the renewable generation sources is collected in 5-minute intervals and sent back to a regional control center utilizing a new supervisory control and data acquisition, or SCADA, system. Early in 2013, the public will be able to view the meteorological and renewable data on the City of Ellensburg's website, www.ellensburg.wa.us.

Ellensburg's sub-project will demonstrate the utility and customer benefits of centralized vs. dispersed small renewable.

The city's subproject will demonstrate the benefits of centralized versus distributed renewable energy to the utility and its customers. Ellensburg expects to see many benefits from using the various renewable energy sources in conjunction with the project's transactive control system, including: better quality control, improved crew safety during utility outages, better load predictability and greater customer satisfaction with renewables. There are direct benefits to customers, too: a cheaper cost to enjoy the benefits of renewables (starting as low as $250), the ability of all customers to participate (including renters) and no direct ongoing maintenance costs to customers participating in the project.

In addition, Ellensburg will be developing comparative data of the relative efficiencies of the various types of renewables, supporting research and K-12 curricula development by professors and graduate students at Central Washington University and, hopefully, demonstrating the ability of centralized small renewables, such as Ellensburg's Renewables Energy Park, to cost effectively help mitigate regional over-generation (high-wind, high-water events) by using the project's transactive control to automatically take the park off-line (and thus increase utility load) in the spring when the region's hydro and large wind generation resources can produce more power than regional load can absorb.

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

QualityLogic

Enabling Phase 2 Completion and Contributions to National Smart Grid Standards

QualityLogic helped the Pacific Northwest Smart Grid Demonstration Project set the foundation for how participants connect with one another.

QualityLogic is a provider of testing products, 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 PNW-SGDP proposal to DOE. 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 supports coordinating 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's Smart Grid Interoperability Maturity Model. QualityLogic is a key contributor to developing the model and is a leader in applying it within the project.

QualityLogic executives and technical staff are deeply involved in the DOE's work on smart grid interoperability.

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 two. 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

The City of Ellensburg is demonstrating the benefits of centralized small renewables for both customers and utilities

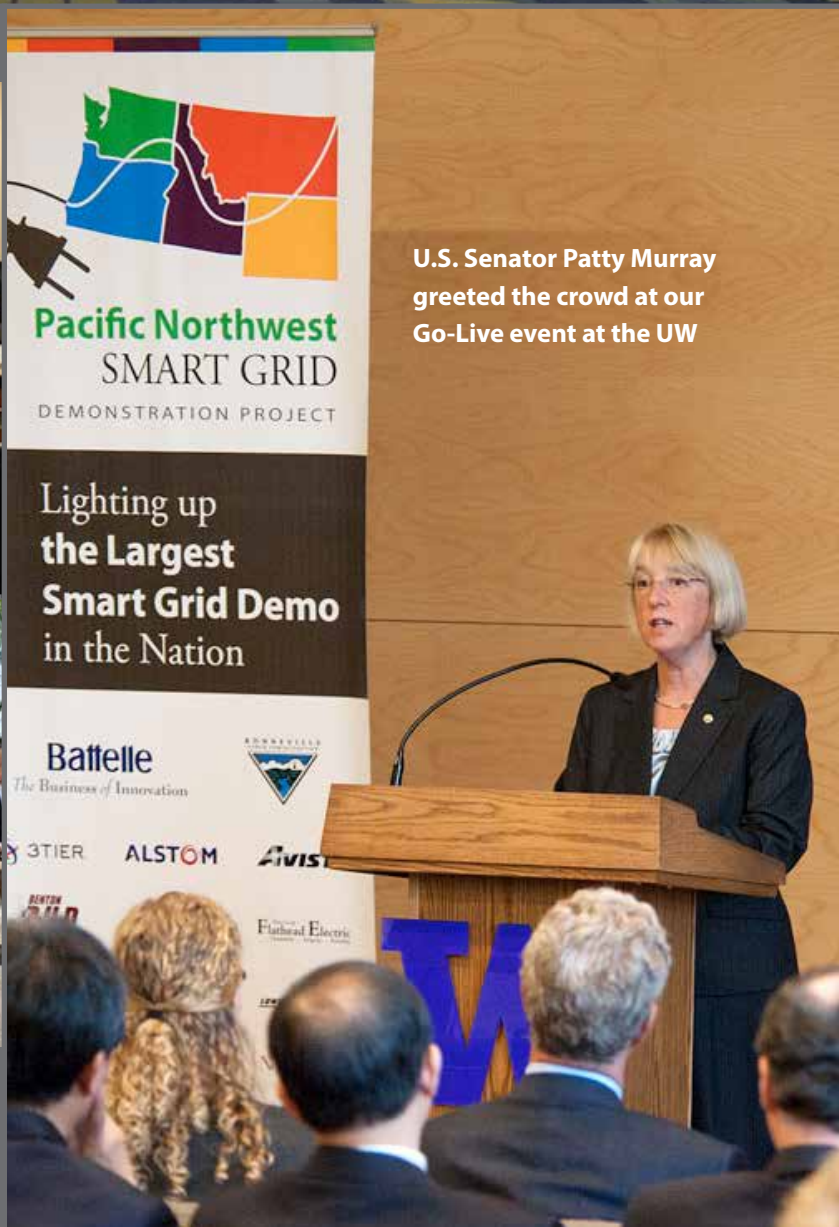
Student researchers Duncan Clausen and Evann Sawyers Rouse with US Senators Maria Cantwell and Patty Murray at our Go-Live event

