Black Hills Power

Advanced Metering Infrastructure/Meter Data Management System/Customer Systems

Scope of Work

Black Hills Power (BHP) is one of three Black Hills Corporation subsidiaries that deployed advanced metering infrastructure (AMI), a meter data management system (MDMS), a customer web portal, and an outage management system (OMS). The other two are Black Hills Corporation/Colorado Electric and Cheyenne Light, Fuel and Power.

Objectives

The BHP project built upon existing smart grid functionality to provide customers with previously unavailable options. The AMI system supports potential future implementation of time-based rate programs that can help customers reduce peak loads and lower their monthly bills. The integration of the AMI system with the new OMS provides improved outage management and restoration services. This combination of advanced technologies and new data analytics capabilities enable more efficient design and operation of the electric distribution system, resulting in improved power quality and better service for BHP customers.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The project deployed a radio frequency (RF) mesh network connecting smart meters and strategically placed data collectors to a wireless backhaul solution that transmits the meter and network data to BHP's back office systems for processing. The two-way communications infrastructure enables enhanced operational capabilities and lays the foundation for future customer-focused programs and service options.

- **Advanced metering infrastructure:** BHP installed 68,980 smart meters and 143 data collectors, achieving system-wide deployment of their AMI network. New features enabled by the AMI system include off-cycle read capability, remote tamper detection, outage and restoration notification, and remote service connect/disconnect capability. A new AMI-enabled web portal presents validated usage data and offers better energy management tools to customers.

- **Meter data management system:** The AMI system is integrated with a MDMS to support validation, analysis, and processing of meter data for billing. The data are also packaged and analyzed for program planning for potential time-based rates, distribution system upgrades, reliability planning initiatives, customer web presentment applications, and power quality enhancements.

At-a-Glance

Recipient: Black Hills Power

State: South Dakota and Wyoming

NERC Region: Midwest Reliability Organization

Total Project Cost: $18,645,268

Total Federal Share: $9,322,632

Project Type: Advanced Metering Infrastructure
Customer Systems

Equipment Installed
- 68,980 Smart Meters
  - 632 Remote Connect/Disconnect Meters
  - 143 Gatekeepers
- AMI Communications Systems
  - Meter Communications Network
  - Backhaul Communications
- Meter Data Management System
- Data Analytics
- Outage Management System

Key Benefits
- Reduced Meter Reading Costs
- Improved Electric Service Reliability
- Reduced Truck Fleet Fuel Usage
- Improved Customer Services

Benefits Realized

- **Reduced meter reading costs:** Operational cost savings are derived from the automation of meter reading and customer service activities through the AMI system.
- **Improved electric service reliability:** The AMI system allows for faster, more efficient outage detection and diagnosis, as well as reduced restoration times. System operators can ping meters to get a clearer picture of what is happening in the field and deploy restoration field crews more efficiently. Meters send power-down/power-up messages, providing near-real-time single outage alerts that enhance OMS diagnostic capabilities. In many cases, the AMI system identifies the outage, a crew is dispatched, and power is restored without any customer calls.
- **Reduced truck fleet fuel usage:** The AMI head-end application allows for remote detection, diagnostics, and troubleshooting of meter malfunctions, reducing the need to dispatch field crews to investigate poorly performing meters. AMI systems have reduced truck rolls by 90% for customer orders such as succession reads and service turn-on/turn-off.
- **Improved customer services:** BHP now offers remote connect/disconnect services, outage and restoration notification, more accurate bills, and fewer estimated bills. Interval data presented on the web portal have been valuable in helping customers understand their consumption and peak usage, as well as in investigating high bill complaints.

Lessons Learned

- A dedicated test enviroment should be set up and used to test new software for meters, system upgrades, and system reconfigurations to validate expected performance, component interoperability, system integrations and clean data transfer.
- If the MDMS and AMI vendors are different companies, the two systems must use adaptors to communicate. Those adaptors require significant system, integration, and regression testing and troubleshooting with each new release. Utilities should be prepared to be in near-constant testing mode.
- Over-the-air meter firmware upgrade functionality eliminates the need for and saves costs associated with firmware upgrades; in the past a field visit was required for each meter.
- The AMI–OMS interface was extensively used during large outages caused by storms. Throughout the duration of the repair effort, meter pinging was used to validate power restoration and identify feeders still experiencing partial or complete outages.

Future Plans

BHP plans to leverage the new AMI system to research, and ultimately, introduce time-of-use rates to customers and implement a demand response program to better manage peak loads. BHP also plans to focus on opportunities to implement distribution automation technologies going forward. **Contact Information**

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