

Midwest Energy, Inc. *Relay Replacement for Knoll Substation*

Scope of Work

Midwest Energy, Inc. (Midwest) deployed new communications equipment and smart relays at its Knoll substation. These relays included synchrophasor measurement technologies that increase grid operators' visibility of bulk power system conditions in near-real time, enable earlier detection of problems that threaten grid stability or cause outages, and facilitate sharing of information with neighboring control areas.

Objectives

The project aimed to provide access to better system operating information, which has allowed Midwest to improve power system models and analysis tools to increase reliability of grid operations and facilitate further renewable energy development.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The project deployed new communications equipment to transmit phasor data to the Midwest control center and potentially to neighboring transmission operators in the future. All communications wiring at the Knoll substation was replaced.
- **Wide-area monitoring, visualization, and control systems:** The project installed new phasor measurement unit (PMU)-ready relay equipment not previously deployed in this area of the Kansas transmission grid. This equipment has provided a more expansive view of the bulk power system and simultaneously revealed dynamic operating conditions, such as voltage and frequency information.
- **Advanced transmission applications:** Midwest is utilizing and developing applications for the synchrophasor system, including the following:
 - **Angle and frequency monitoring** to provide grid operators and engineers with detailed information about grid conditions and power flows
 - **Post-event analysis** to enable power system engineers and grid operators to analyze disturbances and large-scale system events to better understand their causes and improve future system models and operations
 - **Power system restoration** to provide grid operators a better view of power flows and potential grid oscillations during system restoration procedures to avoid system instability and failed restart attempts
 - **Voltage and voltage stability monitoring** to provide grid operators and engineers with detailed information about grid conditions and system stability
 - **Improved state estimation** to infer and impute system conditions for the parts of the transmission grid that lack monitoring equipment

At-A-Glance

Recipient: Midwest Energy, Inc.

State: Kansas

NERC Region: Southwest Power Pool

Total Project Cost: \$1,424,514

Total Federal Share: \$712,257

Project Type: Electric Transmission Systems

Equipment

- 8 Relay-Based Phasor Measurement Units
- 1 Phasor Data Concentrator
- Synchrophasor Communications Network

Advanced Applications

- Angle and Frequency Monitoring
- Post-Mortem Analysis
- Voltage and Voltage Stability Monitoring
- Improved State Estimation
- Steady-State Benchmarking

Key Benefits

- Improved Ability to Avoid Cascading Outages
 - Improved Electric Service Reliability and Situational Awareness
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Midwest Energy, Inc. (continued)

- **Steady-state benchmarking** to analyze data from the new phasor measurement units to improve monitoring of power flow throughout the transmission system

Benefits Realized

Midwest has a synchrophasor network in place that will be leveraged by designing, developing, and deploying advanced applications. Operators will gain better situational understanding of and control over the bulk power system.

Lessons Learned

Installation of a synchrophasor system is only the first step in being able to fully realize the benefits of the new technology. Advanced application design, development, and deployment are necessary to provide operators with mature decision support tools in the control room.

Future Plans

Midwest plans to continue to develop improved monitoring and visualization applications to fully leverage the new grid state data that are available. More robust modeling and simulation for real-time contingency analysis will also provide better decision-making support to grid operators.

Contact Information

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