

Balancing Wind

Embracing the Challenge

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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*

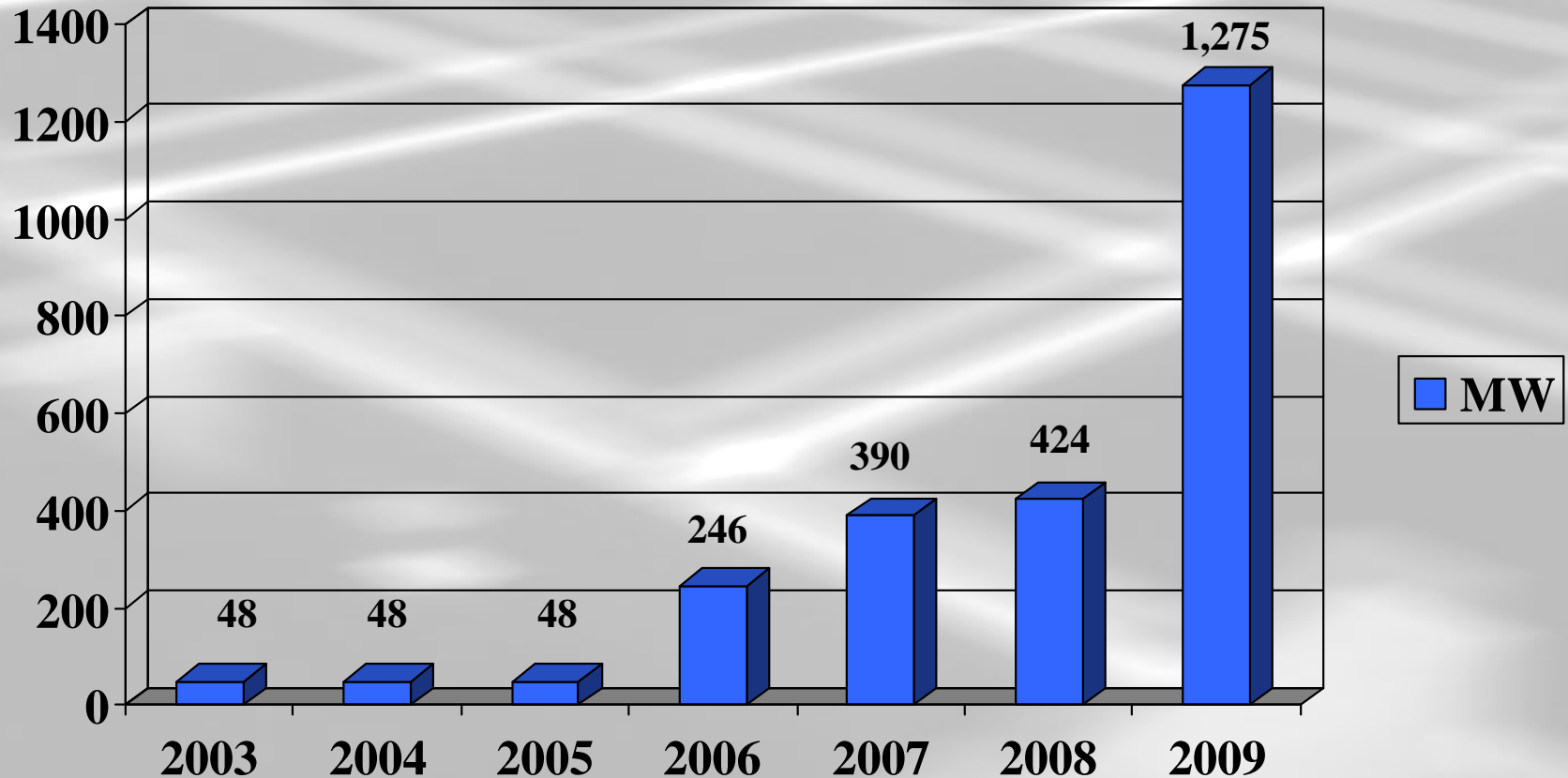
Topics

- **Windpower in New York**
- **NYISO Wind Integration**
 - *Open Access and Non-discriminatory Interconnection Process*
 - *Centralized Wind Forecasting*
 - *Economic Dispatch of Windpower*
 - *Energy Storage*

