U.S. DEPARTMENT OF ENERGY | Electricity Delivery & Energy Reliability

Providing Grid Flexibility in Wyoming and Montana

Introduction

Powder River Energy Corporation (PRECorp) is an electric cooperative serving approximately 11,900 customers in a 16,200 square-mile area of rural Wyoming and Montana. PRECorp's customers frequently experience harsh weather conditions. Severe weather conditions in PRECorp's rural and remote service territory present unique challenges in providing reliable electric service to PRECorp's customers. PRECorp's customers include coal mining facilities that provide approximately 40 percent of all coal production in the United States.

PRECorp addressed these reliability challenges as part of its Smart Grid Investment Grant (SGIG) award totaling $5 million, including $2 million in funding from the U.S. Department of Energy (DOE). The SGIG grant has allowed PRECorp to undertake grid modernization improvements for network communications and control systems infrastructure to ensure higher reliability and increased service efficiency for its customers.

Without SGIG funding, PRECorp would not have undertaken Project PRIDE (Powder River Innovation in Distributing Electricity) in its current form. Project PRIDE is a key component of PRECorp's overall strategic plan to enhance its electric service by adding a microwave network, "last mile" communications, and Supervisory Control and Data Acquisition (SCADA) capabilities. The SGIG funding allowed PRECorp to begin this multi-year project immediately upon grant award. Expansion of its network would most likely not have included SCADA capabilities without funding from DOE. This new network system is laying the foundation for future modernization efforts including implementation of an Advanced Metering Infrastructure (AMI) and integration of distributed energy resources.

Creating Solutions for Unique Grid Challenges

The rugged geography throughout PRECorp's territory is not communications-friendly and inhibits two way communications and connectivity as evidenced by a lack of cell phone coverage and PRECorp's own UHF voice radio network not functioning in several areas of its service territory. To overcome this challenge, PRECorp is establishing a high bandwidth capability to its remote substations by building licensed microwave towers in its northern service region that will provide coverage throughout its entire service territory. The northern route combined with the existing southern microwave route will be used for backhaul of the new substation communication network.

The new addition to the microwave network allows for two-way communications and re-routing, ensuring system reliability. The two-way communications capabilities have added resiliency to PRECorp's network and paved the way for multiple applications to be added a later time.

Additionally, by eliminating some previously leased fiber optics network with the installation of the new microwave network, the company is saving $36,000 annually.

Figure 1: A Remote Powder River Substation

The addition of a communications network to PRECorp's substations improves the overall communications and operations within the PRECorp transmission and distribution grid infrastructure. PRECorp's biggest hurdle in delivering this backbone has been the "last mile" communications (power poles, antennas, and radios) needed to make SCADA systems fully functional. As depicted in Figure 2, information obtained via the substation last mile technology is transmitted wirelessly to the microwave backhaul then to the SCADA Master Station. Control back to the substation from SCADA also uses the microwave backhaul to communicate directly into the substation.

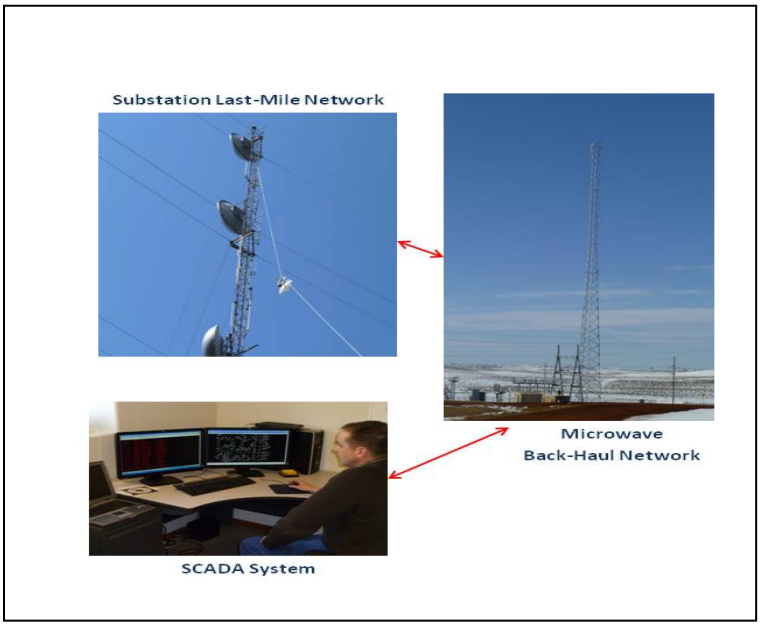

Figure 2: PRECorp's communication infrastructure and SCADA system have two-way communications from the SGIG-funded microwave build-out.

