Growing Wind

Final Report of the NYISO 2010 Wind Generation Study

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National Wind Coordinating Collaborative
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The Roles of the NYISO

Reliable operation of the bulk electricity grid

- *Managing the flow of power nearly 11,000 circuit-miles of transmission lines from more than 300 generating units*

Administration of open and competitive wholesale electricity markets

- *Bringing together buyers and sellers of energy and related products and services*

Planning for New York's energy future

- *Assessing needs over a 10-year horizon and evaluating the feasibility of projects proposed to meet those needs*

Advancing the technological infrastructure of the electric system

- *Developing and deploying information technology and tools to make the grid smarter*

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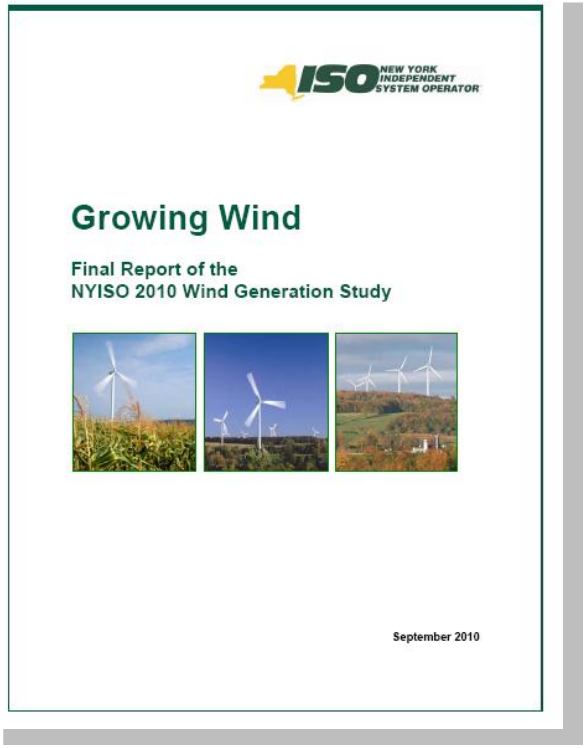
NYISO 2010 Wind Generation Study

1. Background
2. Overview of the Study
3. Reliability Analysis
4. Resource Adequacy
5. Transmission Planning
6. Production Cost Savings
7. Environmental Impacts
8. Conclusions



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Background

- NY Renewable Portfolio Standard 30%
  - *NYSERDA directly procures qualified resources*
- Wind capacity today 1,275 MW (base case)
- 7,000 MW in the interconnection queue
- NYISO requested to study impact of wind generation up to 8,000 MW
  - *2004 study evaluated impact of 3,300 MW of wind generation*
  - *2010 study evaluated 3,500 MW, 4,250 MW, 6,000 MW and 8,000 MW wind generation scenarios*

