

# Complimentary Roles of Storage and Renewable Resources

**Robert Pike**

*Director – Market Design*

*New York Independent System Operator*

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**LIGHTING  
THE WAY**

A DECADE OF PROGRESS:

1999 - 2009

**NYISO**

NEW YORK INDEPENDENT SYSTEM OPERATOR  
[www.nyiso.com](http://www.nyiso.com)

# The Roles of the NYISO



- **Reliable operation of the bulk electricity grid**
  - *Managing the flow of power nearly 11,000 circuit-miles of high voltage transmission lines from more than 350 generating units*



- **Administration of open and competitive wholesale electricity markets**
  - *Bringing together buyers and sellers of energy and related products and services*

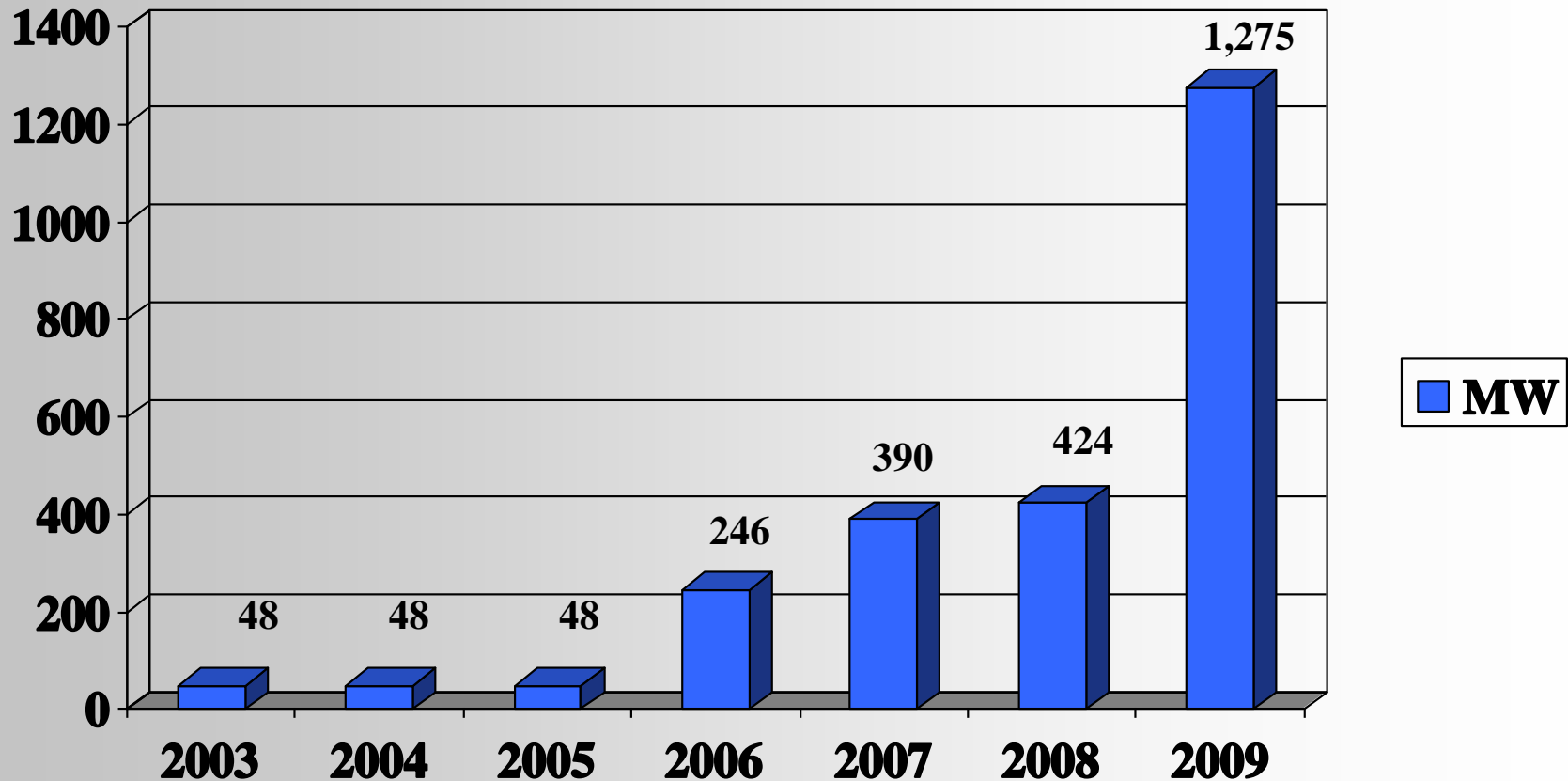


- **Planning for New York's energy future**
  - *Assessing needs over a 10-year horizon and evaluating the feasibility of projects proposed to meet those needs*