The microwave backhaul implementation allows PRECorp to monitor what happens on the "last mile" and isolate substations more quickly and accurately where outages are occurring. "At PRECorp we serve an area measuring 16,200 square miles-larger than Connecticut, Rhode Island, and Hawaii combined. The Smart Grid Project enables PRECorp to communicate between the command center and 30 key substations within seconds instead of hours," says Steve Eliason, PRECorp's Smart Grid Project Manager.

Improving Service to Industrial Customers through SCADA

The enhanced communication functions particularly benefits coal mining companies in PRECorp's region as they require highly reliable power for their activities. To provide service to these electricity-intense industrial customers, PRECorp has increased its service delivery through automating outage detection capabilities funded by the SGIG project. The outage detection mechanisms provide shorter outage times during inclement weather, quicker fault isolation, and the ability to identify and correct situations and maintain power quality to these important companies. PRECorp's SCADA system solution provides these results through deployment of a Master Station and Remote Terminal Units (RTU) at substations.

Figure 3: Decker Substation 5 with SGIG Router (above telephone) - QEI RTU (blue)

RTUs are controlled and monitored by the Master Station (Dual Redundant Servers) at PRECorp headquarters for data concentration and conversion to Ethernet protocol for communications back to the Master Station.

The SCADA build-out has the ability to isolate and automatically identify outages through real-time awareness. Prior to implementing these RTUs on its system, outages were not known until customers called and informed PRECorp of the outage. PRECorp logged more than 273,000 hours of "Call Out" time dispatching crews to detect and resolve outages in 2009. RTUs pinpoint outage events so that immediate actions can be taken to resolve it before a work crew is dispatched.

Major benefits from the SCADA system result from the relay that controls the circuit breaker which stores data in each substation. If lightning hits the line, PRECorp can log into SCADA and investigate the data in real-time and work with the customer to determine where the fault is located. Previously, the company would need to drive out to the substation; sometimes over 80 miles away. "Prior to the implementation of this project, our PRECorp staff could only investigate an outage by driving to it." says Eliason, "Now PRECorp staff is able to view the outage and respond more efficiently and effectively."

Lessons learned: Advanced Planning Overcomes Unique Challenges

PRECorp has learned several lessons regarding the importance of planning, both with regard to implementing Project PRIDE and with respect outage management in its service territory.

PRECorp's forethought in project planning and management allowed it to move quickly and be innovative. PRECorp started planning five months before the company applied for and won the SGIG

grant in March 2010. Continuing this pattern once construction began, PRECorp planned months in advance of SGIG project milestones to anticipate problems, set goals and reviewed progress weekly. Says Eliason, "Following the award of the Smart Grid Investment Grant, PRECorp immediately dedicated resources and realized the completion of the Smart Grid Project three months ahead of schedule and on track with budget costs. DOE, PRECorp management, staff, contractors, and equipment suppliers working together made the Smart Grid Project a success."

Severe weather is PRECorp's biggest risk, so it also applies this planning strategy to these instances. PRECorp carefully reviews all project components and makes sure to include long lead delivery times to design/build around unpredicted weather delays. With substations at least 1.5 hours away from PRECorp Headquarters, equipment failure alone can cause significant damage to infrastructure, with further delay due to severe weather conditions. To avoid this, PRECorp prepares an effective contingency plan ahead of potential weather events. By conscientiously identifying risks and staying ahead of them, as well as spending extra time in project planning, PRECorp achieves effective plan execution.

Future Plans

PRECorp plans to take advantage of its communications and SCADA network by building on its SGIG-enabled capabilities for future products, services, and applications. To do so, the company is planning to conduct an AMI pilot next year. Within the next three to four years, PRECorp expects to have a full AMI system in place to offer additional services. Future services may include AMI meter data collection, mobile two-way radio system, Voice over Internet Protocol (VoIP) phone, network data and video surveillance for security monitoring of crews working at remote substations in dangerous conditions. Like other companies, with the introduction of SCADA, PRECorp realized the need for training early on in the project for its staff. To meet this need, PRECorp is planning on adding a full time SCADA technician to the company.

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