

NYISO: Markets Overview and Opportunities for Storage

Shaun Johnson

New York Independent System Operator

EUCI's Electricity Storage: Business and Policy Drivers

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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

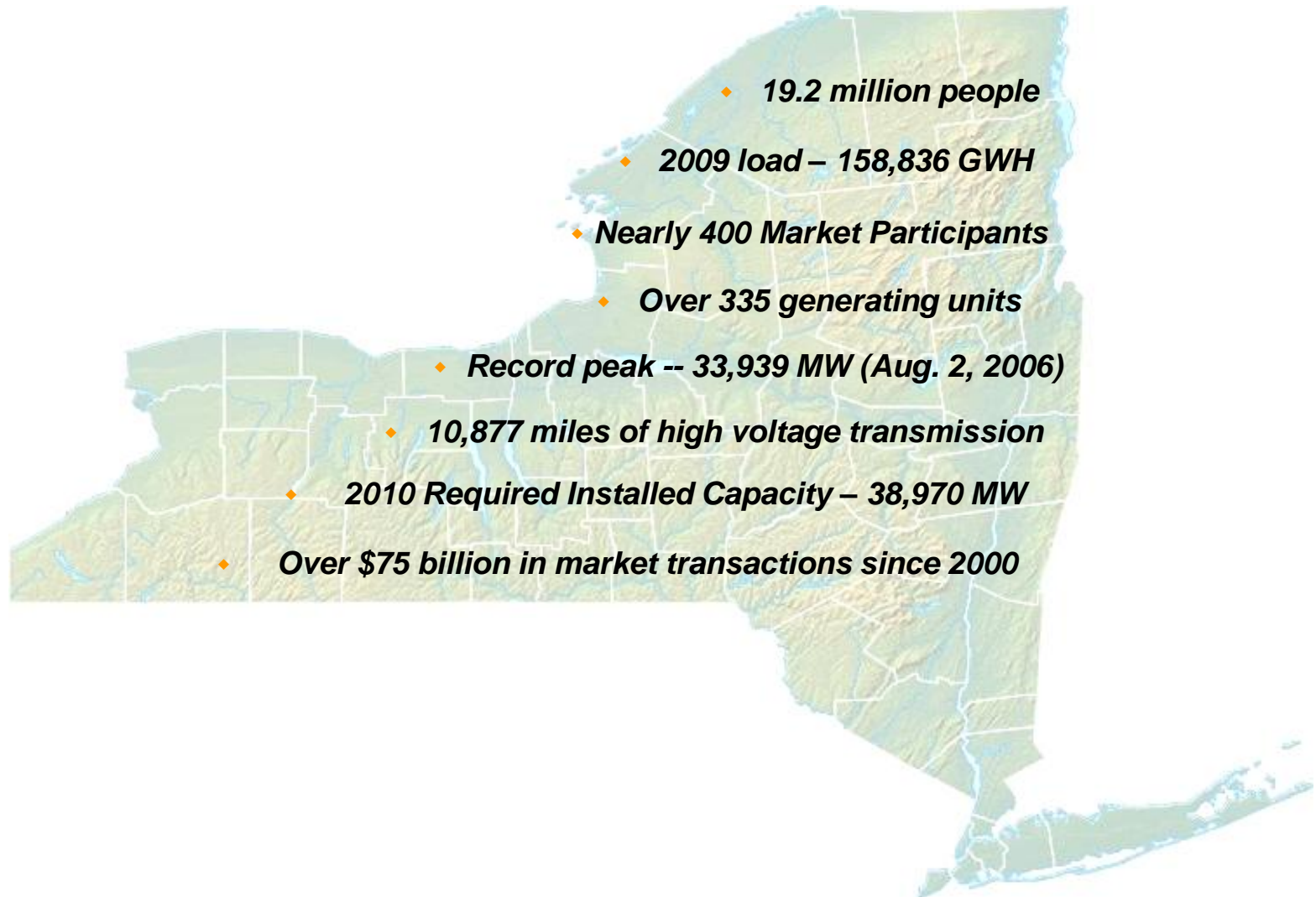
- *Assessing needs over a 10-year horizon and evaluating the feasibility of projects proposed to meet those needs*