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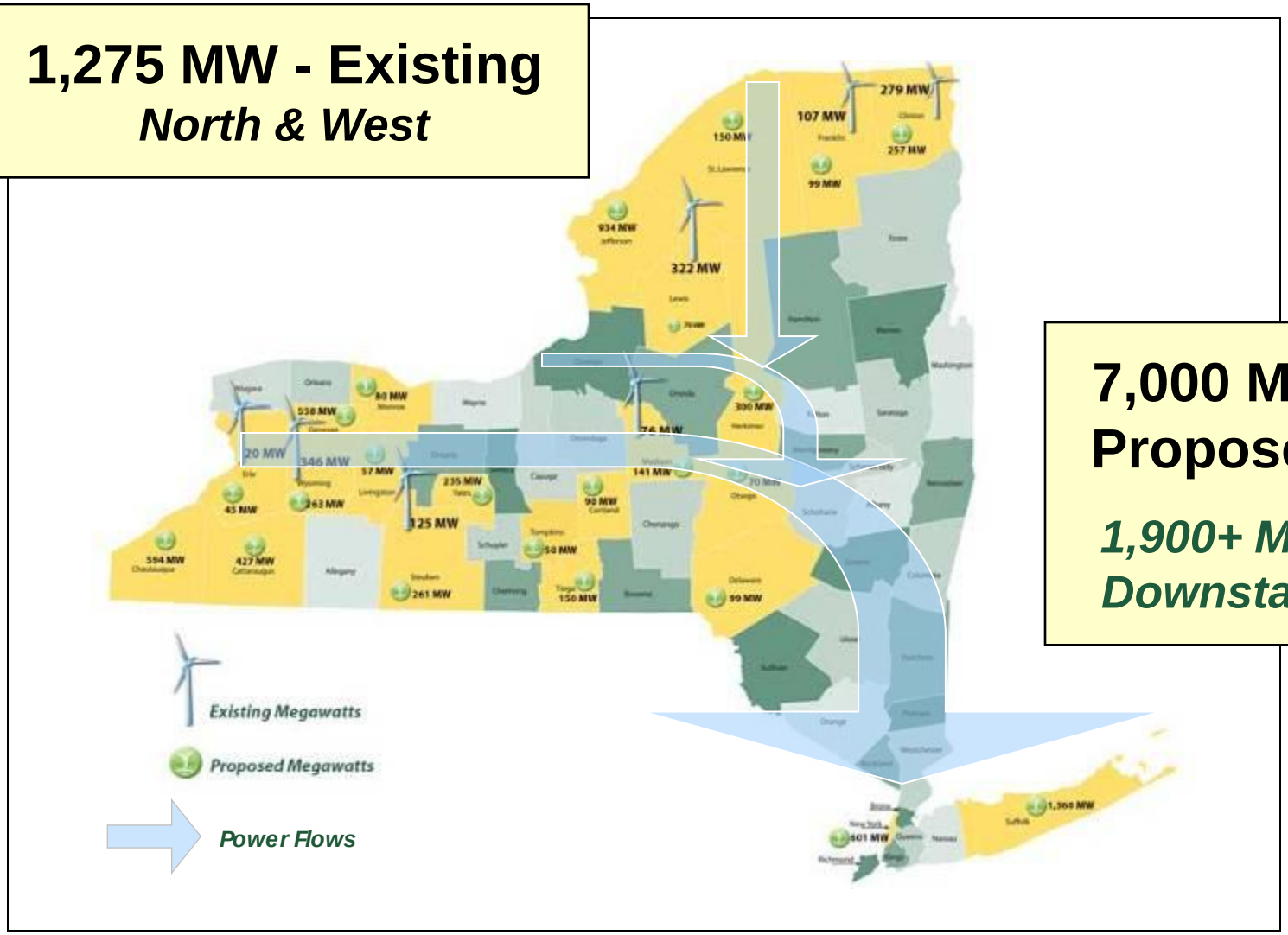
Windpower in NY

1,275 MW - Existing
North & West



7,000 MW Proposed

1,900+ MW Downstate

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Wind Plant Integration Issues

- **Transmission (Task 5, 6 and 7)**
  - *Will local area limitations affect wind plant output?*
  - *Are transmission limitations a major barrier to increasing wind plant penetration in some areas?*
- **System Flexibility (Task 4)**
  - *Will the intermittent nature of wind plant output result in increased system variability?*
  - *Will operator awareness and practices need to be enhanced?*
  - *Earlier study finding has led to the introduction of wind energy management and associated market rules*
- **Wind Plant Performance & Standards (Task 5)**
  - *Wind plant dynamic models and LVRT capability*

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Study Tasks Descriptions

- Task 1: Develop study assumptions
- Task 2: Develop and implement performance monitoring for operating wind generators
- Task 3: Update other regions' experience with wind generators
- Task 4: Study the impacts on higher penetrations of wind on system variability and operations

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Study Tasks (continued)

- Task 5: Evaluate the impact of the higher penetration of wind generation on transmission infrastructure and system performance
- Task 6: Evaluate the impact of the higher penetration of wind generation on energy production and production costs for NY system
- Task 7: Generate a transmission upgrade list

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Reliability

- Study concluded there is no adverse reliability impact with 8,000 MW of wind
- Wind is out of phase with the load in NY
  - *Increases ramp in morning and evening*
- Sufficient load-following resources expected to be available to provide ramp
- No additional Operating Reserves required
- Variability raises Regulation Service requirement
  - *Approximately 9% for every 1GW increase in wind generation*

