



Frequency Regulation Compensation in the Organized Wholesale Power Markets

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Session 1

Value of Frequency Regulation Service in Organized Electric Markets

Forms of Frequency Control

- ◆ Regulation service is used to maintain steady state frequency and generation-to-load balance
- ◆ Frequency Regulation is not the same as Frequency Response
 - ***Frequency Response is the autonomous reaction to a frequency disturbance to arrest a frequency decline***
 - ***Commission has also requested a technical conference on that topic***

Regulation Requirements

- ◆ Requirements driven by needed system response within a dispatch interval
- ◆ Regulation service procured to address differences between the forecasted conditions included in the dispatch and actual conditions
 - *Sources of differences can include load forecast errors, wind power forecast errors and generator following errors*
- ◆ The demands on regulation service in any given interval is highly unpredictable.
- ◆ Variable Generation Impacts
 - *Integration of more wind capacity is likely to require longer-duration, sustained regulation service deployments due to wind power ramp events, rather than short-duration cycling deployments due to intermittent output*

NYISO Marketplace

- ◆ Suppliers bid a Capacity (MW), Ramp Rate (MW/min) and Offer (\$/MW)
 - *Open to generators, demand side and newly created Limited Energy Storage Resources (LESR)*
- ◆ Simultaneously co-optimize to select least cost suppliers of services
 - *Day-ahead – Hourly Schedules and Prices*
 - *Real-Time – 5-minute Schedules and Prices*
- ◆ Establish clearing price based upon marginal cost of service including both the offers as well as any lost opportunity costs from the energy market.