Project Director Ron Melton explains the transactive control signal to Senator Maria Cantwell

BPA represented the PNW Demo at GridWeek in Washington, DC.

Project participants meeting at the EIOC in Richland

Project Participant Idaho Falls Power inaugurated a fleet of PHEVs



U.S. Senator Patty Murray greeted the crowd at our Go-Live event at the UW

developed the transactive node application to support testing transactive signals, system management and data collection.

The project met the requirements for phase two in testing conducted by QualityLogic in October 2012. This allowed the Project Review Board to declare completion of phase two and move on to phase three. In completing phase two, QualityLogic performed conformance testing on test sites throughout the region and conducted interoperability tests on the full system. QualityLogic continues to develop the required conformance and interoperability testing programs for the project to meet anticipated technology updates in future phases.

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 the DOE's work on smart grid interoperability through the efforts of the GridWise Architecture Council, 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, and Smart Energy Profile 2 standards. As the technology matures, QualityLogic will be informing these standards how to interface to transactive control.

QualityLogic co-chairs PNW-SGDP'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 the DOE. In the third phase of the PNW-SGDP, QualityLogic will co-lead 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 judiciously adopting these standards.

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 three and beyond.

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

Flathead Electric Cooperative

Empowering the consumer with energy portals

Flathead is advancing "Peak Time," modernizing its grid and engaging consumers to make better use of its electricity.

In 2012, Flathead Electric Cooperative (Flathead) continued to work diligently to meet the requirements of the scope of work in the PNW-SGDP. Flathead has presented and maintained a positive perception of the project with members and regional stakeholders, while several technical challenges were successfully addressed.

Flathead has completed communications work and the Advanced Metering Infrastructure (AMI) system upgrade in the Libby and Haskill substation areas, enabling Flathead to utilize the Aclara AMI Two-Way Automated Communications System for real-time outage management, providing hourly data and utilizing reliable 30-day billing reads. Also, additional technologies such as Water Heater Demand Response and In-Home Displays were installed and activated for the project in the Libby and Haskill substation areas. The system also enables Flathead to utilize Wi-Fi metering currently available from Aclara.

> *Flathead has collected hourly data for all groups for over a year and is now beginning to analyze data looking at various items.*

Flathead staff completed member outreach and volunteer recruitment using the tools previously developed, including radio and newspaper ads and press releases, member packets, flyers, brochures and PowerPoint presentations. As of November 2012, Flathead volunteer count numbers are as follows:

Libby

- 97 In-Home Displays (IHD) installed, with 88 remaining in service
- 95 Demand Response Units (DRU) installed, with 94 remaining in service and one to be installed
- 100 appliances installed, with 99 remaining in service

Haskill

- 12 IHDs installed, with 12 remaining in service
- 19 DRUs installed, with 19 remaining in service
- 17 appliance sets installed, with 17 remaining in service

Flathead is currently giving both monthly and annual rebates associated with the program in the IHD and DRU groups.

Members in our IHD and DRU groups are able to receive a demand response signal and are responding as planned despite the fact that not all of the equipment has worked as advertised.

The smart appliances and Home Energy Gateway (HEG) systems have been installed in all participating member homes. For the most part, members have been happy with their product and the ease of using the smart grid technology. However, we continued to have a few issues with quality in some of the GE appliances and many issues with the HEG systems. This made it necessary to provide additional support to restore connectivity and upgrade software and client versions in our member homes.