Growing Wind

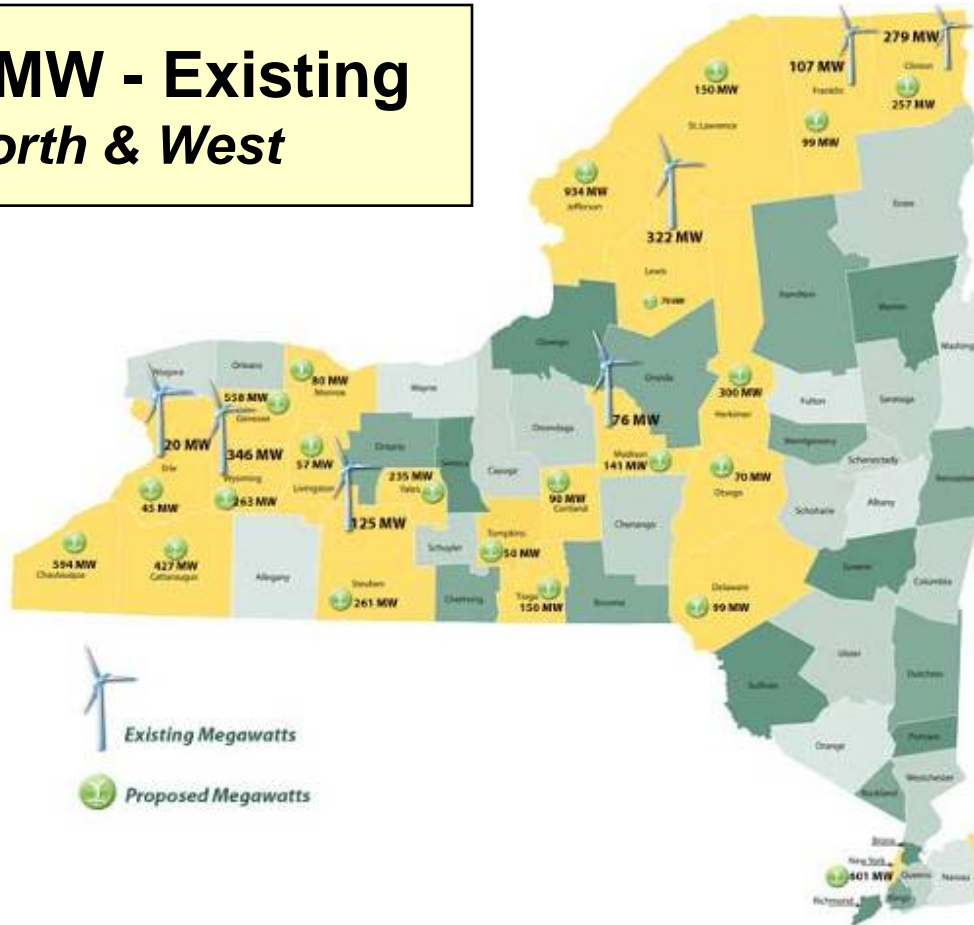
Windpower Capacity in New York State

Nameplate capacity (MW)



