Smart Grid Savings and Grid Integration of Renewables in Idaho

Idaho Power Company (IPC) serves more than 495,000 customers in southern Idaho and eastern Oregon. IPC is vertically-integrated and manages power generation, transmission, distribution, and demand-side resources. Faced with grid modernization challenges from new wind power capacity, rising summer peak demands, and aging electricity delivery infrastructure, IPC's Smart Grid Investment Grant (SGIG) project is multi-faceted and covers all aspects of its electric operations.

The IPC project involves a total budget of $94 million which includes $47million in Recovery Act funds from the U.S. Department of Energy (DOE). The DOE funds have accelerated IPC's grid modernization efforts in several areas and by several years. For example, the DOE funds enabled IPC to accelerate development of renewable energy integration tools and smart grid-related data acquisition systems for wind and load forecasting that have improved access to and use of these clean power resources. In addition, while IPC was already upgrading to advanced metering infrastructure (AMI), the DOE funds enabled an early overhaul of the accompanying customer information system to enable faster implementation of web portals. The web portals provide energy information to customers and wider access to time-based rate programs. And, with the DOE funds, IPC was able to modernize the communications system for its direct load control program, by piggy-backing it onto the communications system installed to serve the new AMI investments.

According to Jan Bryant, IPC's Smart Grid Project Manager, "The DOE's SGIG project came along at the right time for us. While our grid modernization plans were moving forward, SGIG jump-started key activities, accelerated development, and allowed us to make quicker progress on several key smart grid options."

Operational Savings and Enhanced Load Control from AMI

Before SGIG, IPC determined there was a favorable business case for AMI based on operations and maintenance savings alone. With a large service territory of about 24,000 square miles and more than 10,000 customers being added annually, IPC estimated savings from reducing the size of their vehicle fleet and reducing the number of truck rolls for such activities as meter reading, service connections and disconnections, and special meter reads for addressing bill complaints.

IPC has installed 474,000 residential customer smart meters, and this portion of their SGIG project is 100% complete. The savings from the AMI investments include about $9.7 million in operational savings, almost 4,600 avoided truck rolls, and more than 2.2 million avoided vehicle miles traveled, which lowers air pollution. As a result, IPC's fleet has been reduced by 74 vehicles.

Meter services and accuracy have also improved. For example, there has been a 97% reduction in estimated meter reads from approximately 85,000 to 3,000 annually. There has also been a 98% reduction in billing errors, and requests for billing re-reads have been reduced 99% from about 8,000 to 100 annually.

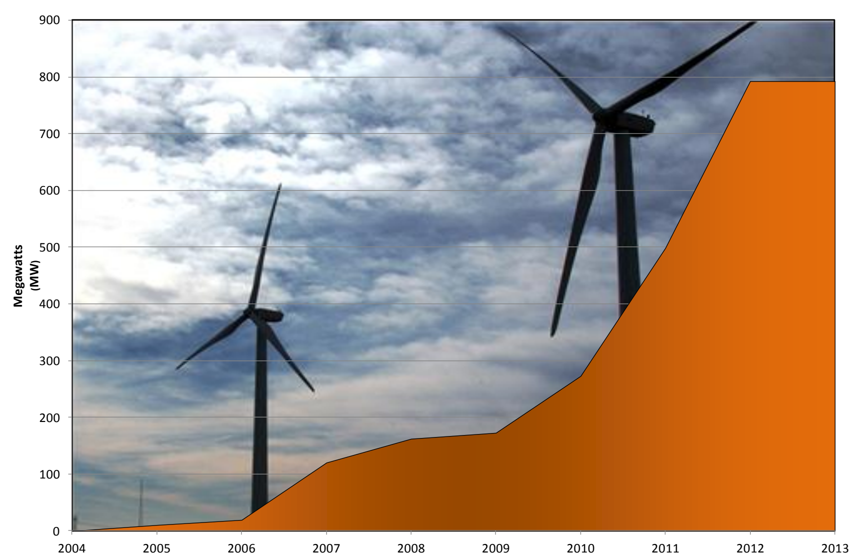
In addition, IPC has been able to use the communications system that accompanied the AMI investment to overhaul communications for their load control programs. This capability has enabled IPC to offer load control to more customers from across its service territory. Agricultural loads, particularly irrigation pumps, are a major contributor to summer peak demand in IPC's service territory and therefore a major target for load control efforts. When IPC's SGIG got underway in 2010, there were about 2,038 service locations for irrigation pump load control totaling about 250 MW of peak demand reduction potential. In 2012, the number of service locations has increased almost 20% and the amount of peak demand reduction potential increased by 100 MW.

