Growing Wind

Final Report of the NYISO 2010 Wind Generation Study

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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
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
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**
Windpower in NY

1,275 MW - Existing
North & West

7,000 MW Proposed
1,900+ MW Downstate
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
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
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
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*
Simulated NYS Hourly Wind Output for 8,000 MW of Wind Based on 2006 Wind Data
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
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
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
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 CO₂ (short tons) as Wind Generation Increases for 2018
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
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.
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.
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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