Advancing the technological infrastructure of the electric system

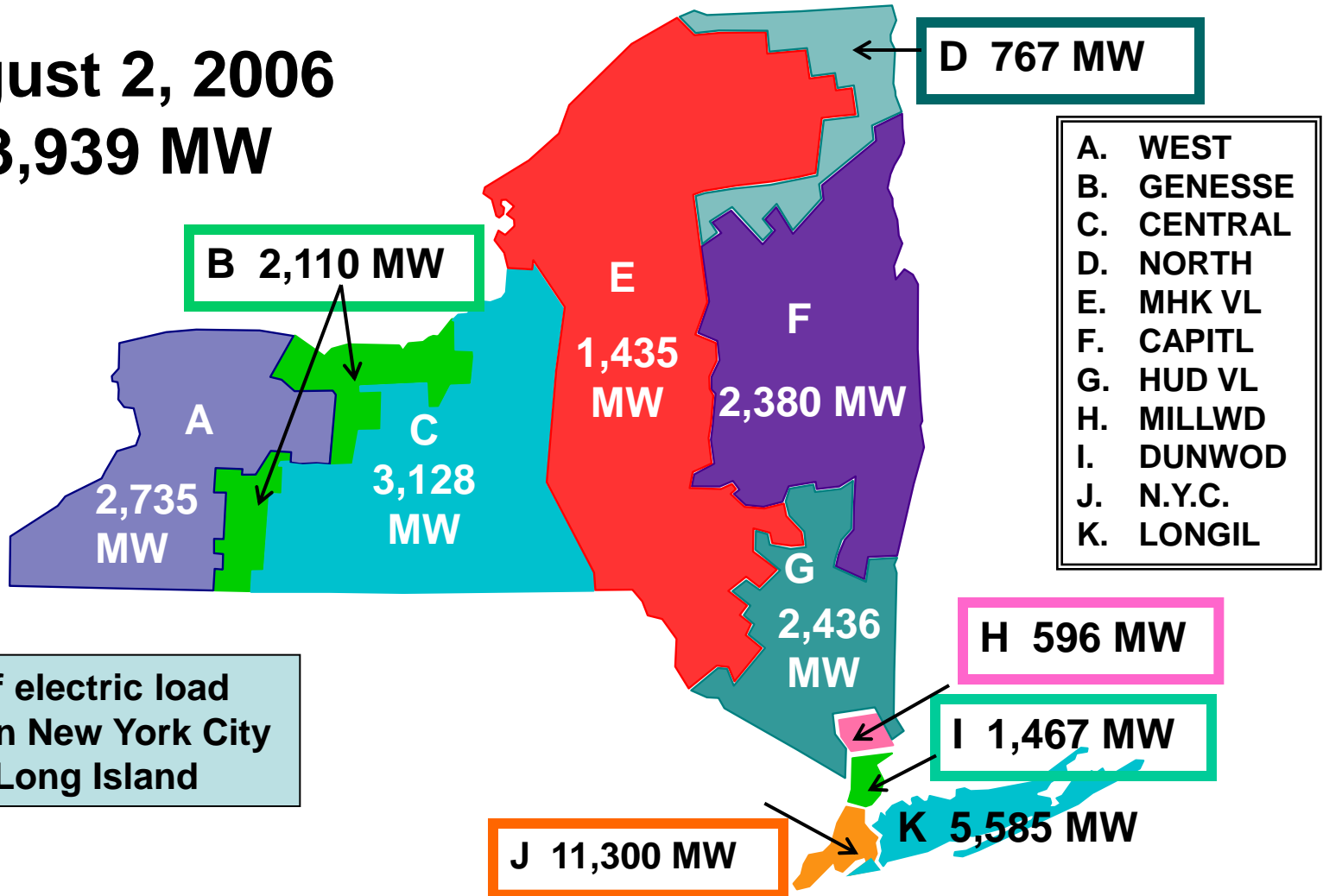
- *Developing and deploying information technology and tools to make the grid smarter*