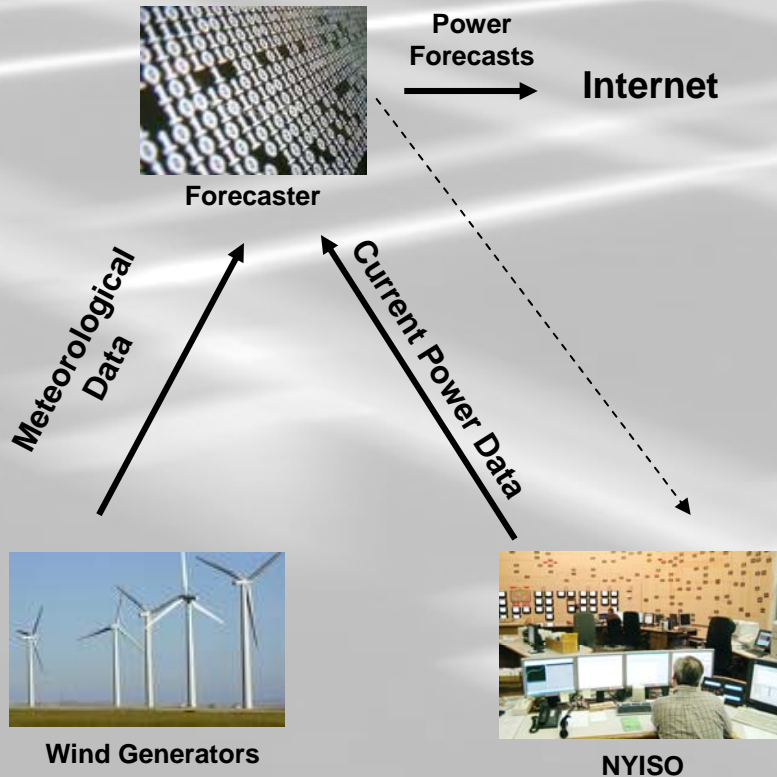
Windpower in New York

1,275 MW - Existing
North & West



7,000 MW
Proposed
*1,900+ MW
Southeast*

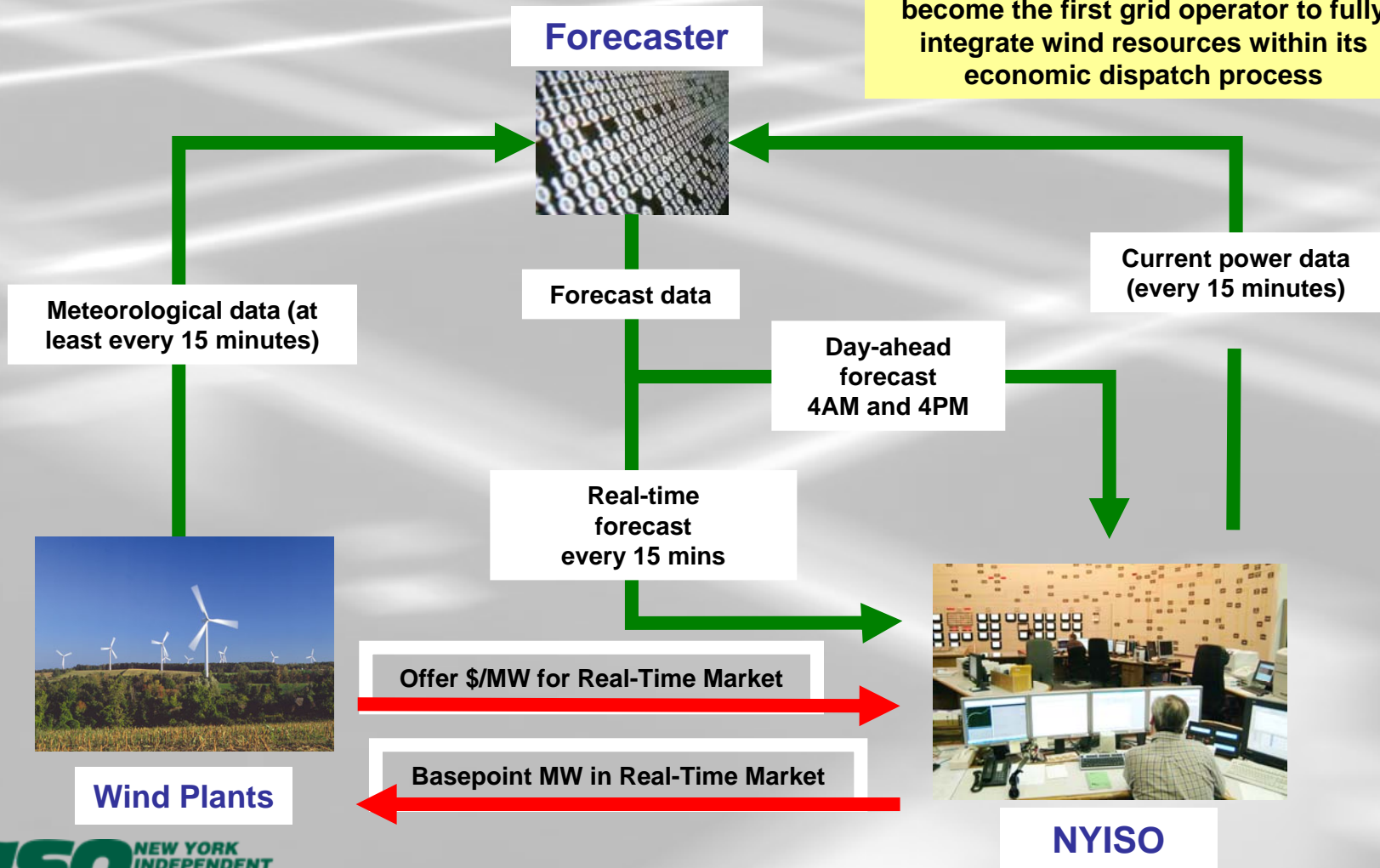
Wind Forecasting



- Implemented in 2008
- AWS Truewind provides forecasts:
 - Day Ahead and Real-time
 - For all wind plants
- Wind generators have access to their individual plant forecasts
- The NYISO uses the wind plant forecasts in its energy market economic dispatch software

Pioneering Wind Dispatch

In 2009, FERC approved NYISO to become the first grid operator to fully integrate wind resources within its economic dispatch process



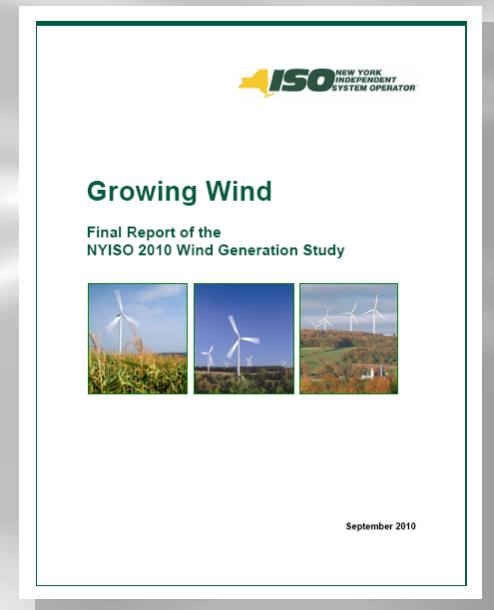
Economic Dispatch

Benefits of integrating wind units into the Security Constrained Economic Dispatch

- Uses the most efficient resources to address reliability requirements while minimizing the wind energy limitations
- Reduces less efficient, out-of-market actions to maintain reliable operations

Planning for More Wind

- **NYISO 2010 study looked at expanding NY wind power from the existing 1,275 MW to 8,000 MW by 2018**
- **Operational requirements associated with reliably integrating sufficient wind generation could be addressed**
- **Additional windpower would lower total energy production costs, reduce power prices, and decrease emissions**