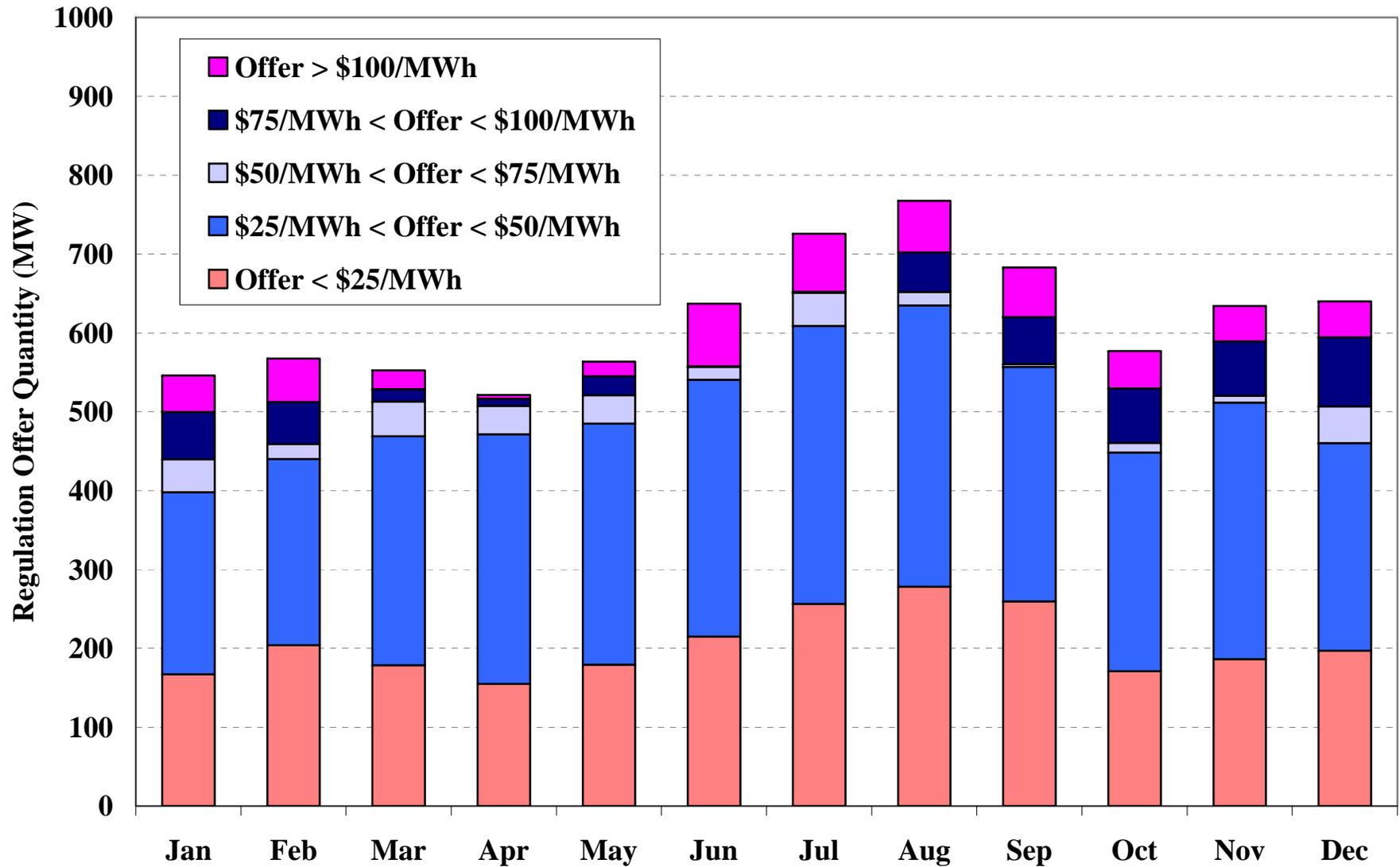
Limited Energy Storage Resources

- ◆ Suppliers that:
 - *Provide only regulation service*
 - *Convert energy but do not offer it; energy output is only incidental to the provision of regulation service*
- ◆ Scheduling of regulation service is comparable to other suppliers of the same service
- ◆ Real Time Economic Dispatch functionality
 - *Recognizes the resource capabilities and limitations, and manages energy storage levels by scheduling charge/discharge operations to maintain full regulating capability*

Limited Energy Storage Resources

- ◆ Settlement Functionality
 - ***Paid for the regulation service capacity scheduled.***
 - ***Charged the hourly real-time time-weighted LBMP for net energy withdrawals.***
 - **Incentivize the most efficient storage technologies**

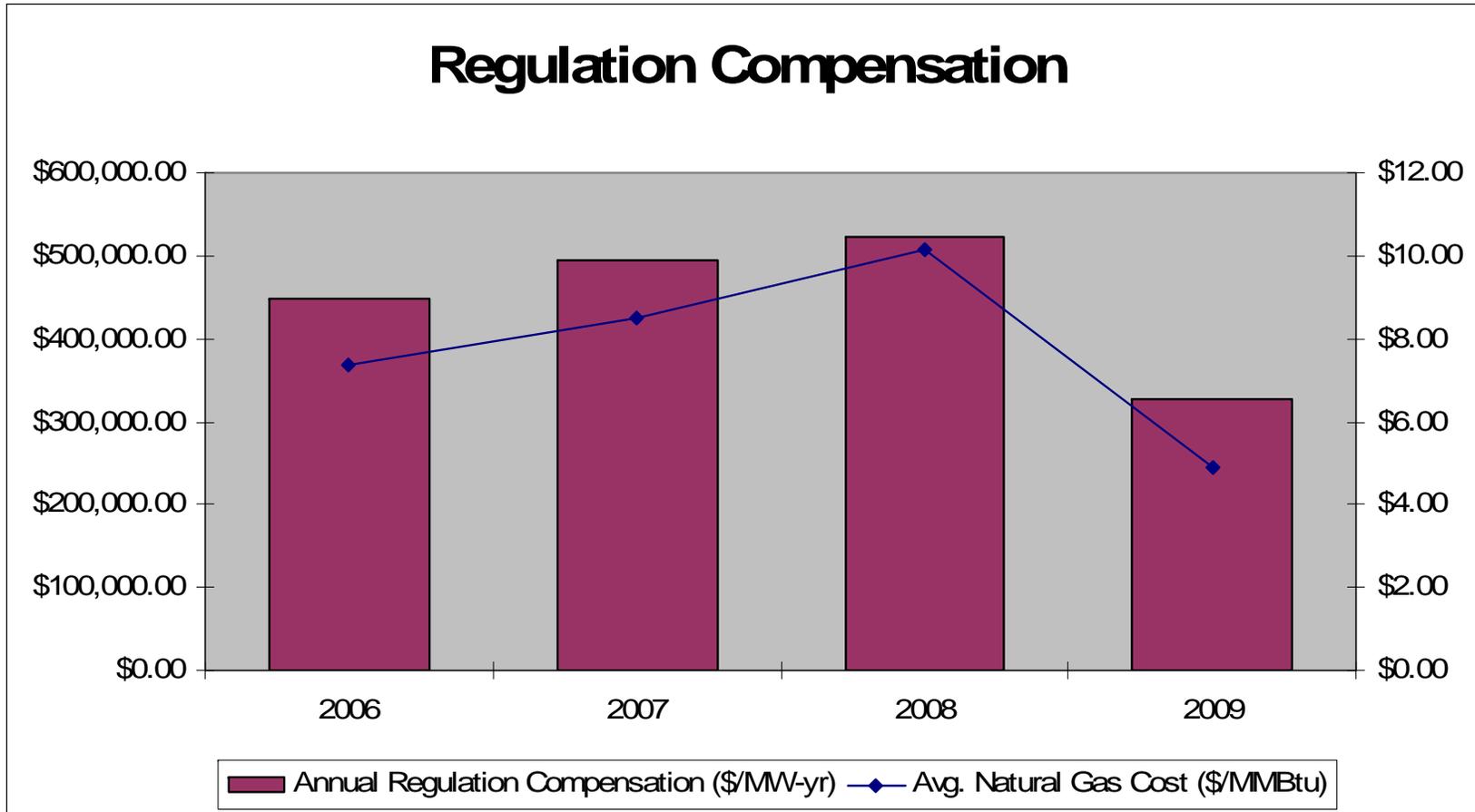
Summary of Regulation Offers in the Day-Ahead Market 2009