NY Facts And Figures



NYCA Load Profile by Zones

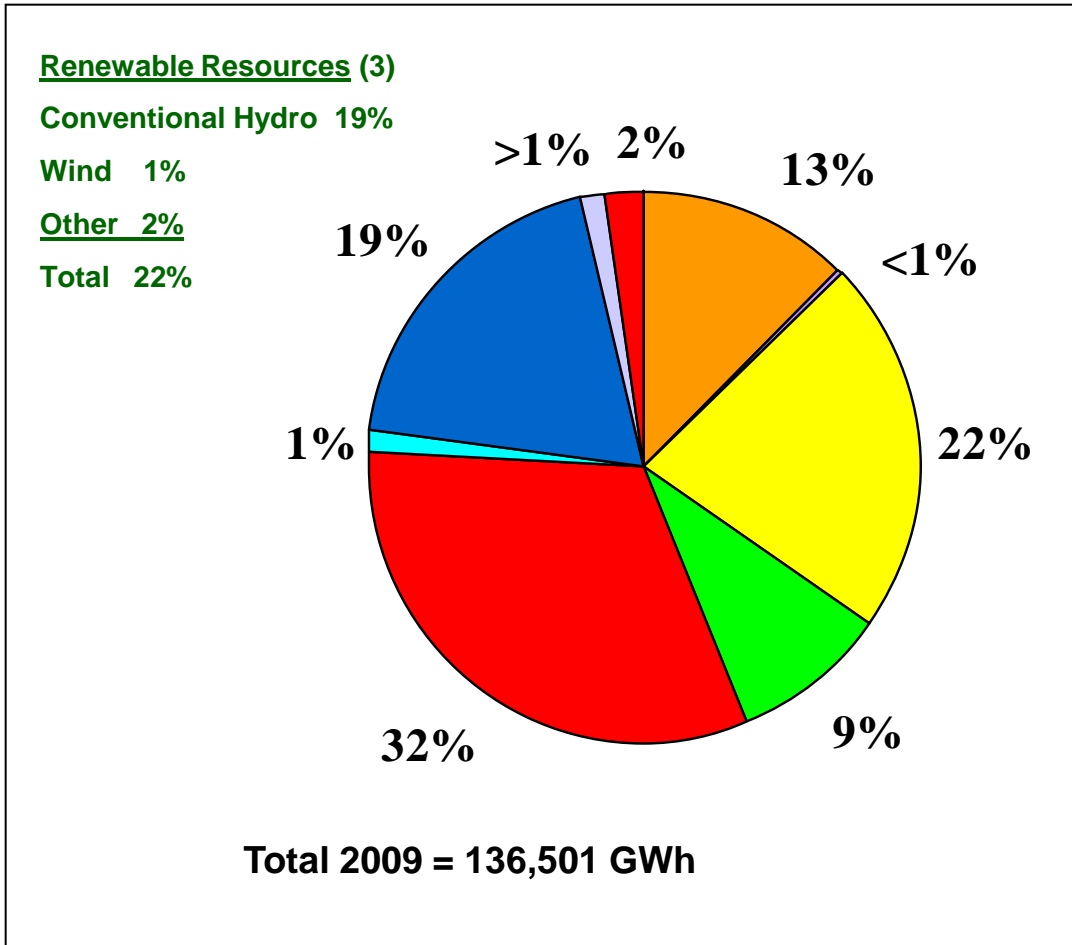
August 2, 2006
33,939 MW



Energy by Fuel Type

GWh (1)

- GAS - 17,126 (13%)
- OIL - 195 (<1%)
- GAS & OIL - 30,133 (22%)
- COAL - 12,618 (9%)
- NUCLEAR - 43,487 (32%)
- HYDRO (PS) - 1,525 (1%)
- HYDRO - 26,420 (19%)
- WIND - 2108 (>1%)
- OTHER (2) - 2,888 (2%)



(1) - All values are rounded to the nearest whole GWh.

