



Operational Challenges and Innovative Solutions to Integrating Renewable Resources

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**Integrating Renewable Resources Into the Wholesale
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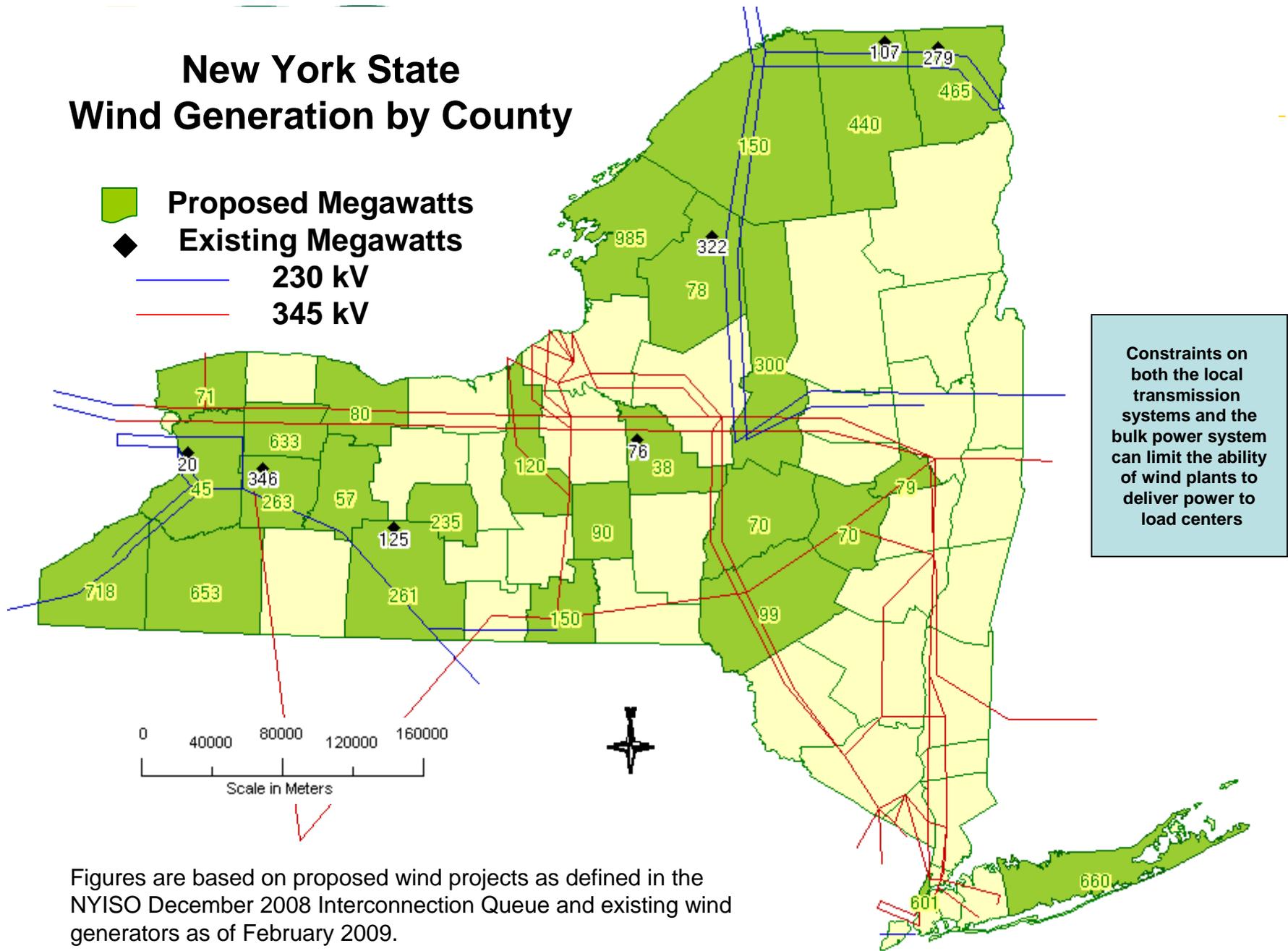
Wind: Operational Challenges

- ◆ In New York State, wind power development is primarily in Northern and Western regions, while load centers are in the Southeastern portion of the state.
 - *Currently **1,275 MW** of wind interconnected*
 - *Additional **1,000+ MW** expected in 2009*
 - *Another **6,500 MW** of wind in the interconnection queue*