Flathead has lived up to the budgetary commitments in its original grant application in the area of job creation and preservation. The original proposal included labor hours spread across various departments within Flathead that have been impacted by the project. The grant money had a positive impact on local employment, as Flathead created one new full-time position for the project: the Demand Response Coordinator in the Libby office, which has been extended for an additional year. Various subcontractors have also benefited from the project, including three businesses in the Libby area that were contracted to install appliances and other components of the program and have reported gaining new customers as a result of contact during the installation process.

Flathead has collected hourly data for all groups for over a year and is now beginning to analyze data looking at various items including: monthly average on and off peak periods (excluding weekends and observed holidays), average proceeding and post hours, peak period maximum, the difference between peak vs. monthly max, weekday averages and weekend averages. Flathead will utilize this information to determine load changes during critical peak periods and to calculate potential member rebates as detailed in the project.

Flathead also had the opportunity to present at two key events in the last year. Teri Rayome-Kelly presented the Peak Time program at Northwest Public Power Association's Northwest Communication and Energy Innovations Conference, and Russ Schneider gave a live demonstration of the appliance technology responding to a peak signal at the Smart Grid Live conference in Fort Collins, Colo. Both presentations were very well received with a high level of interest in the data and analysis of the project.

Flathead's subproject continues to be on schedule and progressing well. The response to the Peak Time project and meter changeouts continue to remain positive due to the ongoing use of staff and media resources to educate our members and address their concerns as needed. Our members remain positive and cooperative despite the setbacks and issues with equipment and the fast-changing technology that requires updates and additional home visits. With an eye toward the future, Flathead is working to develop demand response strategies to present to its board so it can utilize these and other opportunities to continue to provide quality services to our members.

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

Benton PUD

Testing energy storage and electric meter notifications for a more reliable grid

Benton PUD is improving the quality and reliability of electrical service by investing in smart grid technology.

Benton PUD provides electricity to more than 49,000 customers in the cities of Kennewick, Finley, Benton City and Prosser, and surrounding areas in Benton County. For their part in the PNW-SGDP, Benton PUD is demonstrating two technologies: an energy storage device and an Advanced Metering Infrastructure (AMI) meter event tracking system.

Benton PUD worked with Resource Associates International (RAI) to establish the connection and information exchange between RAI's DataCatcher™ software running at Benton PUD's facility and Battelle's transactive control system running at the Electricity Infrastructure Operations Center (EIOC). The

DataCatcher software receives the transactive control incentive signals from the EIOC and, using wireless technology, signals the Grid.Balancer devices at Benton PUD, Franklin PUD and City of Richland to "charge" or "discharge" energy in response to decreasing or increasing incentive signals. Benton PUD is planning to incorporate a wind generation forecast to demonstrate the capability of scheduling the Grid.Balancer charge cycle during periods of high wind generation. The device will be tested over the next two years to quantify the costs and benefits as well as its potential for energy storage.

"The benefit of this technology is the ability to store energy generated from a variety of power sources, including intermittent renewable resources when the power isn't needed," said Jim Sanders, general manager of Benton PUD. "This has the potential to help offset the intermittency of wind and solar, making them a more reliable source of energy."

> *The benefit of this technology is the ability to store energy generated from a variety of power sources, including intermittent renewable resources when the power isn't needed.*

For the AMI meter event tracking system, Benton PUD utilized the alarm reporting capabilities of its newly installed AMI meters, which were deployed separately from the PNW-SGDP. The AMI meters will report alarm events for occurrences such as hot sockets (temperature), tampers, high voltages, low voltages and power failures, in addition to many other alarm events. Since deployment began, Benton PUD has continued to evaluate the best methods for deriving actionable information from the incoming AMI meter event data.

Benton PUD deployed RAI's DataCatcher software with customized screens that present AMI meter alarms to users. Prior to these screens, users relied on emails from the AMI system about alarm events that occurred the previous day. The DataCatcher information is available in real time and also has the capability of reviewing historical data. The DataCatcher combined the AMI meter data with attributes pulled from a Geographic Information System (GIS), which makes evaluation of the alarms events much more efficient. The DataCatcher also provides a map-based view, which can be extremely helpful for evaluating incoming alarms.

Over the next two years, Benton PUD will be evaluating the DataCatcher software as a tool for deriving actionable information from the incoming AMI meter event data. The reliable collection, organization and presentation of AMI meter alarm events should ultimately improve the quality and reliability of our electrical service.

For more information, please contact Blake Scherer at schererb@bentonpud.org.