Field Installation of an Irrigation Load Control Package at Idaho Power Company

Integrating Wind Power into Grid Operations

Wind generation capacity for IPC has grown rapidly in recent years from about 100 MW in 2006 to almost 800 MW in 2012, and now represents about 5.5% of IPC's total electric generation mix. Prior to SGIG, IPC grid operators had little experience with the integration of wind power resources. Specifically they faced challenges with harmonizing wind and hydroelectric power, and in using wind to address peak demand requirements, since the times of day when wind power is most available are not co-incident with the times of day when electricity demand reaches peak levels.

The lack of operator experience in harnessing wind power resources caused situations where IPC used the available wind capacity (as they are required to do in Idaho), but at the same time made sure there was an equivalent amount of natural gas-fired generation on-line. They simply did not have enough data to determine accurately how much of the wind capacity would actually be available to serve load, so they had to use natural gas plants, too, to ensure resource adequacy.



Growth in Wind Generation Capacity for Idaho Power Company

IPC saw an opportunity to address these problems by building a wind forecasting tool that would provide grid operators with more timely and accurate information on the availability of wind capacity on an hourly basis from the various wind power sites from across the region. This aim proved challenging as it required more granular data on wind speeds and directions at elevations consistent with the height of wind turbines, which is at least 100 meters above ground level. It also required development of customized computer models to apply that data to forecast both loads and resources and provide operators with the decision tools they need to determine the most cost-effective mix of generation resources on any given day.

IPC engaged universities and consulting firms and produced a successful forecasting tool that has boosted the confidence of its grid operators in using available wind resources and has saved IPC and its customer's money through improved power generation operations and reduced need for natural gas-fired back up generation. For example, IPC's wind forecasting tool recently predicted that about 500 MW of wind capacity would be available to serve load. Previously, before the tool was in place, grid operators would not have been sure of the accuracy of such a prediction, so they would have also made available up to 500 MW of gas-fired generation, just in case the wind capacity was not there. They did this to ensure reliability would be maintained and that capacity shortfalls would be avoided. Now, with more confidence in the forecast, IPC grid operators were able to use 15% of natural gas-fired reserves instead of 100%, with the result being savings to the utility and its customers. In this instance, the savings amounted to approximately $50,000 for this one event, and events like this now occur routinely, resulting in even greater cumulative savings.

IPC has plans to improve the wind and load forecasting tool and the data collection efforts that are needed to support it. This plan involves continuing to work with universities across the country to test and refine new models and approaches and gathering more accurate and timely data on wind speeds and directions to improve accuracy and thereby lower further the amount of natural gas generation needed to support the growing fleet of wind turbines.

Distribution Automation and Future Plans

IPC is also planning on expanding the application of automated systems for electric distribution. For example, in 2015, state regulators are expected to start auditing IPC's performance in maintaining reliability levels, by monitoring the frequency and duration of both momentary and sustained outages. In anticipation of this requirement, and to improve the company's ability to detect outages and accelerate service restoration, SGIG funds were used to conduct a study and produce a detailed specification for a distribution management system (DMS) that could be used by IPC grid operators to manage voltage levels and achieve more efficient reactive power compensation through automated control of capacitor banks and transformers. These systems can be used for conservation voltage reduction (CVR) strategies that create new methods for IPC to reduce electricity demand during peak periods, and to achieve additional electricity conservation when CVR is operated over longer periods of time.

IPC is already making use of voltage data at the customer level that is available from smart meters to develop maps that show grid operators where voltage levels are running low, and where needs for voltage optimization could improve system efficiency. This data will be helpful for optimizing voltages and reactive power compensation, and when coupled with the DMS, IPC's capabilities for control capacitors and transformers for CVR operations and voltage and volt-ampere reactive support will be greater than ever before.

Summary

IPC has a broad set of grid modernization investments underway as part of its SGIG project and plans are in place for expansion of these efforts to other aspects of its electric system planning and operations. According to Ms. Bryant, "IPC is looking forward to a new electricity future for our customers and our company. The integration of smart grid devices and systems has improved our efficiency and saved money and we think we are just scratching the surface of what can be accomplished. The SGIG program has helped to jump-start our efforts and we look forward to our continued activities in estimating the impacts of our activities and sharing lessons learned."

Learn More

The American Recovery and Reinvestment Act of 2009 provided DOE with $4.5 billion to fund projects that modernize the Nation's electricity infrastructure. For more information visit www.smartgrid.gov or www.oe.energy.gov. There are five recent reports available for download:

- Smart Grid Investment Grant Progress Report, July 2012
- Demand Reductions from the Application of Advanced Metering Infrastructure, Time-Based Rates, and Customer Systems – Initial Results, December 2012
- Operations and Maintenance Savings from the Application of Advanced Metering Infrastructure – Initial Results, December 2012
- Reliability Improvements from the Application of Distribution Automation Technologies and Systems – Initial Results, December 2012
- Application of Automated Controls for Voltage and Reactive Power Management – Initial Results, December 2012