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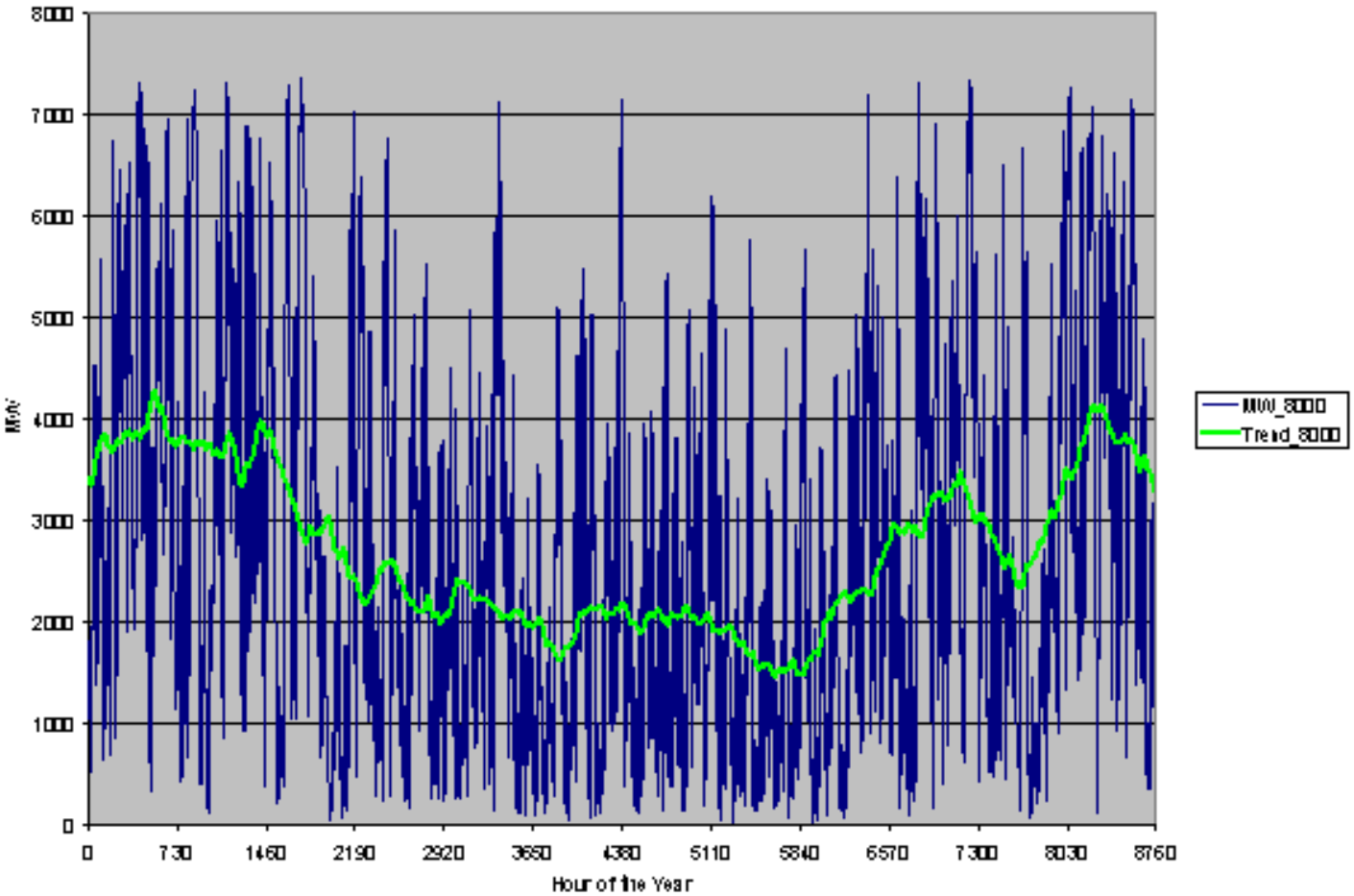
Simulated NYS Hourly Wind Output for 8,000 MW of Wind Based on 2006 Wind Data



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Resource Adequacy

- **Simulations indicate 1 MW of wind will be equivalent to .2 to .3 MW of conventional generation due to lower availability**

- **Wind's lower availability, all else being equal, will result in an increased IRM**
  - ***However, LSEs purchase "Unforced" capacity (UCAP) which is adjusted for availability, and this amount is essentially unchanged***

- **Transmission constraints will limit the ability of some wind to sell into Installed Capacity market**

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Transmission Planning

- The 6,000 MW scenario determined that 8.8% of the energy production of the wind plants in three zones in upstate NY would be "bottled" or "energy constrained"
- The principal transmission constraints are the local 115 kV transmission facilities
  - *No significant 345kV upgrades required*
- Transmission upgrades ranging from $75 million to $320 million could relieve most of the constraints