# Growing Wind

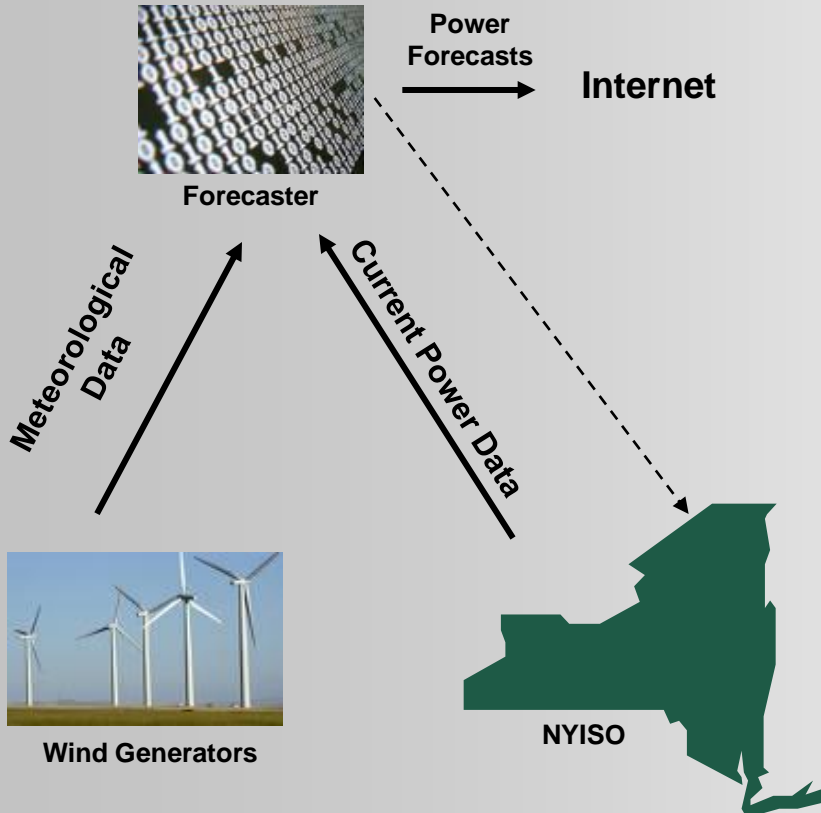
## Wind Power Capacity in New York State

*Nameplate capacity (MW)*





# NYISO Wind Forecasting

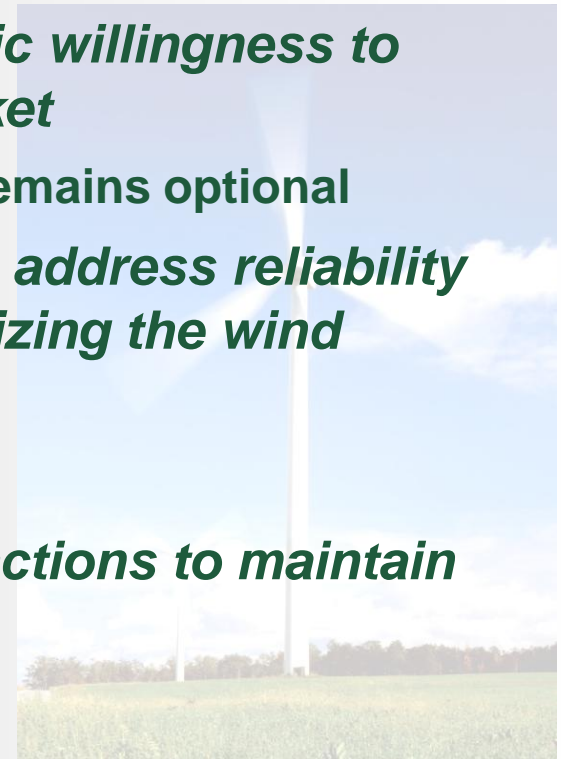


- Implemented in 2008
- AWS Truewind provides forecasts:
  - *Day Ahead and Real-time*
  - *For all wind plants*
- Wind generators have access to their individual plant forecasts
- The NYISO uses the wind plant forecasts in its energy market economic dispatch software

