

Northern Virginia Electric Cooperative

Electric Distribution System Automation Program

Scope of Work

Northern Virginia Electric Cooperative's (NOVEC's) Electric Distribution System Automation Program deployed digital devices to expand automation and control systems to cover a majority of NOVEC's substations and distribution circuits. The project also deployed a new communications network to complement the distribution system upgrades, enabling more precise monitoring and management of grid operations.

Objectives

The project's primary purpose was to accelerate the deployment of digital technologies to NOVEC's substation and distribution line automation program to improve system efficiencies, reduce line losses, and enhance situational awareness of critical components on the system. NOVEC also aimed to achieve overall reliability improvements and lower operating costs.

Deployed Smart Grid Technologies

- **Communications infrastructure:** Installation included internet protocol-based communications links from the substations to the main data center. NOVEC leveraged the upgraded communications infrastructure to integrate supervisory control and data acquisition (SCADA) and outage management software with new distribution and substation automation equipment. SCADA and other data are transported from field locations to central servers via a secure private network.
- **Distribution system reliability improvements:** NOVEC deployed remote switches, and electronic reclosers on 105 high-priority circuits. These devices reduce service interruptions and the frequency and duration of outages while also significantly reducing the need to send repair crews into the field.
- **Distribution system volt/VAR improvements:** The integration of automated capacitors and voltage regulators with a power-quality monitoring system improves volt/VAR control, power quality, and distribution capacity by reducing energy losses on the distribution system.
- **Substation automation systems:** Automation equipment was installed at 37 substations to better monitor substation assets and respond to changing grid conditions. Enhanced monitoring capabilities and new voltage reduction controls support more effective demand response programs aimed at achieving peak load reductions.

At-a-Glance

Recipient: Northern Virginia Electric Cooperative

State: Virginia

NERC Region: SERC

Total Project Cost: \$10,000,000

Total Federal Share: \$5,000,000

Project Type: Electric Distribution Systems

Equipment Installed

- **Distribution Automation Equipment for 105 of 235 Circuits**
 - Automated Reclosers
 - Remote Feeder Switches
 - Capacitor Automation Equipment
- **Substation Automation Equipment for 37 of 53 Substations**
 - SCADA Communications Network
 - Regulator Automation Equipment
 - Automated Recloser Controls
 - Smart Relays
 - Power Transformer Monitors
 - Battery Bank Monitors

Key Benefits

- Increased Electric Service Reliability and Power Quality
 - Reduced Cost from Distribution Line Losses
 - Reduced Operations and Maintenance Costs
 - Reduced Greenhouse Gas and Criteria Pollutant Emissions
 - Reduced Truck Fleet Fuel Usage
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Benefits Realized

- **Improved distribution system reliability:** Detailed outage information is provided by NOVEC’s existing advanced metering infrastructure (AMI) system combined with new motor-operated air-break switches and fault locator tools. The data provided allow NOVEC to pinpoint faults, reduce outage duration and restoration times, and improve system reliability. NOVEC has seen its reliability indices improve significantly from its winter and summer baselines:

	SAIFI	SAIDI	CAIDI	MAIFI
Summer 2013 Performance	0.40	21.96	70.63	0.12
Summer Baseline	0.62	54.49	88.50	0.39
Winter 2012 Performance	0.28	16.03	71.09	0.13
Winter Baseline	0.48	36.08	74.93	0.39

- **Improved power factors and reduced line losses:** By installing 32 capacitors, NOVEC saw improvements in 2012 distribution system performance: power factor improved from .94 to .98, average line losses fell from 2.12% to 2.04%, and a capacity increased by 5.7 megavolt amperes (MVAs).
- **Reduced operating and maintenance costs:** NOVEC can perform automated daily testing of recloser batteries with battery bank monitors instead of relying on monthly truck rolls. This testing is 95% effective in sensing and reporting battery failures. With this automated technology, NOVEC is able to replace recloser batteries before they fail—ensuring exceptionally high reliability and reducing monthly inspection costs.

Lessons Learned

The cybersecurity program faced challenges resulting from different understandings of cyber issues between NOVEC’s operational and information technology (IT) programs. Cross-cutting facilitation and leveraging of broader expertise across the overall organization were needed to move the cybersecurity plan forward, yet each program was focused on its own expertise and organizational role. Smart Grid technologies cut across traditional utility engineering, operations, and IT organizations and systems; NOVEC learned that in order to succeed, previously “compartmentalized” departments need to be engaged early and aligned behind mission-critical objectives.

Future Plans

NOVEC plans to pursue demand reduction by leveraging AMI voltage data and remote voltage control. NOVEC’s initial pilot program in this area suggests a positive business case for territory-wide implementation in the future.

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