

Idaho Power Company IPC Smart Grid Program

Scope of Work

Idaho Power Company's (IPC's) Smart Grid Program included deployment of advanced metering infrastructure (AMI), AMI-enabled customer systems, and advanced synchrophasor monitoring equipment for the transmission system. IPC installed 380,928 smart meters for residential and commercial customers and deployed a web portal to provide customers with access to their AMI data and new energy management tools. Smart meters enable IPC to enhance its offering of existing time-of-use rates to customers and further reduce peak loads on the system. Peak load is also managed through direct load control devices on participating customers' irrigation systems. IPC also installed phasor measurement units (PMUs) to improve the diagnostic capabilities and overall reliability of the transmission system. In addition, the company developed tools to enable the effective integration of renewable resources onto the transmission grid.

Objectives

The goal of IPC's Smart Grid Program was to accelerate elements of a smart grid that IPC first road mapped in 2009. Objectives included the following:

- Support a greater level of consumer engagement in energy use choices by providing customers with more detailed and timely data.
- Enable load shaping capabilities through the use of time-variant pricing and direct load control.
- Provide greater visibility into and awareness of transmission system conditions.
- Enhance IPC's forecasting capability with respect to the availability of renewable generation, thereby enabling improved balance of supply and demand as renewable power generation is added to the system.

Deployed Smart Grid Technologies

- **Communications infrastructure:** IPC installed a power line carrier (PLC) network to enable two-way communication between the smart meters and IPC's substations. A broadband communications network carries meter data from the substations to the IPC information technology center. IPC also

At-A-Glance

Recipient: Idaho Power Company

State: Idaho and Oregon

NERC Region: Western Electricity Coordinating Council

Total Project Cost: \$98,270,405

Total Federal Share: \$47,000,000

Project Type: Advanced Metering Infrastructure
Customer Systems
Renewables Integration Tool
Electric Transmission Systems

Equipment

- 380,928 Smart Meters
- AMI Communications Network (Power Line Carrier and Broadband)
- Web Portal Access for 416,020 Customers
- Customer Information System
- 8 Phasor Measurement Units
- Transmission Line Monitoring Equipment
- Distribution and Transmission Communications Networks (Power Line Carrier, Fiber Optics, Radio, and Wireless)

Time-based Rate Programs Available to 490,000 Customers*

- Time of Use
- Critical Peak Pricing

* Inc. customers who received SGIG-funded smart meters.

Advanced Transmission Applications

- Angle and Frequency Monitoring
- Voltage and Voltage Stability Monitoring
- Post-Mortem Analysis
- Oscillation Energy and Mode Meter Monitoring
- Reactive Reserves Monitoring
- Model Baseline, Validation, and Improvement
- Path Loading and Congestion Management

Key Benefits

- Reduced Operating and Maintenance Costs
- Optimized Generator Operation
- Improved Electric Service Reliability

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uses the PLC network to operate its existing direct load control devices. Distribution automation and advanced transmission systems include additional communications infrastructure comprising fiber optic assets, radio systems, and wireless carriers that enable enhanced monitoring and control.

- **Advanced metering infrastructure:** The project involved territory-wide deployment of 380,928 smart meters to residential and commercial customers. The meters provide IPC with detailed usage information to support existing and future time-based rates that create financial incentives for customers to shift and conserve their energy use. The AMI system also provides premise-level outage and restoration information, which is integrated with the existing outage management system.
- **Customer system devices:** An energy-use advisory tool enables two-way information exchange between customers and IPC. The device allows customers to monitor their energy use and electricity bills through an online web portal. IPC customer representatives used a similar tool to help inform customers of issues or applicable energy-efficiency incentive programs. Furthermore, irrigation system load control devices that were deployed by IPC prior to the Smart Grid Investment Grant (SGIG) project now use the two-way PLC communications network to transmit control signals. Customers enrolled in the Irrigation Peak Rewards Program receive rebates in exchange for allowing IPC to cycle their irrigation pumps during periods of peak demand.
- **Time-based rate programs:** The AMI system, integrated with a new customer information system, has allowed IPC to make time-of-use rates available to a much wider group of customers. The meters make possible future implementation of other new rate options.
- **Distributed energy resources interface and control systems:** Enhanced renewable energy forecasting tools enable IPC to better manage the operations of variable renewable generation. Implementation of the forecasting tools, along with automatic generation controls, allows IPC to maintain system balance while reducing the use of fossil fuels.
- **Advanced transmission systems:** A wide-area monitoring, visualization, and control system uses synchrophasor technologies that provide IPC with better real-time information about transmission system operation and reliability. A portion of the information is being shared with the Western Electricity Coordinating Council to provide greater visibility and awareness of transmission conditions in western bulk power markets.

Benefits Realized

- **Reduced operating and maintenance costs:** 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 customers being added annually, IPC has realized savings from reduced operations costs in meter reading, service connections and disconnections, and special meter reads for addressing bill complaints. From January 2009—the start of AMI meter exchanges—through December 2013, IPC realized a \$14.3 million reduction in total operational and maintenance expenses; vehicle-related expenses represent about \$3.4 million of that savings.
- **Optimized generator operation:** At any given time, wind power can provide up to 35% of IPC's system needs. The renewable integration tool pre-schedule and real-time forecasts are providing forecast values that more accurately predict wind generation. Idaho Power uses PMU data for generator model validation of wind plants. The PMU validation technique reduces the validation time by 75% from a two day test period, including travel time, to a 4 hour data assembly. Particularly, the short-term demand forecast is providing values at intervals not previously available. During a three-month demonstration, the tool achieved 26%–32% improvement in forecast accuracy over the forecasting methods previously used by IPC. IPC estimates that this improvement in forecasting accuracy saved about \$287,000 over the three-month study period, or about \$96,000 a month.

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- **Improved electric service reliability:** The detailed outage information provided by the AMI system helps IPC pinpoint faults, reduce outage duration and restoration times, and improve system reliability.
- **Deferred investment in distribution capacity expansion:** The AMI network enables IPC to offer direct load control options to more customers. IPC also benefits from the irrigation load control devices through the reduction of peak load and the resulting deferred distribution capacity investments.

Lessons Learned

- The SGIG project involved multiple technology sub-projects, straining technical resources and limiting how much could actually be accomplished. Some significant efforts needed to be postponed (e.g., a self-healing network and a new outage management system). Security and data integrity issues presented the team with tremendous time- and resource-intensive obstacles.
- During deployment of the AMI system, public concerns regarding health, privacy, and security were widespread, and managing the misinformation being published in the public media was challenging.
- The wind forecast tool was originally supposed to be off-the-shelf, but the lack of wind data specific to the IPC system was a primary issue, so the tool was developed in-house.
- The self-healing network project required a distribution system designed with far more loops than the IPC system currently has to be successful.
- The Energy Use Advising Tool (Account Manager) gave customers immediate access to usage data and new tools to compare rate plans that were intuitive, all in a web location that many already used for bill paying.

Future Plans

A team of senior managers is currently reviewing the projects completed in 2013 and developing a vision for the next steps in smart grid for IPC. Several smaller projects will focus on data analysis. Distribution automation will be revisited. The wind forecast tool will be part of a continuous improvement program and may include other renewable generation. Increased analysis and usage of AMI data will be a priority. Idaho Power is working with Washington State University to use PMU data for the purpose of developing real-time and post event voltage stability and oscillation mode shape applications using algorithms developed at WSU.

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