- ◆ *See **NYISO White Paper: “Integration of Wind into System Dispatch”***
 - http://www.nyiso.com/public/webdocs/documents/white_papers/wind_management_whitepaper_11202008.pdf



New York State Wind Generation by County

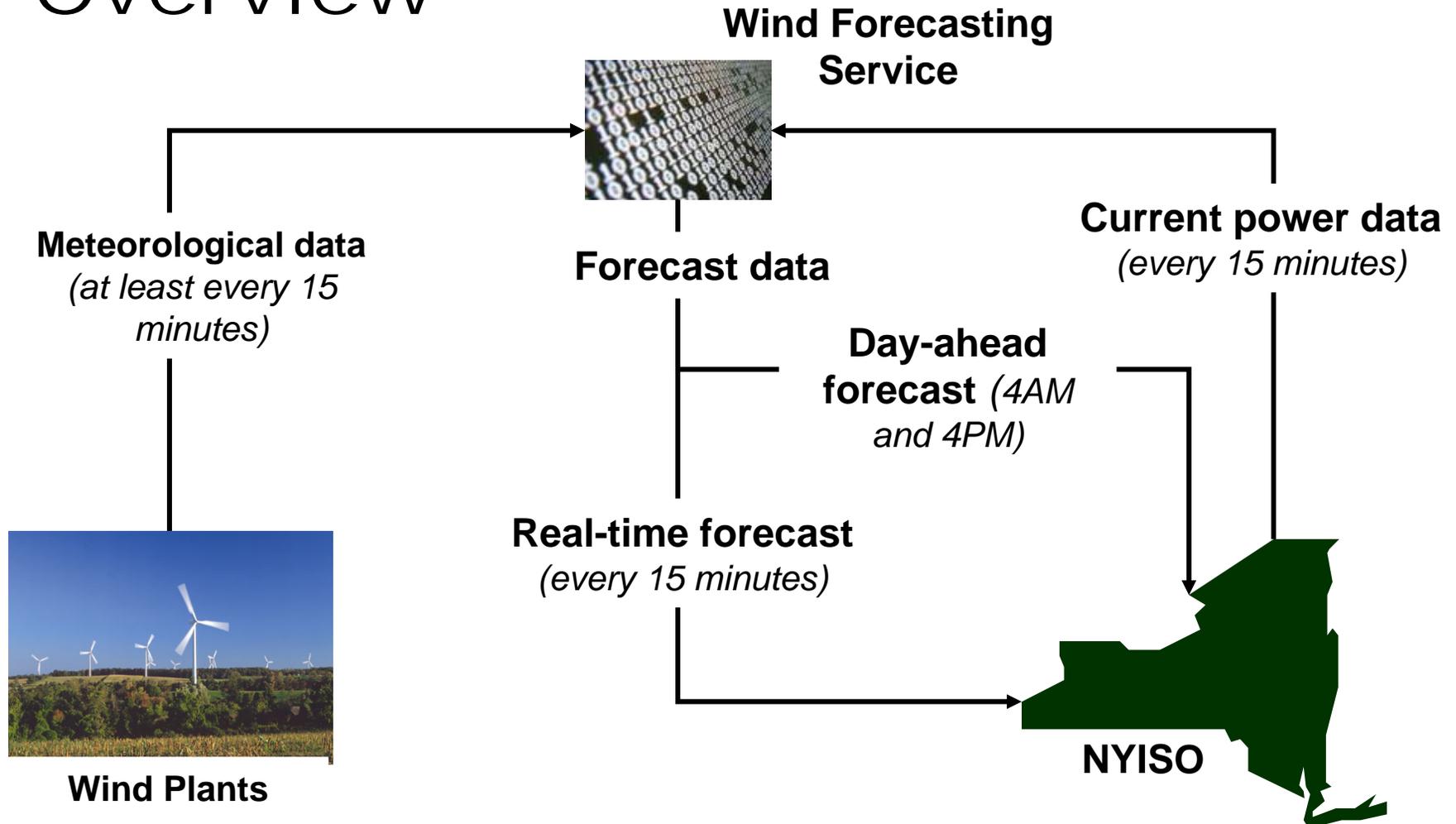


Figures are based on proposed wind projects as defined in the NYISO December 2008 Interconnection Queue and existing wind generators as of February 2009.