(2) - Includes Methane, Refuse, Solar & Wood

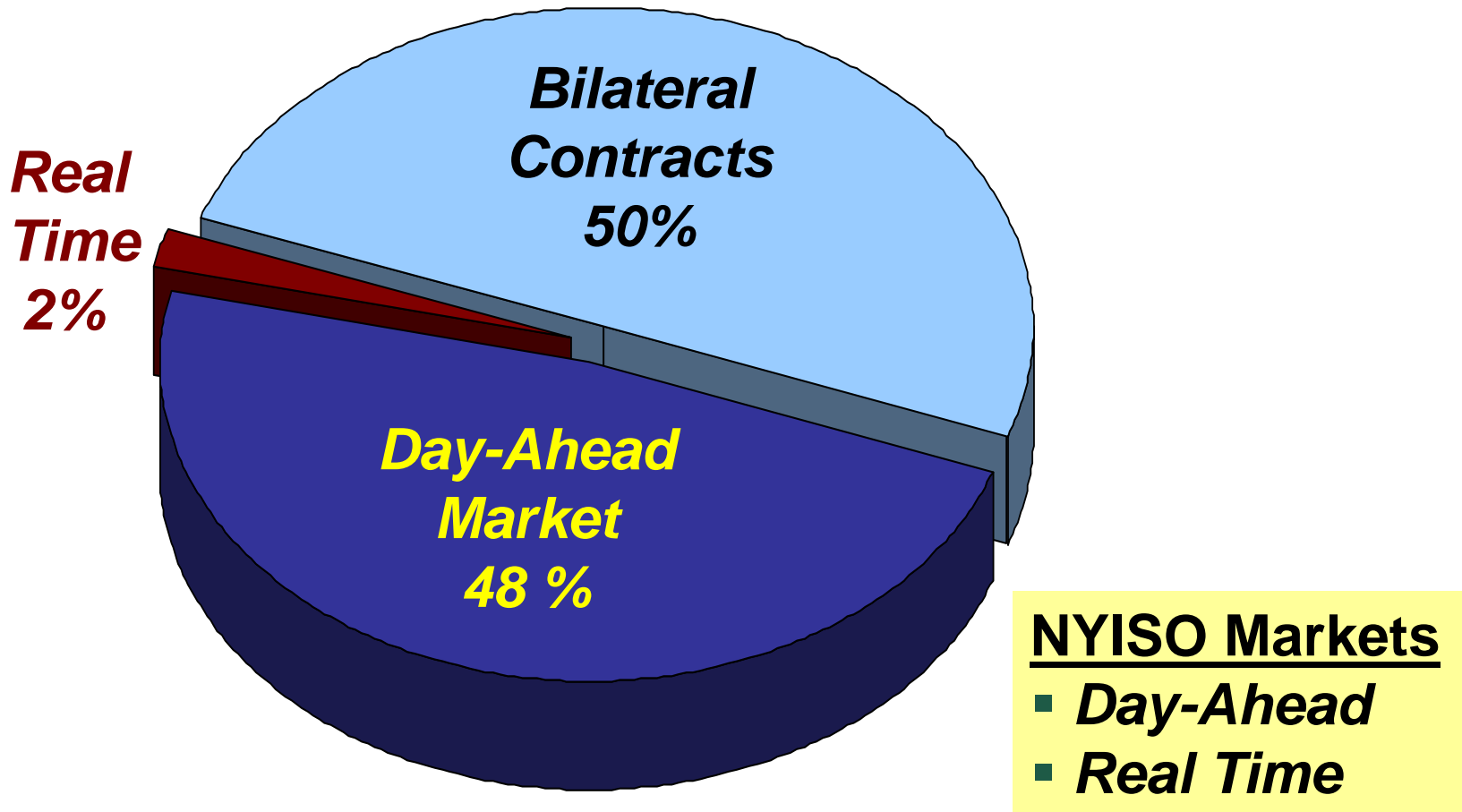
(3) - Renewable Resources do not necessarily match the NYS Renewable Portfolio Standard (RPS) Definition

