NEW YORK INDEPENDENT SYSTEM OPERATOR

Building The Energy Markets of Tomorrow . . . Today

New York, New England and PJM Electricity Markets Overview

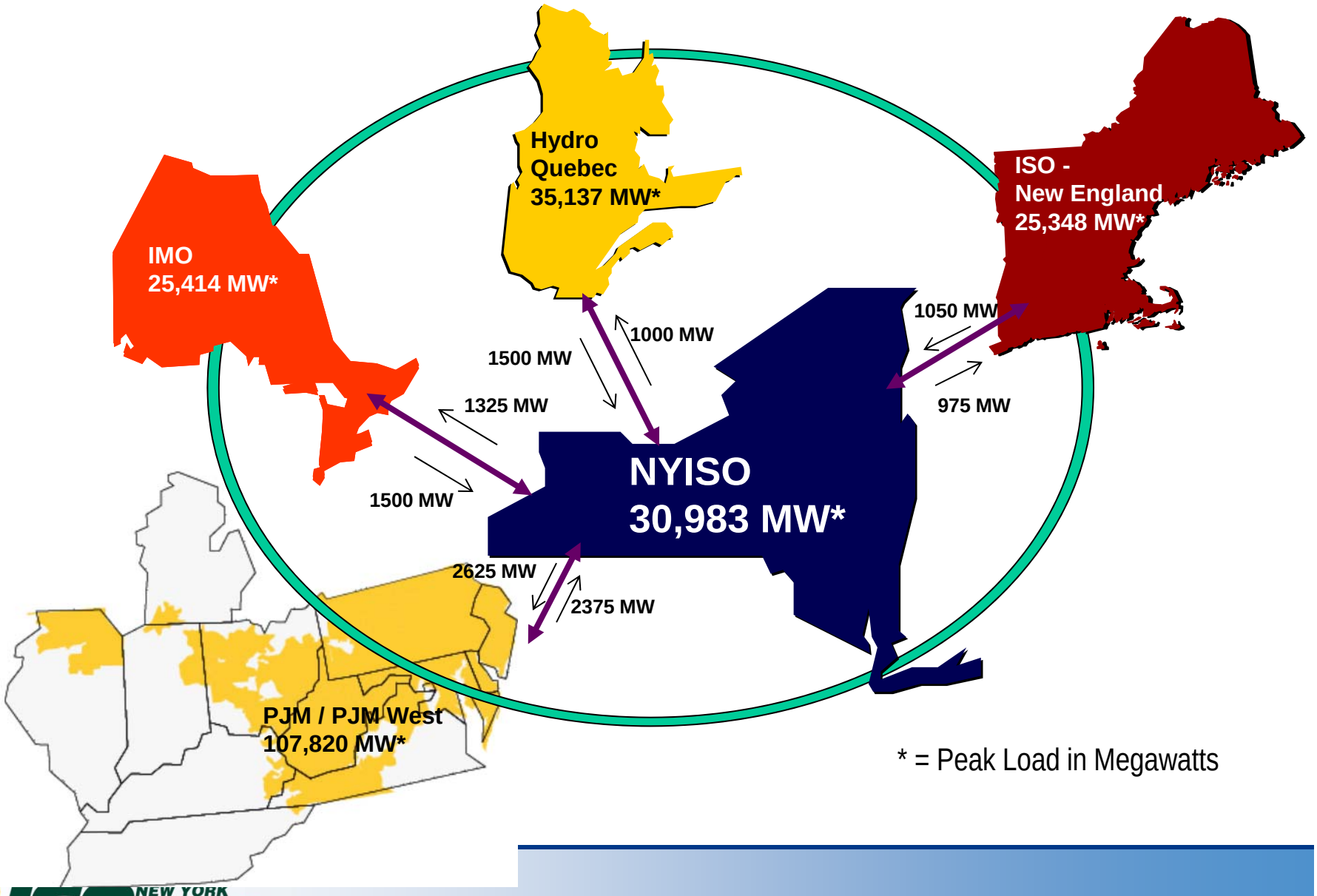
Prepared for:

