

American Transmission Company LLC (II) Phasor Measurement Unit Project

Scope of Work

American Transmission Company LLC's (ATC's) Phasor Measurement Unit project deployed synchrophasor technologies to expand collection of synchrophasor data from 25 to 70 substations across the company's service area. The project deployed phasor measurement units (PMUs) and data collection software, and digital fault recorders (DFRs) were upgraded to achieve PMU functionality.

This project was associated with ATC's Enhanced Supervisory Control and Data Acquisition and PMU Communications Backbone Project, another project funded through the Smart Grid Investment Grant program.

Objectives

Successful delivery of ATC's project scope has increased grid monitoring capabilities and improved system reliability. The newly deployed technologies are being used to collect and monitor sub-second grid state data, providing insights in the event analysis process that were not available from traditional data sources such as supervisory control and data acquisition (SCADA) systems. ATC has used synchrophasor monitoring to improve electric system reliability by identifying component issues before they cause problems on the system.

Deployed Smart Grid Technologies

- **Synchrophasor technology:** ATC upgraded existing DFRs to give them PMU functionality and installed stand-alone phasor measurement equipment at site locations that did not have DFRs. The project deployed 49 PMUs, 45 phasor data concentrator field units that concentrate (but do not store) data, an improved data collection system for acquisition and delivery of data from the field PMUs, and control center computers that feed visualization applications for grid operators. The project delivered the primary collection capability at 45 substations within ATC's transmission footprint, for a total of 60 data collection points. Existing (pre-project) phasor data concentrators collect, store, and analyze data from the PMUs and DFRs.
- **Advanced transmission system applications:** ATC leveraged the synchrophasor system to develop and implement angle/frequency monitoring and post-mortem analysis. Efforts are under way to utilize the systems to enhance state estimation and to develop steady-state model benchmarking applications.

Benefits Realized

- **Improved electric service reliability and power quality:** Grid state data from the PMUs and DFRs have enabled transmission operations personnel to identify and analyze grid disturbances. The newly deployed technologies have increased grid operators' ability to monitor the condition of bulk power systems in near-real time, enabled earlier

At-A-Glance

Recipient: American Transmission Company LLC

State: Wisconsin

NERC Region: Midwest Reliability Organization

Total Project Cost: \$2,661,650

Total Federal Share: \$1,330,825

Project Type: Electric Transmission Systems

Equipment

- 49 Phasor Measurement Units*
- 45 Substation Phasor Data Concentrators

*Represents 60 data collection points at 45 substations and includes 31 stand-alone PMUs and 18 upgraded digital fault recorders

Advanced Transmission Applications

- Angle/Frequency Monitoring
- Post-Mortem Analysis

Key Benefits

- Improved Electric Service Reliability and Power Quality

American Transmission Company LLC (II) *(continued)*

detection of conditions that could result in grid instability or outages, and facilitated the sharing of information with neighboring regional control areas.

Lessons Learned

- Installing the devices and configuring the data flow was relatively easy. The challenges are sorting through and archiving the massive influx of data to derive the information that supports operations, planning, and system protection personnel.
- Managing maintenance of the new technology was initially an issue, as ATC had limited field support staff with good working knowledge of the holistic delivery system, i.e., how it worked from metering device to control center data concentrator. ATC continues to work with field maintenance personnel to improve understanding.
- Moving the technology from development to production has been more difficult than expected. The post-mortem data analysis has been beneficial, but finding must-have applications for real-time operations has been challenging.
- Small wins can be important when trying to gain acceptance for a new technology. Every time ATC shares data with an employee to help solve a problem, demand for the data and supporting applications grows. Requests for data have escalated from once every month or two (at project initiation) to every time a significant event occurs on the system.

Future Plans

- The company will continue to perform post-mortem event analysis to better understand the dynamic operation of the ATC system. ATC will also continue sharing knowledge with others to help gain wide-scale acceptance of the technology.
- The company will expand the “high-speed” view of the upper Midwest transmission system by requesting data from PMU installations outside the ATC footprint.
- Project staff are working to develop model verification and improvement processes using analysis tools that can easily compare PMU event data to expected operation.
- Existing synchrophasor data will be used to validate ATC’s State Estimator (SE) solution. The company will also investigate the use of synchrophasor data to improve SE results.
- Management will consider using data to support voltage stability applications. The decision will be based on results from others, including ATC reliability coordinator MISO.
- ATC will pursue enablement of synchrophasor data from opportunity sites as new projects are implemented, although there are currently no plans for additional wide-area PMU installations.

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