(PS) - Pumped Storage

Day-Ahead and Real-Time Markets



NY's Wholesale Electricity Markets

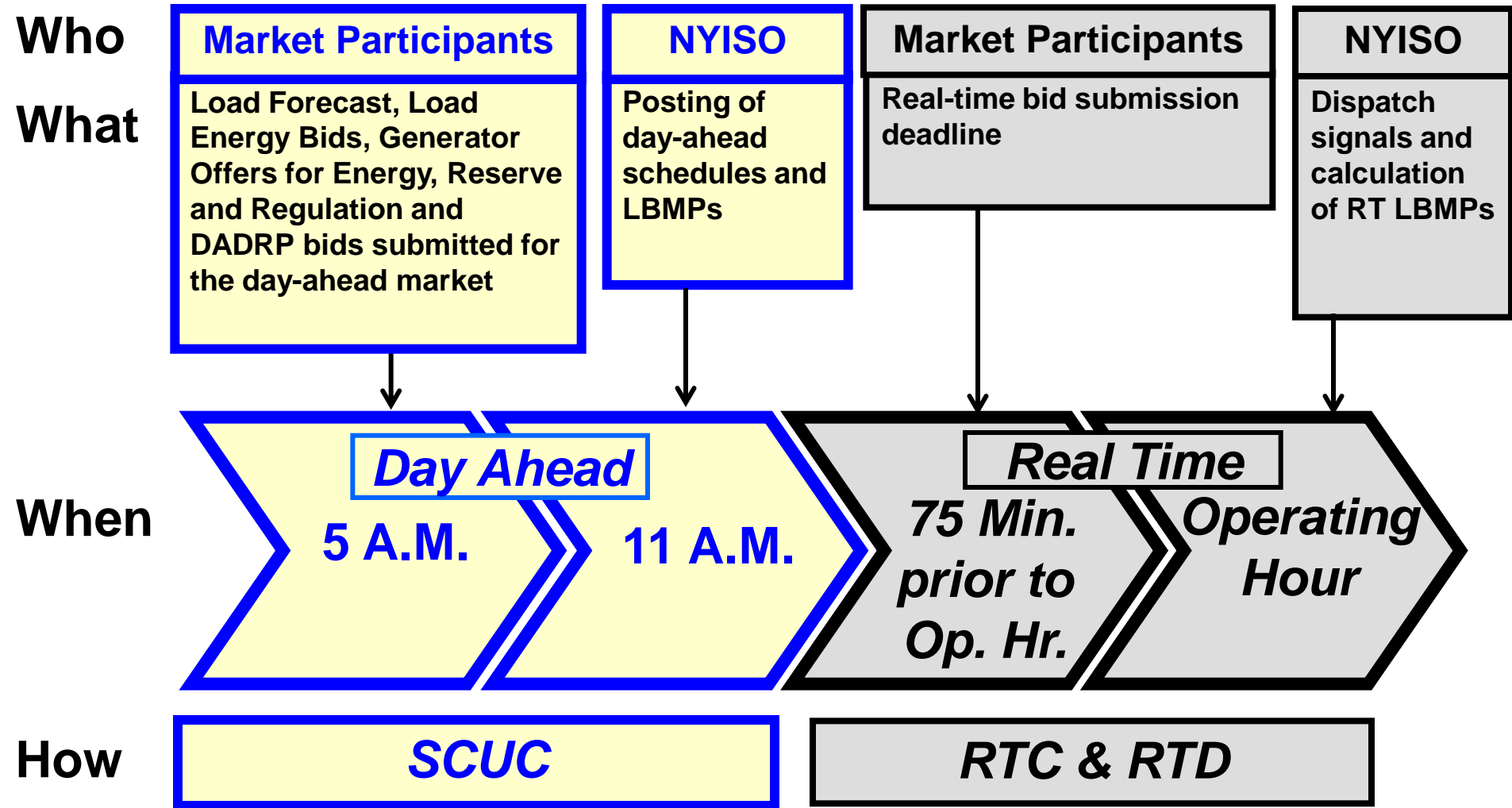


NYISO Markets

A showcase in advanced market design

- ◆ Full two-settlement LBMP market for Energy and Reserves
- ◆ Co-optimization of Energy, Operating Reserves and Regulation
 - *Bid Based Security-Constrained Economic Dispatch (SCED) and Commitment (SCUC)*
 - *Scarcity pricing for operating reserves*
 - *Bid Production Cost Guarantees (Uplift)*
 - *Virtual Bidding*
 - *Demand Side Participation*
 - *Economic dispatch of wind*
- ◆ Transmission Congestion Contracts (TCC)
- ◆ Installed Capacity Markets (ICAP)
- ◆ Market Power Mitigation
 - *Conduct/ Impact tests and Automated Mitigation Procedure*

