Avista Utilities

Spokane Smart Circuit

Scope of Work

Avista Utilities' (Avista's) Spokane Smart Circuit project upgraded and automated targeted sections of Avista's distribution system. New switches, capacitors, and sensors were installed in substations and on distribution circuits across the project area. This equipment provides automated regulation of power quality, rapid response to grid disturbances, and improvements to grid reliability. A radio and fiber optic communications system integrates real-time data from grid sensors with the grid operator's distribution management software platform.

Objectives

The project aimed to reduce energy losses and improve reliability and efficiency in the distribution system while reducing the need for new generation facilities. Avista implemented distribution automation (DA) equipment, such as 600 and 300 kVAR mid-line reclosers and switched capacitors, to enable load and greenhouse gas emission reduction through conservation voltage reduction (CVR), as well as improved diagnostic capability on high-priority circuits. The upgrades also reduce the need for field visits for system maintenance and operations, thereby further reducing costs and greenhouse gas emissions.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The project installed new fiber optic cable and radio devices throughout the distribution network, covering 14 substations. A wireless radio frequency mesh communications network connects to a backhaul data link that relays data from the distribution sensors to control systems and grid operators. The near-real-time monitoring of grid conditions provided by these systems enables more rapid response to power disturbances and increases overall grid reliability.
- **Distribution automation:** The project deployed automated switches and reclosers on 59 of 330 distribution circuits. The equipment was integrated with a distribution management system, which automatically sectionalizes, protects, and restores functional sections of the grid during outages. The project also installed a network of automated capacitors and conductors that are being integrated with a power quality monitoring system.

At-A-Glance

Recipient: Avista Utilities

State: Washington

NERC Region: Western Electricity Coordinating Council

Total Project Cost: $40,048,996

Total Federal Share: $20,000,000

Project Type: Electric Distribution Systems

Equipment Installed

- Distribution Automation Equipment for 59 out of 330 Circuits
  - Distribution Management System
  - Distribution Automation Communications Network (radio frequency mesh and fiber optic cable network)
  - Automated Distribution Circuit Switches
  - Automated Capacitors
- Substation Automation/Upgrade for 13 out of 206 Substations
  - Supervisory Control and Data Acquisition Communications Network
  - Equipment Condition Monitors

Key Targeted Benefits

- Improved Electric Service Reliability and Power Quality
- Reduced Costs from Equipment Failures and Distribution Line Losses
- Reduced Operating and Maintenance Costs
- Reduced Truck Fleet Fuel Usage
- Reduced Greenhouse Gas Emissions

Avista Utilities *(continued)*

Benefits Realized

- **Improved distribution system reliability and resiliency:** Automated distribution system operations improves system reliability by enabling faster, more coordinated response to disturbances than previously possible. The distribution management system allows dispatchers to provide useful feedback to field personnel, and this feedback is growing into viable situational awareness. In addition, integrating capacitors with a power quality monitoring system provides Avista with tools to improve volt/VAR control and power quality.
- **Reduced distribution line losses:** The network of automated capacitors and conductors increases distribution capacity by reducing energy losses on the system. Integration with regulators facilitates automated conservation voltage reduction.
- **Reduced truck rolls and fleet fuel usage:** The automated restoration algorithms reduce the number of field visits required to respond to outages. Also, the application of "hotline hold" (see Lessons Learned below) reduces the number of truck miles required to do line work.

Lessons Learned

- Safety awareness: Implementation of distribution automation equipment has resulted in the development of beneficial safety procedures. Avista has implemented a "hotline hold" procedure to familiarize linemen with the new devices. The procedure is designed to increase confidence in the system by assuring linemen that if a line or equipment trips, no automatic or manual reclosing will occur until all personnel are cleared and the hotline hold has been released.
- Transition from dispatch to operational center: Significant challenges exist in the deployment and integration of developing technologies. The most significant challenge is training and adapting a workforce evolving from a dispatcher function to an operational function. The dispatchers must understand network topology and control functions to restore isolated sections of the feeders, as well as the alarms and messaging that provide feedback on the electrical system's state and health. The electrical distribution system cannot be operated without a competent dispatch center.
- Integration of engineering into operational center: Avista created a new work group called Distribution System Operations. This group is responsible for the deployment, enhancements, and maintenance of the distribution management system. Distribution System Operations is also developing training and reporting tools to support distribution dispatch and regional engineers.
- Cybersecurity: An unanticipated benefit was heightened attention to security across many systems on the periphery of the deployed operational systems. Avista created a security organization, from which the company continues to benefit.

Future Plans

- System optimization: Smart device measures allow Avista to better characterize the load on feeders. The company is now determining how this information can best be leveraged. A variety of options include tuning and reconfiguring feeders to offset loading on key line segments and developing more accurate planning models for capital build-out. A fair amount of data and analysis is required to determine specific capital offset benefits.
- Seasonal loads: Avista will use the additional data being collected to review the seasonal performance of each individual feeder. After feeder performance has been modeled, each feeder will be "tuned" to optimize system performance.

Avista Utilities *(continued)*

- Grid modernization: In addition to standard feeder upgrades, Avista is developing a program to continue to automate feeders to extend the smart grid footprint.

Contact Information

John Z. Gibson, P.E.
SGIG Project Manager
Avista Utilities
John.Gibson@avistacorp.com