3TIER

Forecasting renewable energy for the Pacific Northwest

3TIER provides wind energy production forecasts an hour, day and week ahead of time for the majority of the wind assets in the Pacific Northwest.

3TIER provides wind energy production forecasts an hour, day and week -ahead of time for the majority of the wind assets in the Pacific Northwest on a project-specific and regional basis. For thePNW-SGDP, 3TIER is responsible for designing, building and testing the infrastructure needed for the transactive control system. Although originally tasked with providing forecasts for solar energy production, 3TIER and Battelle decided that, given the limited amount of utility-scale solar currently in the region and the project timeline, the PNW-SGPD would forego incorporating the solar forecasts into the regional transactive control model. This supported the overall goal to stay on schedule for the two-year data collection period, which started in October 2012. Instead, 3TIER will be providing solar data as part of the simulations and analysis phase of the project.

In addition to delivering forecasts, 3TIER is responsible for providing technical expertise in support of meeting the project objectives, particularly related to successfully integrating renewable energy into the system.

3TIER is providing expert review of the wind energy function that has been developed by Alstom as part of the transactive incentive signal.

3TIER has met all of the deliverables to-date as described in the scope of work and current project schedule. 3TIER is currently providing real-time individual wind forecasts for the majority of the wind assets in the study region and a regional forecast for the BPA region. 3TIER has actively been involved in collaborating with project participants with regards to integrating the renewable energy forecasts into the signal and meeting the renewable energy project objectives. 3TIER is providing expert review of the wind energy function that has been developed by Alstom as part of the transactive incentive signal and looks forward to continuing to take an active role in helping the team meet the project objectives.

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

Portland General Electric

Salem Smart Power Center Opens Spring 2013

PGE's battery facility will allow visitors to see smart grid technology in action.

Portland General Electric broke ground on the 8,000-square-foot Salem Smart Power Center in April 2012 celebrating the commencement of construction on the energy storage facility that houses the project's 5-megawatt battery-inverter system and will serve as a smart grid educational center. The center is slated to open to the public for tours in late spring of 2013. It will give visitors an unprecedented behind-the-scenes tour of a working smart grid demonstration project featuring educational exhibits.

The facility is part of PGE's Salem Smart Power Project, which is testing several smart grid technologies including energy storage, dispatchable standby generation, locational marginal pricing, demand response and high-reliability zone operations, including remote-operated power line switches. All of these technologies will work in concert to create a "micro-grid" in a residential, business and commercial area of Salem, Ore. The project is part of the five-year PNW-SGP. Accomplishments on the project this past year include:

Twenty PGE residential customers are signed up and ready to participate in a water heater demand response program. PGE conducted several test events to ensure the system is ready to go live. Also, 51 commercial customers are signed up to participate in a voluntary demand response effort by responding to PGE requests to lower their use of power for a set period of time. Three large commercial customers are participating in the project with their total of 5.7-megawatt generators. In the event the area's electrical feeder line is lost, the battery will sufficiently support the region until the generators come online forming a unique, high-reliability micro-grid within PGE's larger system.

PGE participated in first-ever regional efficiency and reliability pricing market, where local and regional conditions including transmission congestion, generator availability and customer reliability are considered as electricity price indicators. The system also uses newly developed software developed in cooperation with Pacific Northwest National Laboratory (PNNL) that exchanges price information with utility load forecasts, which is one of the most important functions a utility performs to maintain reliability and low-cost service for customers. PGE began using a new forecasting tool and passed significant testing milestones this year bringing the system online including sending more than 1 million data records to PNNL.

To prepare the 5-megawatt battery-inverter system for operation, PGE conducted a 250-killowatt battery system test at the National Renewable Energy Laboratory.

To prepare the 5-megawatt battery-inverter system for operation, PGE conducted a 250-killowatt battery system test at the National Renewable Energy Laboratory outside Boulder, Colo., during the summer of 2012, allowing the team to address any issues and make improvements as needed.

PGE plans to complete a 1-megawatt test onsite in Salem in early spring before taking the Salem Smart Power Center's 5-megawatt system live. PGE also installed the necessary equipment to connect the 5-megawatt battery system to PGE's distribution feeder.

In the coming months, PGE will make final preparations to the facility to connect the Salem Smart Power Center to PGE's grid and welcome visitors to the center.

For more information, please contact Elaina Medina at Elaina.Medina@pge.com.

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PROJECT PARTNERS

PNNL-SA-93413