

Rappahannock Electric Cooperative

Smart Grid Initiative

Scope of Work

Rappahannock Electric Cooperative's (REC's) Smart Grid Initiative project deployed smart meters across the service territory and a supporting communications infrastructure, as well as a meter data management system (MDMS) to help manage the increased data available from the smart meters. The project also deployed distribution automation equipment, including supervisory control and data acquisition (SCADA) and automated controls on distribution voltage regulators to improve power quality, reduce line losses, and reduce operations and maintenance costs through monitoring and control of distribution voltage.

Objectives

REC implemented digital improvements and a variety of new technologies and grid upgrades to ensure more efficient and reliable power delivery. In addition, full smart meter coverage allowed REC to introduce and test advanced pricing programs and a prepay program.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The project deployed new digital microwave backhaul links and a point-to-multi-point data radio network which delivers distribution SCADA and meter data from substation collectors to REC headquarters. A power line communications-based network using two-way automatic communications systems technology connects substation data collectors to meters and demand response devices.
- **Advanced metering infrastructure:** The project deployed 54,200 smart meters across REC's service territory, which completes coverage for all of REC's customers. The newly installed meters have functionalities such as outage detection, power quality monitoring, and tamper detection; and 10,572 of the installed meters have remote connect and disconnect functionality.
- **Direct load control devices:** The project deployed direct load control devices to customers who volunteered for the demand-side management program. The devices control water heaters and air conditioners and enable REC to lower peak demand, lessening the utility's need to purchase power at the most expensive times. This reduces REC's electric supply expense which helps to reduce future energy costs to the utility's

At-A-Glance

Recipient: Rappahannock Electric Cooperative

State: Virginia

NERC Region: SERC Reliability Corporation

Total Project Cost: \$31,435,874

Total Federal Share: \$15,694,097

Project Type: Advanced Metering Infrastructure
Customer Systems
Electric Distribution Systems

Equipment

- 54,200 Smart Meters
- AMI Communications Systems
 - AMI Meter Communications (Point-to-Multi-Point Radio, Power Line Carrier)
 - AMI Backhaul Network (Microwave)
- Meter Data Management System
- 14,865 Direct Load Control Devices
- Distribution Automation Equipment for 66 Circuits
 - SCADA Communications Network (Point-to-Multi Point Radio)
 - Voltage Regulator Controls
 - Usage Monitoring System

Key Benefits

- Reduced Electricity Costs for Customers
- Reduced Operating and Maintenance Costs
- Increased Electric Service Reliability and Power Quality
- Reduced Costs from Equipment Failures, Line Losses, and Theft
- Reduced Truck Fleet Fuel Usage
- Reduced Greenhouse Gas Emissions

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members.

- **Distribution automation systems:** The project deployed advanced automated equipment to improve distribution equipment performance. REC deployed automated distribution voltage regulator controls. SCADA has been installed in all REC substations, allowing the utility to monitor its entire distribution system. REC can thus better respond to changes in load and system conditions, increasing system reliability while reducing operation costs and outages. REC also replaced 792 down-line single-phase hydraulic reclosers with a mixture of three-phase and single-phase electronic-controlled vacuum reclosers. These new reclosers provide the platform for future system monitoring and control.
- **Distribution system energy efficiency improvements:** The project integrated automated voltage regulator controls with power quality monitoring and reverse power capability. The network of regulators improves voltage and volt-ampere reactive (VAR) control, improves power quality, and increases distribution capacity by reducing energy losses on the distribution system.

Benefits Realized

- **Improved customer service and reduced electricity costs:** These newly deployed technologies have reduced manual processes, improved meter data quality, increased data storage capabilities, and supported more accurate calculations of unbilled revenue. The meter data processed through the MDMS supports improved operational efficiency, customer service, energy forecasting, distribution system reliability, and regulatory compliance. Specifically, the MDMS has reduced high bill complaints since REC now has reliable hourly data, and the system provides quicker notification of meter failures at both a communications and hardware level. Integrating the AMI system with REC's customer information system has provided additional operational efficiencies and improved customer service. Furthermore, full smart meter coverage has allowed REC to offer additional rate programs and monitor electricity demand more accurately.
- **Reduced operating and maintenance costs:** As a result of AMI and MDMS deployments, operational cost savings have been realized through automation of meter reading and customer service activities.
- **Improved electric service reliability:** The AMI system has allowed 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. In many cases, the AMI system identifies the outage, a crew is dispatched, and power is restored—all without any customers calling to report the outage. The cooperative has also been able to take advantage of the automated voltage regulator controls' reverse power capability. There is no longer a need to send outage restoration crews to the downed-line regulator locations to manually turn the regulator controls off when lines are being back-fed to restore service. This allows the outage restoration crews to focus their efforts on locating and making repairs.
- **Reduced costs from theft:** New AMI features include tamper detection that allows utility personnel to locate and fix theft-of-energy situations quickly and cost-effectively.
- **Reduced truck fleet fuel usage:** The project has saved fuel and avoided pollutant emissions, thanks to both more efficient crew dispatching and the elimination of manual meter reading.
- **Improved safety:** The new electronically controlled reclosers have provided REC with additional flexibility in its system protection and coordination schemes. The reclosers allow system engineers to isolate feeders with a greater degree of certainty by utilizing the electronic recloser controls advanced/customizable coordination curves. This

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flexibility allows the cooperative's system engineers to better protect the electrical system, thus providing additional safety for REC employees and the general public.

Lessons Learned

- The use of good construction contractors – especially those experienced with the technologies and who have established relationships with the utility – to help perform the work is essential in order to meet project goals and deadlines. While it is tempting to assume utility staff can do it all, when the right partners are selected, both the utility and the project benefit.
- Just as with contractors, project teams should spend a good deal of time evaluating software vendors and select more mature products that have proven track records.
- REC experienced a delay in deploying some equipment due to vendor issues with component deliveries from a supplier. Ordering equipment and materials well in advance helps ensure that they are available when needed and the project does not experience delays.

Open and frequent communications throughout the project organization and with the public will help eliminate problems and is essential to a successful project. For example, REC held a regular weekly meeting with key project staff throughout the project duration. Contractors and vendors provided monthly updates on status, giving the project manager an opportunity to address any potential issues early. REC began its promotion of enrolling members into its load management program with an extensive cooperative marketing campaign that included bill inserts, updates on the REC website, and articles published in the cooperative's monthly magazine, which informed customers of changes associated with the project. Later the campaign transitioned into a proactive outbound call campaign, which dramatically helped with enrollments and participation in the utility's direct load control programs.

Future Plans

REC continues to install AMI equipment and smart meters as the system grows. By completing the system-wide installation of the AMI equipment and meters, the cooperative has been able to develop and initiate additional rate options and a prepay system for its members. REC will continue to enhance or replace technologies to take full advantage of the related equipment that was and continues to be installed.

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