NEW YORK INDEPENDENT SYSTEM OPERATOR

NYISO's DOE Smart Grid Investment Grant Initiatives

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Focused Upon Situational Awareness

- April 2004 Final Report on the August 14, 2003 Northeast Blackout concluded one of the principal causes was "*a lack of situational awareness, which was in turn the result of inadequate reliability tools and backup capabilities*"
- NYISO's Smart Grid initiatives focus primarily upon improving situational awareness within the New York Control Area and the Eastern Interconnection at-large.
- NYISO's Smart Grid projects encompass the deployment of enabling infrastructure and situational awareness applications.
- Projects are collaborative efforts with the New York Transmission Owners

Targeted Recommendations

- *"Development of practical real-time applications for wide-area system monitoring using phasor measurements and other synchronized measuring devices, including post-disturbance applications;"*
- *"Development and use of enhanced techniques for modeling and simulation of contingencies, blackouts, and other grid-related disturbances;"*
- *"Investigation of protection and control alternatives to slow or stop the spread of a cascading power outage, including demand response initiatives to slow or halt voltage collapse;" and*
- *"Strengthen reactive power and voltage control practices in all NERC regions."*

Situational Awareness Initiatives

- Synchronized Phasor Measurement Network
- Phasor-Assisted State Estimation
- Real-Time System Visualization Tools
- Voltage Stability Management
- Controlled System Separation
- Dynamic Model Calibration
- Smart Grid Enabling Reactive Power Resources

Wide-Area Measurement System

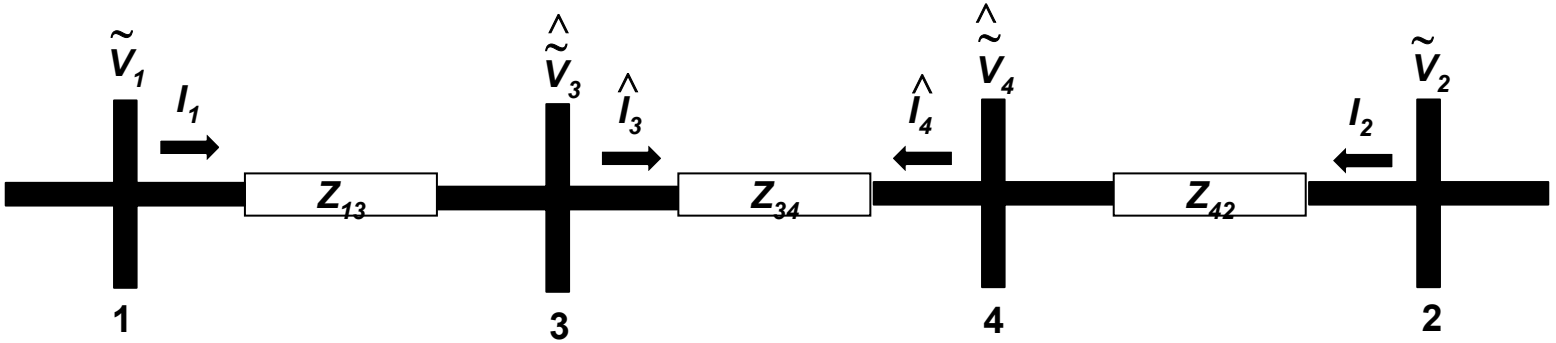
- TOs to expand Synchro-Phasor Network to ~50 PMUs
- Achieve phasor observability at 230 KV & above
- Study to be conducted to optimize siting
- Proposed network topology consistent NASPInet
  - *Transmission Owners' (TOs') Phasor Data Concentrators (PDCs) Poll PMUs*
  - *NYISO's PDC Communicates with TOs' PDCs*
  - *PDCs to be Integrated with NASPInet*
- PMU capability achieved by upgrading protective relays, digital fault recorders, and sequence of events recorders

Phasor Assisted State Estimation

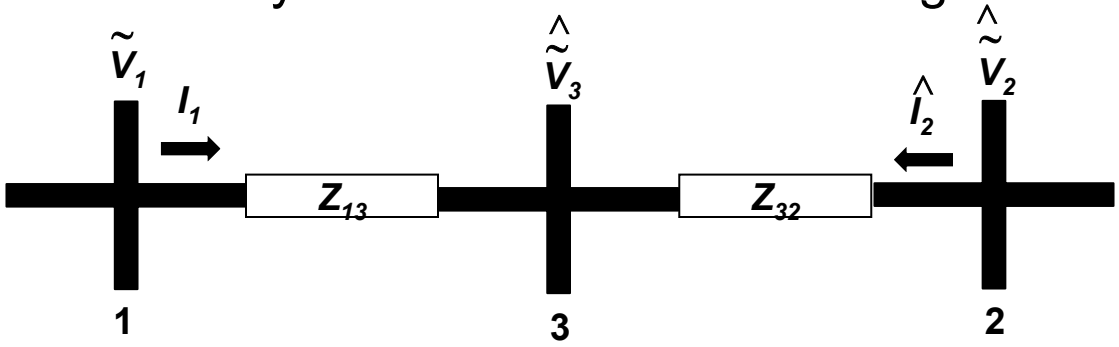
- System operations and monitoring traditionally based upon State Estimators
- Phasor measurements can be used to improve State Estimator solutions
  - *Facilitating identification and correction of bad data*
  - *Provide for scaling calibration*
  - *Increase observability through derivation of unmeasured data using phasor measurements at adjacent buses*

Phasor Assisted State Estimation

If phasor measurements are available at V_1 , I_1 , V_2 , and I_2 , then phasor quantities at can be computed for V_3 , I_3 , V_4 , and I_4



If only 1 bus separates 2 PMU measurements, V_3 estimation is redundant, as it can be derived from measurements at either bus (i.e., V_1 & I_1 and V_2 & I_2). Such redundancy allows correction of scaling errors in time series data.