# Economic Dispatch of Wind

## Benefits of integrating wind units into the Security Constrained Economic Dispatch:

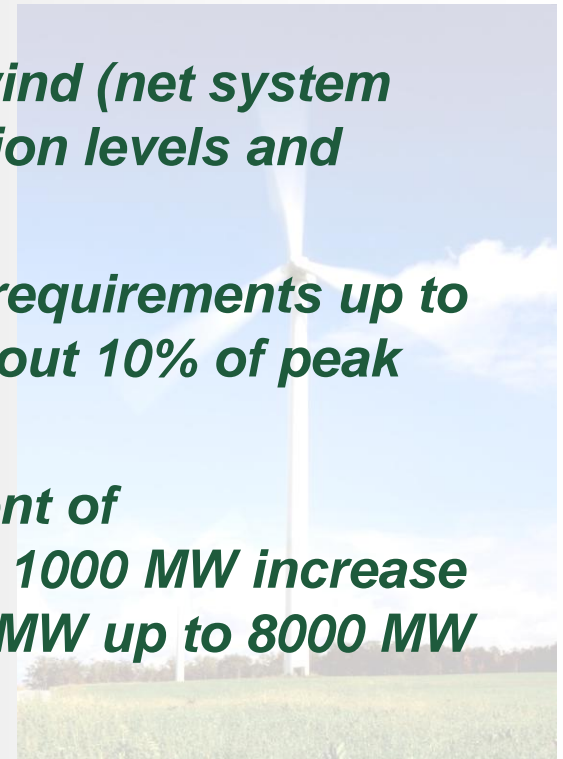
- *Wind resources indicate their economic willingness to generate in the Real-Time Energy Market*
  - Offering in Day Ahead Energy Market remains optional
- *Utilizes the most efficient resources to address reliability [transmission] limitations while minimizing the wind energy limitation and duration*
- *LMP calculation includes wind*
- *Reduces less efficient, out-of-market actions to maintain reliable operations*



# Planning for More Wind

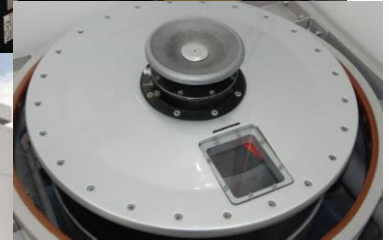
In 2009, the NYISO studied the impact of up to 8000 MW of wind resource integration on system regulation requirements

- *Analyzed the variability of load and wind (net system variability) at specified wind penetration levels and forecasted load levels*
- *No significant increase in regulation requirements up to a 3500 MW wind penetration level (about 10% of peak load)*
- *Increases in the regulation requirement of approximately 10% (25 MW) for every 1000 MW increase in wind penetration level above 3500 MW up to 8000 MW (about 23% of peak load)*