Energy Market Timeline



RT/DAM LBMP Results

DAM LBMP (hourly):

Generator Bus

NYISO Zone

RT LBMP (RTD - 5 min):

Generator Bus

NYISO Zone

Generators

Paid the LBMP (where they inject power) at the Generator Bus.

Load

Charged the Zonal LBMP based where the Load is located.
Zonal LBMP is a Load Weighted Average for the Zone.

*The cost to provide the next MW of Load at a
specific location in the grid*

Generator Bidding Flexibility

- Hourly bidding flexibility:
 - *Startup Cost*
 - *Minimum generation bid and MW*
 - *Incremental energy in 11 bid/MW pairs*
 - *Normal and emergency operating limits*
 - *Operating reserve bids*
 - *Regulation reserve bids and availability*
- Self-scheduling and economic scheduling options
- Response rates for normal, emergency and regulation operation
- Minimum run time, minimum down time, maximum starts/ day

Guarantee Payments ("Uplift")

BPCG: Bid Production Cost Guarantee (BPCG)

Ensuring recovery of sufficient revenue to cover as-offered costs

- *Meet qualifying criteria*
- *Based on [Submitted bid costs less Total Revenue]*
- *DAM and/or RT*

Types:

- Power Suppliers (internal)
- Transaction Customers (imports)

DAM Margin Assurance

Guarantees Generator's DAM margin (profit) is not reduced by balancing market settlements in RT due to reliability scheduling

RT/DAM Ancillary Services (AS) Results

DAM AS (hourly):

Location

Product

RT AS (RTD - 5 min):

Location

Product

Generators

All flexibly dispatched generators must offer operating reserves.
Paid the Clearing Price for the location and service provided.
Performance factors included in real-time settlement.