Real-Time Visualization Tools

- Suite of System Operator tools to monitor and appropriately alarm for conditions pertaining to:
  - *Phase angle separation*
  - *Damping status and trend*
  - *Oscillations: High mode energy / Low Damping*
  - *Frequency variation across interconnection*
  - *Voltage instability*
  - *Reliability Margin: "How far are we from the edge"*

Voltage Stability Management

- Integrate Voltage Stability Analysis (VSA) application with real-time phasor data;
- Compute Voltage Stability Margins for key transmission interfaces;
- Provide VSA Monitoring and Alarming for NYISO System Operators; and
- Develop operational protocols to improve voltage stability.

Controlled System Separation

- No current protection system for controlled system separation, which is a final defense to prevent a blackout under cascading failures.
- Controlled separation protocols could:
  - *Reduce power interruptions in New York state transmission system;*
  - *Minimize impacts resulting from major disturbances;*
  - *Enable prompt system restoration, since most generation units survive after separation and most customers are continuously served in electric islands.*

System Separation Project Scope

- Increase knowledge in controlled separation;
- Identify further hardware/software development for implementation of controlled separation
  - *Identify potential transmission system separation points ;*
  - *Real-time oscillation monitoring through synchronized phasor measurement network;*
  - *Develop criteria to trigger system separation; and*
  - *Develop criteria for timing of controlled separation.*

Dynamic Model Calibration

- Gather data from existing PMUs, DFRs, and DSRs to identify events for near-term system dynamic model validation
- Provide input into locations and configuration of additional PMUs
- Incorporate data from PMUs added through Smart Grid initiative and identify events
- Simulate observed events to verify the *existing* generator and load models
- Identify opportunities to improve system models

SG Enabling Reactive Resources

- TOs to install ~950 MVAr of switched/controllable capacitor banks
- Improved ability to control voltage across the system when and where needed
- Foundation to enable future smart grid functionality through:
  - *Self-driven intelligent devices*
  - *Dispatcher controlled optimization of T&D resources to enhance economical power system operation*

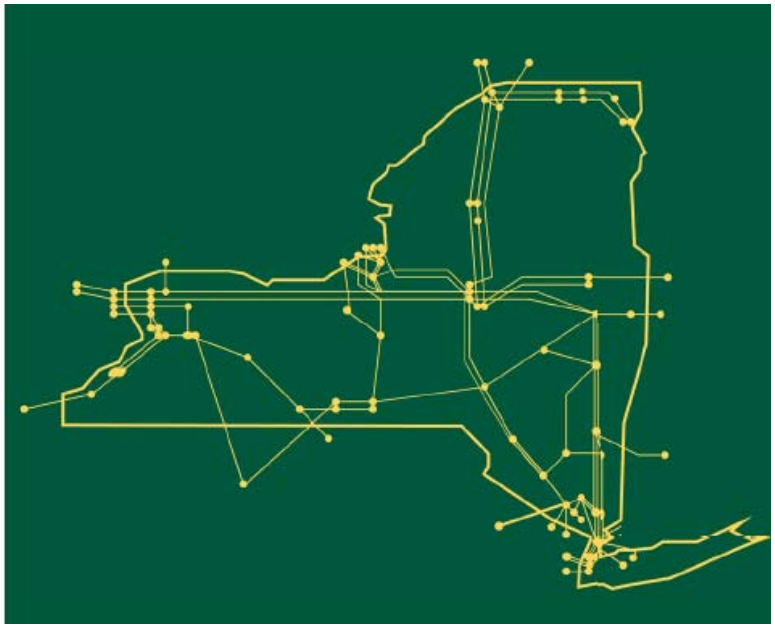
Voltage Profile Enhancements

- Maintain voltage and reduce system losses
- Projected impact from reduced system losses
  - *~$9.7M savings annually; and*
  - *CO2 reductions of ~58,440 tons annually.*
- Relieve base need for dynamic reactive power supply from rotating generators
  - *Allows for increased dynamic voltage support during system contingencies*
- Potentially mitigate voltage constraints, thus increasing transfer capability

Immediate Next Steps

- NYISO has begun dialogue with the TOs regarding the administration of the grant and management of the project
- NYISO is negotiating a sub-award agreement with the involved TOs to define roles and responsibilities
- DOE is conducting a briefing for selectees on November 19th
- NYISO will establish grant administration and project management processes
- An RFP has been issued to engage a firm to perform grant administration and project management functions
- NYISO engaged CDAS to begin discussions on their role in developing interoperability, data management, and applications standards

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and conducts comprehensive planning for the state's bulk electricity system.



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