# Energy Storage Technologies

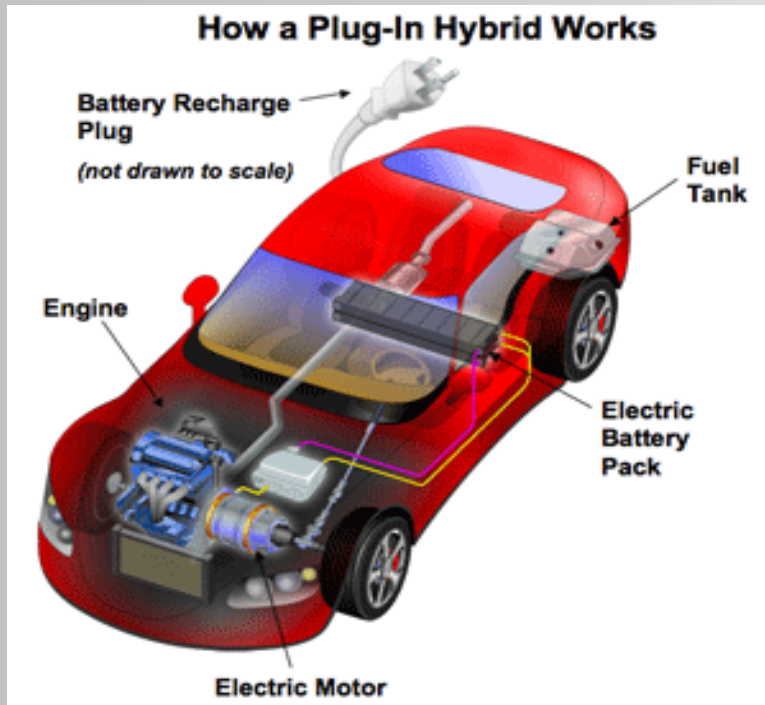
- Energy storage technologies in NY include:
  - *Large-scale hydro pumped storage*
  - *Proposed Compressed Air Energy Storage (CAES)*
  - *Other new technologies such as flywheel, advanced battery systems and PHEVs*
- Energy storage providers in NYISO markets can select treatment as either:
  - *Traditional Pumped Storage Generator*
  - *Limited Energy Storage Resource (LESR)*



# Limited Energy Storage Resource (LESR)

- Provide only Regulation Service
  - *Convert energy but do not offer it; energy output is only incidental to the provision of Regulation Service*
- Regulation Service is scheduled consistent with other Regulation suppliers
- Real Time Economic Dispatch functionality
  - *Recognizes the Limited Energy Storage Resource (LESR) capabilities and limitations*
  - *Manages energy levels by scheduling charge/discharge operations to maintain full regulating capability*

# Plug-in Hybrid Vehicles (PHEV)



Source: Odyne Corporation

A PHEV is as a hybrid electric vehicle which contains at least:

- *A battery storage system of four kilowatt-hours or more, used to power the motion of the vehicle*
- *A means of recharging that battery system from an external source of electricity; and*
- *An ability to drive at least ten miles in all-electric mode, and consume no gasoline*

IEEE-USA

Position Statement on Plug-in Hybrid Vehicles  
June 2007

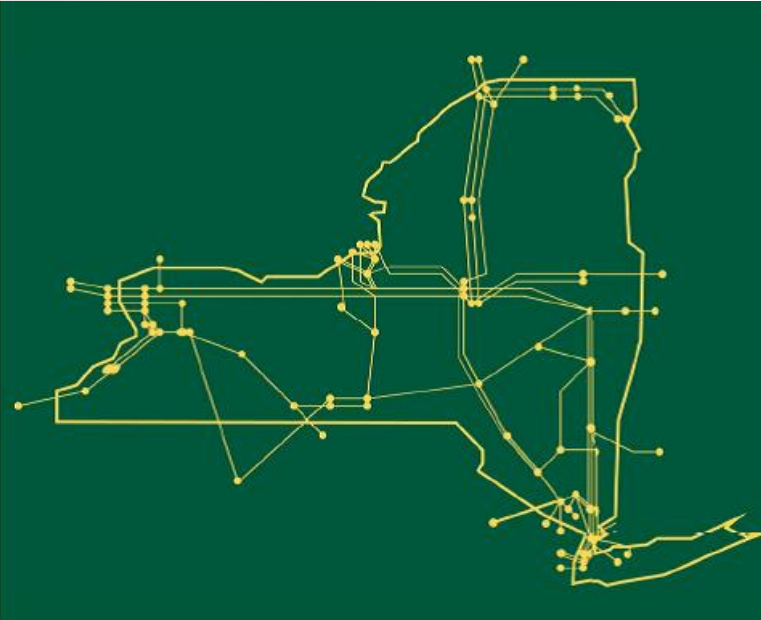
***If deployed with technology and incentives to encourage favorable charging patterns, PHEVs can offer valuable new ways to store electricity produced in off-peak periods.***

# The Future of Wind & Storage

In collaboration with EPRI, we are studying further synergies between energy storage and renewable resources. Our analysis will:

- *Quantify the ability of bulk energy storage to improve the economic feasibility of intermittent resources*
- *Determine the value of (or barriers to) storage technologies*
- *Provide insight on the roles of storage for operation, congestion management and T&D investment*

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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