Load

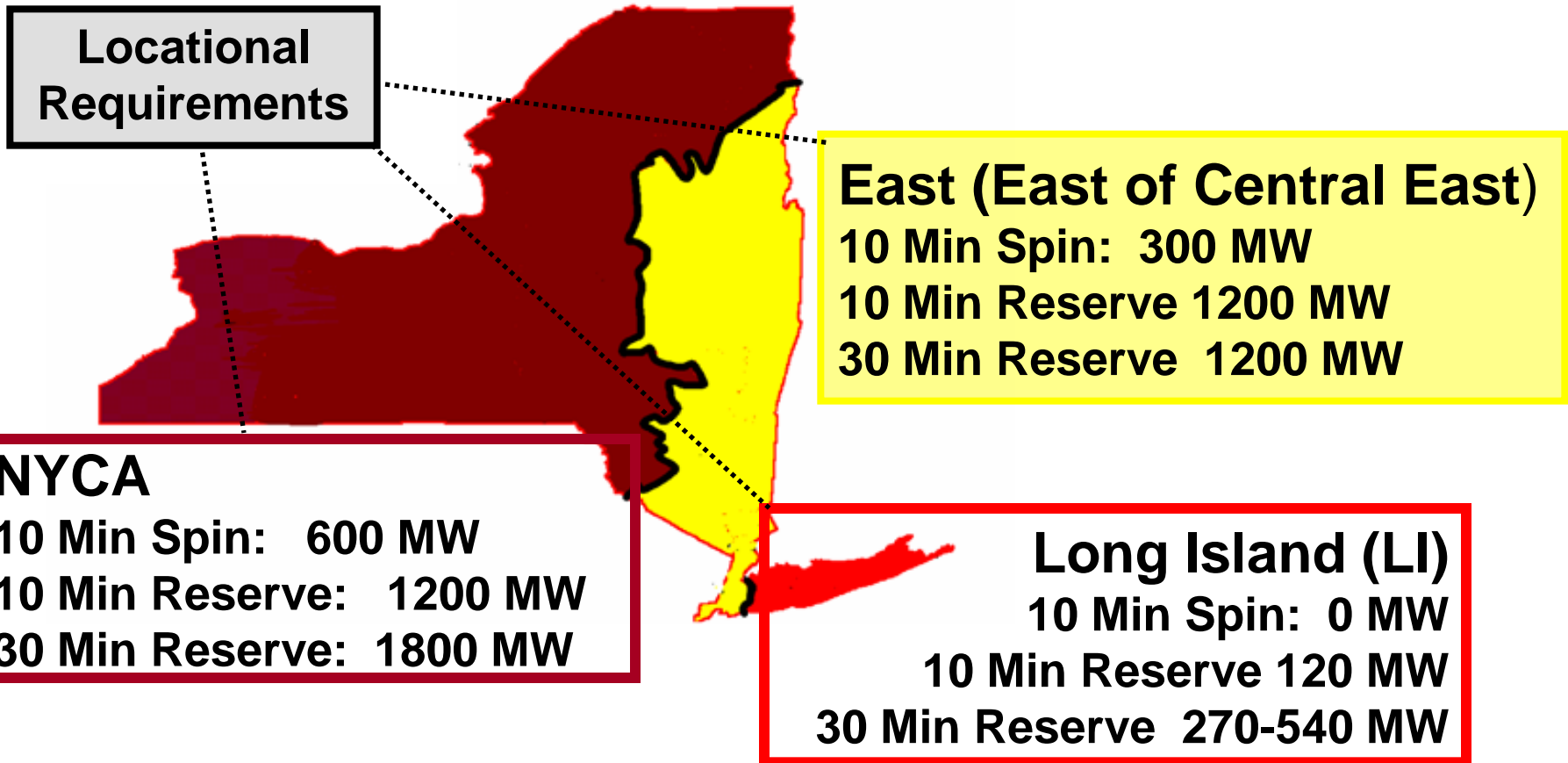
Fully purchase AS in Day-Ahead Market. Real-Time balancing lies with suppliers.

Clearing prices incorporate both the lost opportunity cost of the marginal suppliers and the availability bid

Operating Reserve

Ensuring Backup Generation is Available

Reserve Offers are placed in DAM and RT



Limited Energy Storage Resource (LESR)

- ◆ A Generator authorized to offer Regulation Service only and characterized by limited energy storage, that is, the inability to sustain continuous operation at maximum energy withdrawal or maximum energy injection for a minimum period of one hour
- ◆ Converts energy but does not offer it, energy output is only incidental to the provision of regulation
 - *Settlement is generally consistent with those of other Suppliers, but includes specific modifications to address LESR limitations*
- ◆ Automated Generation Control (AGC) software recognizes the LESR capabilities and limitations and manages LESR energy levels

Cost Based Products

- ◆ **Voltage Support Services**
- ◆ **Black Start Service**

Voltage Support Service (VSS)

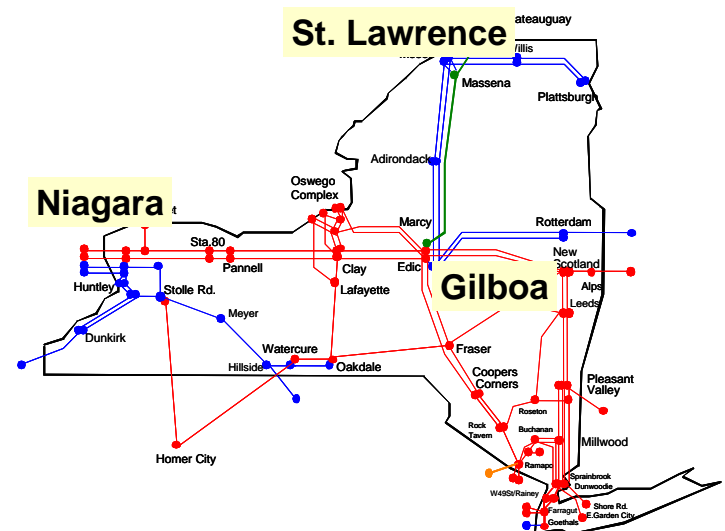
- ◆ **Reactive Power Service**
- ◆ **VSS Suppliers Receive Monthly**
 - *Payments based on Annual*
 - *Rate of \$3,919/MVar*
- ◆ **NYISO coordinates bus voltage profiles**
- ◆ **Transmission Owners responsible for local control in their network**