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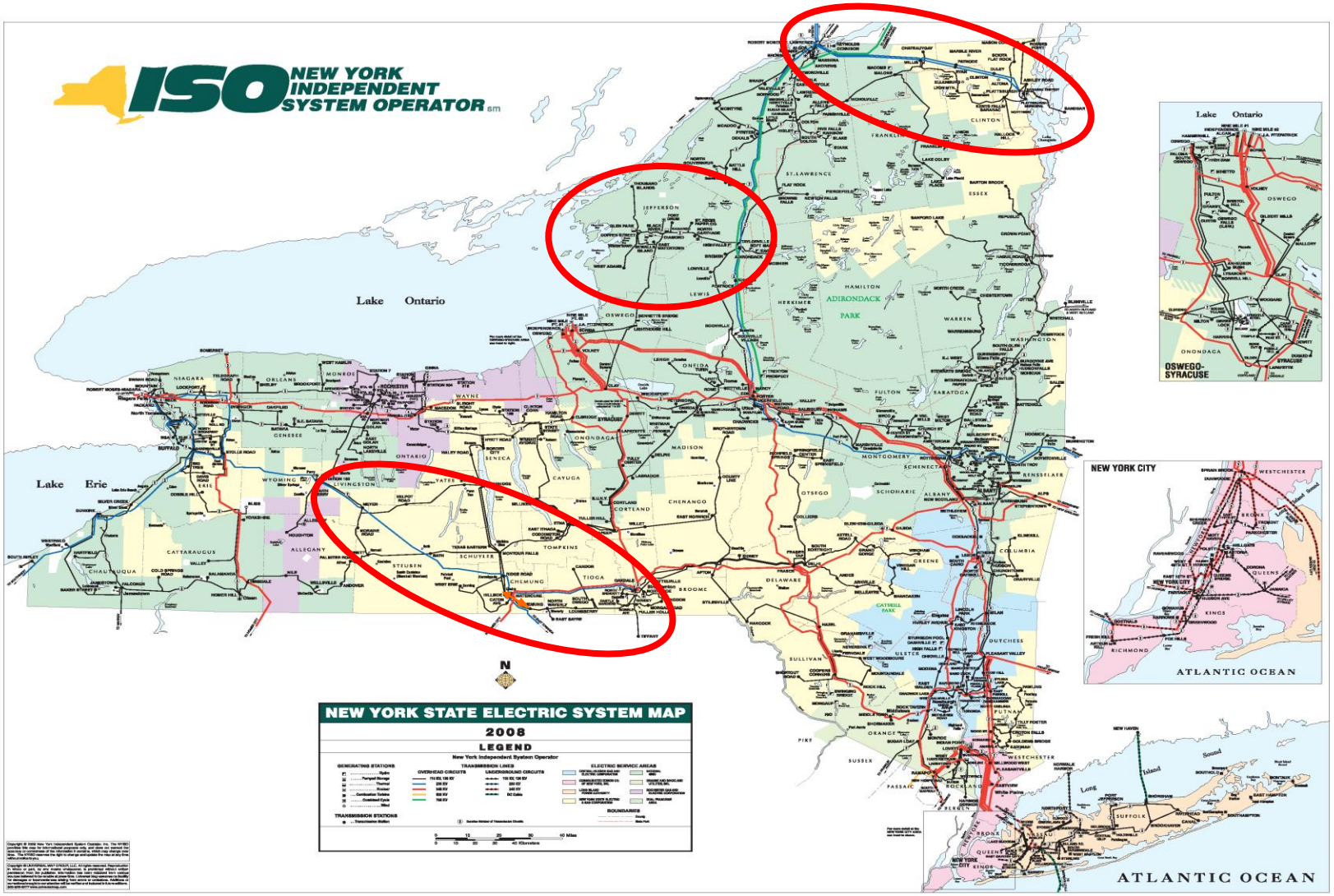

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Production Cost Savings

- **For the 8,000 MW simulation production costs dropped by 16.6% when compared to the base case**
  - ***Wind assumed to be a price-taker***

