

Snohomish County PUD

Smart Grid Infrastructure Modernization of Electrical Distribution System

Scope of Work

Snohomish County Public Utility District, Washington, (Snohomish PUD) upgraded 42 of 85 substations with automated control capabilities to prepare the substations for full-scale deployment of distribution automation (DA) and integration of distributed energy resources. The project deployed DA upgrades to 10 targeted circuits in a 90-square-mile project area. These assets are being managed through a new distribution management system (DMS), which communicates through a wireless communication network installed in the project area. Information from the project area is then collected at the substation and transmitted back to Snohomish PUD's headquarters via the 163 miles of fiber optic cable that was also installed system-wide as part of the SGIG project.

Objectives

Snohomish PUD upgraded substations, deployed DA equipment, and installed supporting systems to reduce load and line losses on the system and improve service reliability for customers. The increased grid visibility realized through the addition of intelligent equipment (i.e., relays, line regulators, switches, and end of line meters) will support such reductions. The new DMS, DA equipment, and communications network allow the utility to monitor real-time sensor data and respond to changes in electricity demand and grid operating conditions. Snohomish PUD aims to reduce operations and maintenance costs over time and improve distribution system reliability.

Deployed Smart Grid Technologies

- **Communications infrastructure:** An expanded fiber optic network connects all Snohomish PUD substations to the energy control center supporting real-time data transfer and grid monitoring. The project also installed a dedicated wireless field area network to support the 10 circuits upgraded with DA equipment. This infrastructure supports future deployment and integration of new applications, such as an advanced metering infrastructure (AMI) and an outage management system (OMS).
- **Distribution automation systems:** Snohomish PUD deployed automated switches, reclosers, and regulators on 10 high-priority circuits. These DA upgrades will enable a faster and more effective response to grid disturbances, reduce the frequency and duration of outages, and lower operations and maintenance costs. DA equipment has been integrated with a DMS that enables Snohomish PUD to improve safety, track abnormal operating conditions, and manage power distribution to better match customer demand. The DMS also enables more precise modeling and future integration of distributed generation resources such as solar, wind, and energy storage.

At-A-Glance

Recipient: Snohomish County PUD

State: Washington

NERC Region: Western Electricity Coordinating Council

Total Project Cost: \$31,651,634

Total Federal Share: \$15,825,817

Project Type: Electric Distribution Systems

Equipment

- Distribution Management System
- Distribution Automation Communications Network (wireless field area network)
- Fiber Optic Network Extension
- Distribution Automation Equipment for 10 of 356 Distribution Circuits
- Automated Switches/Reclosers
- Automated Regulators
- End-of-Line Voltage Meters with Telemetry
- Circuit Monitors/Fault Indicators
- 381 Intelligent Substation Relays

Key Benefits

- Reduced Operating and Maintenance Costs
 - Increased Electric Service Reliability and Power Quality
 - Reduced Distribution Loads and Line Losses
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- **Substation automation:** The project upgraded electromechanical relays to digital relays at 42 substations. A total of 381 smart relays were installed throughout the Snohomish PUD territory. Communications infrastructure inside the substation was enhanced to capture and transmit valuable operational data. Part of the SGIG project was to extend the single fiber cable by 163 miles to all but one substation with redundancy provided by using protocol loop protection.

Benefits Realized

- **Reduced distribution load and line losses:** The automated voltage regulators work with DMS load/voltage management function to optimize the voltage profile over the length of the feeders. This optimization, in concert with existing capacitor banks, improves volt/VAR control and power quality, increasing distribution capacity by reducing load and energy losses on the distribution system.
- **Improved reliability:** The DA devices provide data for the fault isolation and service restoration (FISR) function of the DMS. Whether working in an advisory capacity or automatically, FISR can identify faulted line sections and either automatically restore power to unfaulted sections or direct operators and line personnel to the appropriate area for line isolation and repair. This improved response reduces the frequency and duration of outages as well as reducing crew and vehicle travel time.
- **Substation automation:** The installation of digital relays gives Snohomish PUD an opportunity to gain near-real-time insights as to what caused a disturbance at the substation level—or to predict what might cause one. By leveraging this new stream of data, Snohomish PUD will be able to provide a higher level of customer responsiveness and plan more accurately for system expansion and maintenance.

Lessons Learned

A fully functional end-to-end smart grid test lab was designed and installed under the SGIG project. Numerous work groups leverage the test lab to prove out and/or troubleshoot conceptual smart grid designs, applications, and equipment prior to deployment to the production environment. The test lab provides the foundation from which to make educated and informed decisions regarding future operational technology investments. Being able to see how software systems from different vendors with diverse development backgrounds actually work together in the Snohomish PUD environment has proven to be an invaluable capability. Interoperability testing and validation is critical prior to deploying these new systems and equipment.

Future Plans

Snohomish PUD is committed to continuing an intentional and thoughtfully crafted smart grid technology deployment throughout the distribution system. The utility will carefully evaluate information received from the intelligent DA devices in the pilot area to determine the best approach to further deploy DA. The energy controllers, dispatchers and planners can now access real-time operating information from the DMS and from DA devices via the field area network. This capability will give Snohomish PUD options never before realized at the distribution level. Eventually having this visibility out to the “fingertips” of the distribution system will allow the utility to integrate another layer of “smart” technologies, such as advanced metering infrastructure, while effectively managing distributed generation and other alternative or customer-owned power sources.

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