NYCA Black Start Service

- ◆ NYCA Black Start Restoration Plan
- ◆ Fixed payment based on provider's costs
- ◆ NYISO selects generating resources with black start capability based on:

- *Electrical location in the grid*
- *Startup time*
- *Maximum Response rate*
- *Maximum Power output*

- ◆ Currently three providers



Future Opportunities for Energy Storage

- ◆ 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 (~3.75% of peak load).*
 - *Nearly 8,000 MW of wind in the interconnection queue*
 - Including more than 2,000 MW of offshore wind development.
 - *Increases in intermittent power will lead to increased opportunities for arbitrage*
- ◆ Broader Regional Markets initiatives are increasing opportunities and frequencies for trading and arbitrage between regions
 - *15 minute scheduling with Hydro Quebec and PJM in 2011*
- ◆ NYISO evaluating ways to improve modeling of storage in the scheduling mechanisms in future years

Reference Materials

Available on NYISO.COM

NYISO Tariffs

Manuals

Technical Bulletins

Manuals

- ♦ *Explain the procedures and policies that will be used to operate the bulk power system of the New York Control Area and to conduct the New York Wholesale Electricity Market.*

Technical Bulletins

- ♦ *Explain changes to – and provide instruction for – NYISO processes and procedures*

Legal and Regulatory

- ♦ *Documents related to filings and orders to and from FERC and the NYPSC and notices to Market Participants*

Studies and Reports

- ♦ *Monthly and yearly reports*

Quarterly Newsletter for Market Participants

User Guides

- ♦ *Assist users with information needed to participate in NYISO Energy Markets*

More Information

- ◆ NYISO Home Page

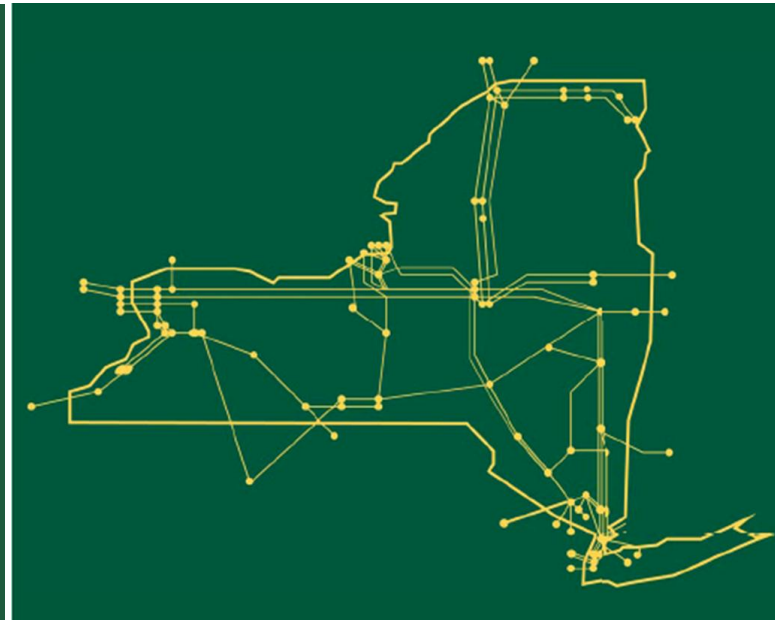
- www.nyiso.com



- ◆ New York Market Orientation Course (NYMOC)

- www.nyiso.com/public/services/market_training

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