Energy Storage

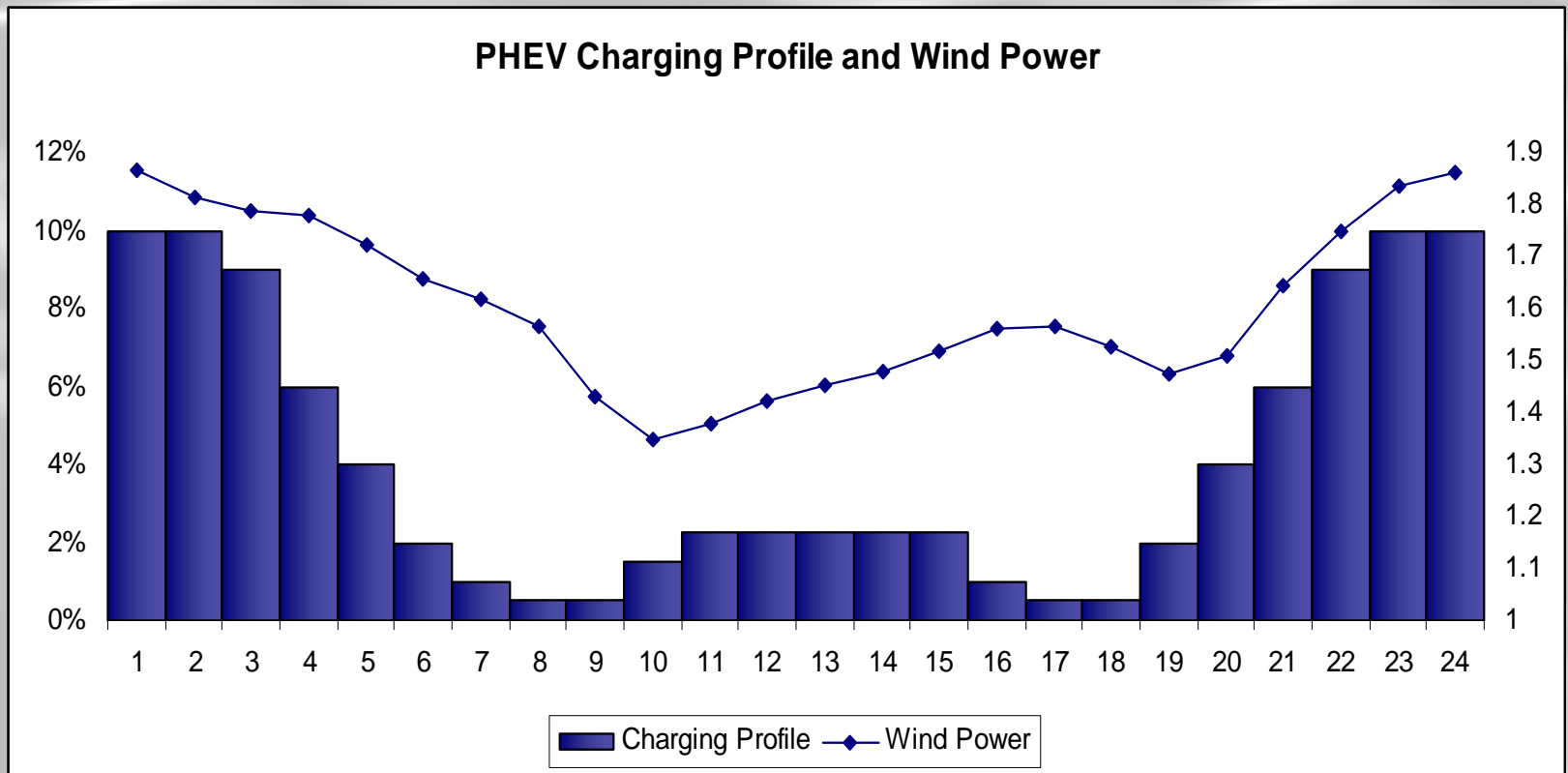
- **Energy storage technologies in NY**
 - Large-scale hydro pumped storage
 - Flywheels and advanced battery systems
 - Proposed Compressed Air Energy Storage (CAES)
- **Energy storage in NYISO markets**
 - Traditional Pumped Storage Generator
 - Limited Energy Storage Resource (LESR)



Limited Energy Storage Resources

- In 2009, the NYISO became first grid operator in the nation to establish federally approved market rules and deploy associated software and control systems for Limited Energy Storage Resources (LESR)
 - Provide only Regulation Service (*balancing electricity supply with load to maintain the proper frequency*)
 - Regulation Service of LESRs is scheduled consistent with other Regulation suppliers
 - Real Time Economic Dispatch functionality

PEV Charging & Wind Supply



Charging Profile: EPRI/NRDC
 Wind Power: 2007 average normalized load

Regional Integration of Wind

- **NYISO Broader Regional Market initiative**
 - **Addresses seams between markets**
 - **Collaborative effort - NYISO, PJM, MISO, IESO, ISO-NE and Hydro Quebec (HQ)**
 - **More frequent scheduling with HQ as well as PJM and ISO-NE will facilitate better regional integration of wind**
 - **HQ's vast hydro resources provides tremendous storage capability**

NYISO Focus

**Sustaining and enhancing
reliability**

**Bolstering open and
competitive markets**

**Planning a smarter, greener,
and more efficient grid**



NEW YORK INDEPENDENT SYSTEM OPERATOR

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.

www.nyiso.com