Session 2

Performance, Compensation, and Market Design

Regulation Compensation



New Resource Market Entry

- ◆ Recent applications to the NYISO interconnection queue include five – 20 MW energy storage installations.

Queue Pos.	Owner/Developer	Project Name	Date of IR	SP (MW)	Type/ Fuel	Location County/State
260	Beacon Power Corporation	Stephentown	9/25/07	20	F	Rensselaer, NY
318	AES Energy Storage, LLC	Westover Energy Storage	12/3/08	20	ES	Broome, NY
319	AES Energy Storage, LLC	Cayuga Energy Storage	12/3/08	20	ES	Onondaga, NY
320	AES Energy Storage, LLC	Somerset Energy Storage	12/3/08	20	ES	Niagara, NY
346	Beacon Power	Scotia Industrial Park	11/24/09	20	F	Schenectady, NY

- ◆ **Source:**
http://www.nyiso.com/public/webdocs/services/planning/nyiso_interconnection_queue/nyiso_interconnection_queue.xls (as of 05/05/2010)

Regulation Service Performance

- ◆ Resource awarded service contracts based upon ramp rate and resources capacity, as well as the economic offers of the resource. Resources compete for the service based upon the same qualifications
- ◆ Establish clearing price based upon marginal cost of service including both the offers as well as any lost opportunity costs from the energy market
- ◆ Resources paid based upon the regulation clearing price and the accuracy of the response to regulation instructions (*Performance Index*)

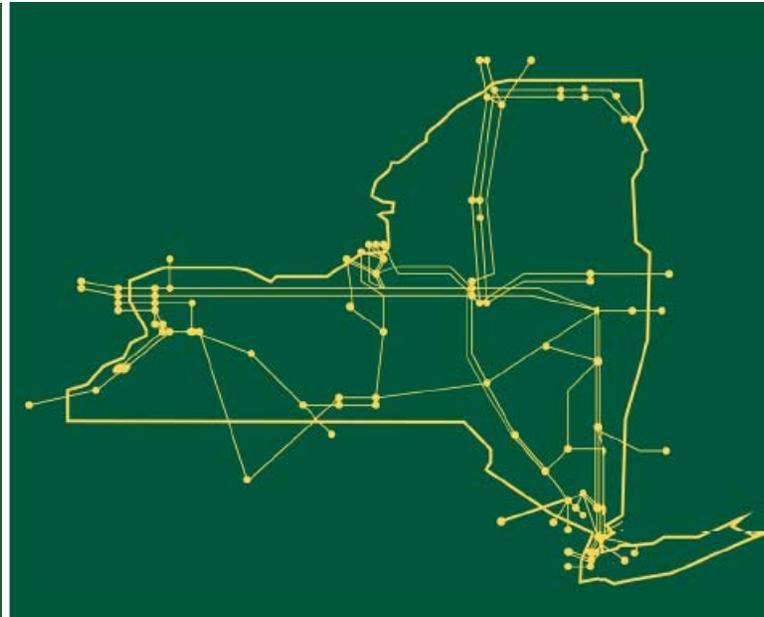
Benefits of NYISO Market Design

- ◆ Compensation based upon regulation service award and performance of service
 - ***Provides incentive to offer maximum amount of regulation service that can be reliably and accurately delivered***
- ◆ Market clearing prices capture the complete marginal cost of providing service
 - ***Provides transparent market signals and explicit cost of service***

Alternative Market Options

- ◆ After market payments for service inhibit the ability of the market place to efficiently respond to system needs. Complete cost of providing service is not transparent.
 - *Requires the ISO to assume the risk of uncertainty in regulation service needs rather than place and reflect the price of those risks in the market place*
- ◆ It is not clear that multiple classes of regulation service would result in a reduction in overall costs. The current class of service may need to continue to be substantially maintained to ensure adequate supply of resources to meet more sustained deviations.

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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