

New York Independent System Operator, Inc.

New York State Capacitor/Phasor Measurement Project

Scope of Work

In the New York State Capacitor/Phasor Measurement Project, the New York Independent System Operator, Inc. (NYISO) and its eight transmission owner (TO) subrecipients deployed phasor measurement units (PMUs), phasor data concentrators (PDCs), and smart grid-enabled capacitors. These devices provide the NYISO with enhanced transmission grid monitoring capabilities for the New York Control Area (NYCA). Project participants also deployed new software to assist in determining real-time grid stability margins.

Objectives

The project's main objectives were to improve electric service reliability and power stability and to reduce costs associated with line losses. The project has improved NYISO grid operators' visibility into and across New York's bulk power systems, allowing them to monitor in near-real time and enabling earlier detection of disturbances that could result in instabilities or outages. In addition, the NYISO is working on sharing synchrophasor data with neighboring regional control areas. Project-funded capacitor banks further improve the ability of the NYISO and the NYCA TOs to regulate transmission voltages.

Deployed Smart Grid Technologies

- **Communications infrastructure:** A new synchrophasor communications network collects data from PMUs and PDCs deployed across the participating utilities in the NYCA and transmits these data to the NYISO.
- **Wide-area monitoring and visualization systems:** These systems provide NYISO grid operators with a more detailed view of the bulk transmission system, revealing dynamic operating characteristics. Transmission operators utilize these detailed, real-time data to identify grid disturbances at early and localized stages.
- **Advanced transmission applications:** The NYISO implemented advanced transmission applications to harness the data being captured by PMUs. Grid operators can access these applications through new control center panels that display streaming PMU-based parameters.
 - **Post-mortem analysis application:** This application enables grid operators to analyze disturbances and large-scale system events. These data are also being used to calibrate system models.

At-A-Glance

Recipient: New York Independent System Operator

State: New York

NERC Region: Northeast Power Coordinating Council

Total Project Cost: \$70,336,403

Total Federal Share: \$35,138,211

Project Type: Electric Transmission Systems

Equipment Installed

- 50 Phasor Measurement Equipment (PME)
Locations:
 - 41 Additional TO Substations Covered by PME
 - 9 Grandfathered PME Locations
- 8 TO Control Center Phasor Data Concentrators
- 1 TO Substation Phasor Data Concentrator
- 2 "Super" Phasor Data Concentrators at NYISO Control Centers
- Synchrophasor Communications Network
- 938 Megavolt-Amperes Reactive (MVAR) of Automated Capacitors

Advanced Applications

- Post-Mortem Analysis
- Phasor-Enhanced State Estimation
- Voltage Stability Monitoring
- Real-Time Dynamic Monitoring System

Key Benefits

- Improved Electric Service Reliability and Power Quality
- Increased Wide Area View
- Reduced Costs from Line Losses

Note: The dollars presented within the project description are approved project budget amounts as of October 31, 2014. Actual figures will not be available until after the official close of the project on June 30, 2015.

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- **Phasor-enhanced state estimation application:** The addition of the new PMU-based data improves the accuracy of the state estimation function within the NYISO's grid operations.
- **Voltage stability monitoring application:** This application provides grid operators and engineers with detailed information about grid conditions and system stability.
- **Cyber security implementation:** A robust, confidential cyber security plan was developed and implemented to ensure secure communications and operation of the PMU network.
- **Smart grid-enabled capacitor banks:** Previous analysis had shown NYCA needed significant additional reactive power resources. NYISO installed automated transmission system capacitors that were compatible with the advanced monitoring and control capabilities provided by the PMUs and advanced applications.

Benefits Realized

The NYISO has already realized benefits from the SGIG project and expects that others will become evident as situational awareness capabilities and advanced software applications mature and are used by grid operators. Some of the existing and anticipated benefits are listed below.

PMU-related benefits/impacts:

- Monitoring of electric power system reliability
- Increased wide-area view
- Increased capabilities to detect disturbances

Capacitor-related benefits/impacts (sum of winter 2012 and summer 2013):

- Avoided transmission losses: 19,368 megawatt-hours (MWh)
- Generation cost savings: \$5.97 million
- Avoided peak generation: 20 megawatts (MW)
- Avoided carbon dioxide emissions: 23,262 tons

Lessons Learned

From the start, the NYISO realized the importance of creating a solid, well-rounded team to support the project initiatives. The NYISO had to integrate project management, grant compliance, and technical consulting teams within its own organization and from each of the eight TOs. Strong project management and dedicated executive sponsorship have proven to be critical to the project through various challenges, which included delays due to natural disasters and the use of a new, untested data source in multiple applications.

The NYISO benefited from the development of technical specifications and requirements in advance of equipment installations in the field and prior to implementing the applications. This was important to ensure consistency in project execution among the TOs and to avoid integration issues.

Frequent communication with the U.S. Department of Energy (DOE) and TOs also played a significant role in completing the implementation phase of the project. The NYISO participated in weekly phone calls with DOE in an effort to ensure that its expectations were met and that potential issues or risks were promptly addressed. The NYISO also worked to foster strong communication with each of the TOs as part of the extended project team.

Future Plans

The NYISO and the TOs have plans to further capitalize on the full capabilities of the smart grid technology deployed as part of the project. The NYISO expects to continue to enhance its situational awareness through additional development

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of the visualization applications. In addition, the NYISO expects to use these applications as a participant in the recently created data-sharing network for the Eastern Interconnection. Certain TOs plan to develop and utilize situational awareness applications as well and will continue to work on maintaining and hardening the security of PMUs. Data analysis may lead to other post-implementation modifications to the PMU network to achieve additional efficiency.

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