2008 Efforts: Wind Forecasting Integration

- ◆ In 2008, the NYISO implemented a centralized program to forecast energy output for interconnected wind generating plants.
- ◆ Wind-energy output is currently being forecast for thirteen (13) wind generating plants.
- ◆ These forecasts are provided to the NYISO by a third-party wind forecasting company for both real-time and day-ahead energy market operations.

Wind Forecasting Integration: Overview



Wind Forecasting Integration (continued)

- ◆ Real-time forecasts are integrated into the NYISO's real-time Security Constrained Dispatch (SCD).
 - *Wind plant output levels are updated every 15-minutes on a 15-minute interval basis for an eight hour forecast period.*
 - *Mean Absolute Error (MAE) of 4.8% for one hour ahead forecast.*
- ◆ Day-ahead forecasts are integrated into the day-ahead unit commitment process for reliability purposes.
 - *Wind plant output levels are updated twice daily on an hourly interval basis for the next two operating days.*
 - *Mean Absolute Error (MAE) of 11.5% for day ahead operation.*

Wind Forecasting Integration (continued)

- ◆ Ongoing costs of the wind forecasting service are recovered from wind plant operators.
- ◆ Wind plant operators must supply site-specific meteorological data for at least one location every 15 minutes for use in the forecast (*Site requirements will be increased in 2009*).
- ◆ Wind plants may be penalized for continued failure to deliver accurate meteorological data.

2009 Efforts: Wind on Dispatch

- ◆ The NYISO will be seeking Tariff changes to become effective in May 2009 to improve the integration of wind resources into its Security Constrained Dispatch (SCD).
- ◆ The changes, if accepted, will require wind plants to receive and follow dispatch-down instructions (*via SCD basepoints*) when it is determined that a wind resource's energy output is subject to limitations.
- ◆ This enhanced wind management capability will allow the NYISO to use the most economic resources to meet New York's energy demands while still meeting all reliability requirements.
- ◆ Penalties will be imposed for exceeding SCD basepoints during dispatch-down instruction periods. Penalties will be phased-in.

Wind on Dispatch: Benefits

- ◆ Integrating wind units into the Security Constrained Dispatch provides the following benefits.
 - *Wind resources may indicate their economic willingness to generate (offering in Day-Ahead Market remains optional).*
 - *Identification and use of the most efficient resources to address reliability limitations while minimizing the energy limitation (MW) and duration.*
 - *Incorporates wind plant dispatch instructions into energy market clearing price.*
 - *Minimizes the need for less efficient, out-of-market actions to maintain reliable operations.*

Wind: NYISO Study Work

- In 2004, the NYISO studied the impact of 3,300 MW of wind resource integration.
 - *This study concluded no need for increased system regulation requirements at this level of wind generation.*
 - *Some areas of transmission limitations were identified.*
- NYISO actions to address future wind potential include:
 - *Updating the original 2004 study for wind resource potential by studying future wind plant integration ranging from 3,500 MW to 8,000 MW.*
 - *Participating in Regional and National wind study initiatives.*

Wind: Future Enhancements

- ◆ NYISO is investigating the ability to manage significant regional wind plant output ramp events.
 - *Sudden large increases in wind speeds and plant outputs.*
 - *High wind speeds approaching wind plant cut-out levels.*
 - *Sudden large drops in wind speeds and plant outputs.*
- ◆ New wind plant data requirements.
 - *Meteorological data (wind speed and direction) within 5 km from each wind turbine.*
 - *Meteorological data from plants to be transmitted directly to NYISO every 30 seconds.*
- ◆ Security Constrained Dispatch could be used to address some wind plant ramp events in order to maintain reliable operations.

Limited Energy Storage Resources – Overview

- ◆ The NYISO is also seeking tariff changes to incorporate Limited Energy Storage Resources (LESR) into the Regulation market.
- ◆ The NYISO defines LESRs as generators offering Regulation Service only, characterized by limited energy storage or the inability to sustain continuous operation for a minimum period of one hour.
 - *Includes flywheel and battery storage technologies*
- ◆ Adding LESRs to the Regulation market increases the competitive nature of that market and assists the NYISO in meeting the potential for increased system regulation requirements that may result from higher levels of renewable resource integration such as wind.

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 system and resource planning for the state's bulk electricity system.

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