- **Wind generation expected to displace primarily upstate gas generation**

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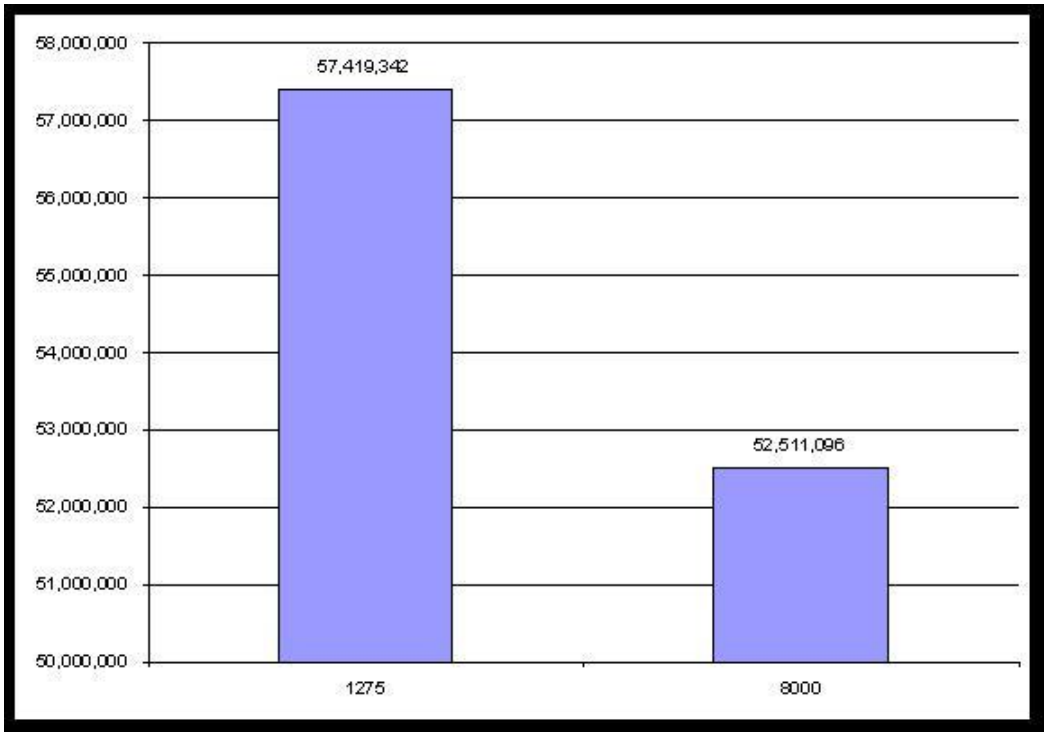
Environmental Impacts

- **Emissions reductions between 1,275 MW base case & 8,000 MW wind case**
  - ***CO2 ▼ 8.5%***
  - ***NOX ▼ 7%***
  - ***SOX ▼ 9.7%***



Reduction in CO_2 (short tons) as Wind Generation Increases for 2018

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Study Conclusions

- 8,000 MW of wind generation can reliably supply clean energy at a very low cost of production to the NY power grid
- Due to its variable nature and lower availability, wind generation poses operating challenges such as higher magnitude net-load ramps

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Study Conclusions (cont.)

- NYISO's security constrained economic dispatch is capable of managing and responding to the higher magnitude ramps and system variability, but wind will increase the need for Regulation Service
- Transmission upgrades would be needed to relieve wind energy bottling in three Zones of Northern and Central New York

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Study Conclusions (cont.)

- Wind resources will generally result in lower overall energy production costs that can benefit consumers through lower LBMPs, but may create a challenging economic environment for future wind development and the conventional resources needed to provide ramp, reserves and regulation

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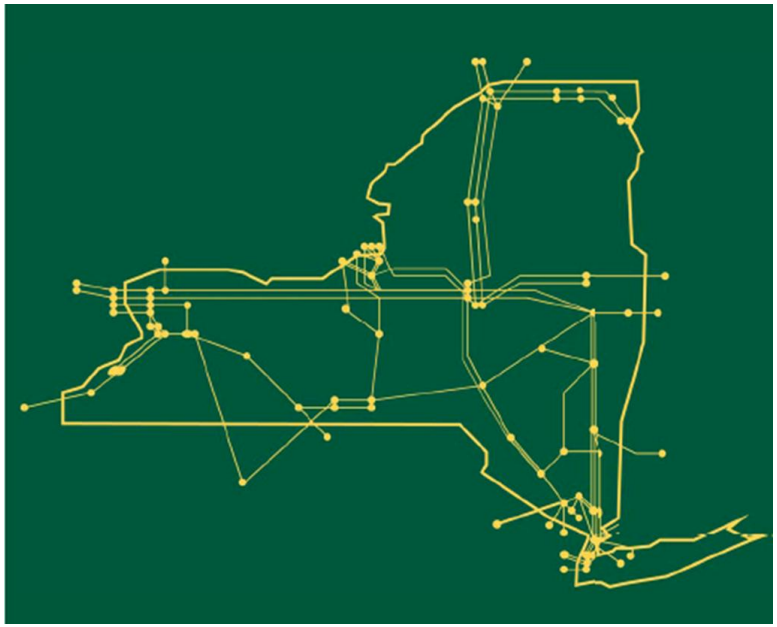
The New York Independent System Operator (NYISO) is a not-for-profit corporation responsible for operating the state's bulk electricity grid, administering New York's competitive wholesale electricity markets, conducting comprehensive long-term planning for the state's electric power system, and advancing the technological infrastructure of the electric system serving the Empire State.



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