Regional Greenhouse Gas Initiative Workshop

November 30, 2004

Goals of This Presentation

- Provide an overview of the various wholesale electricity market elements that relate to RGGI design issues
- Identify reliability requirements and operational issues pertinent to the RGGI process



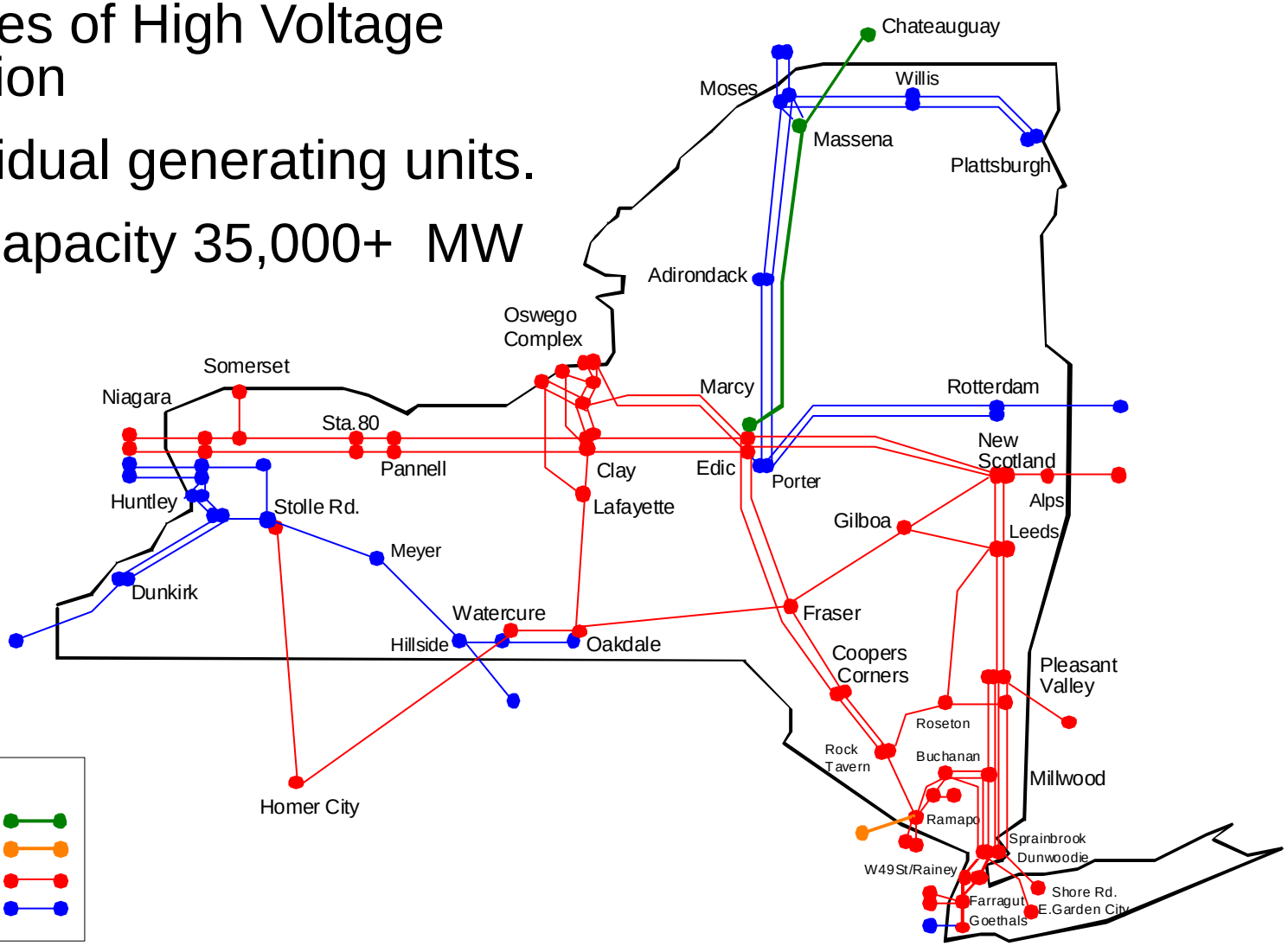
* = Peak Load in Megawatts

New York's Electrical System

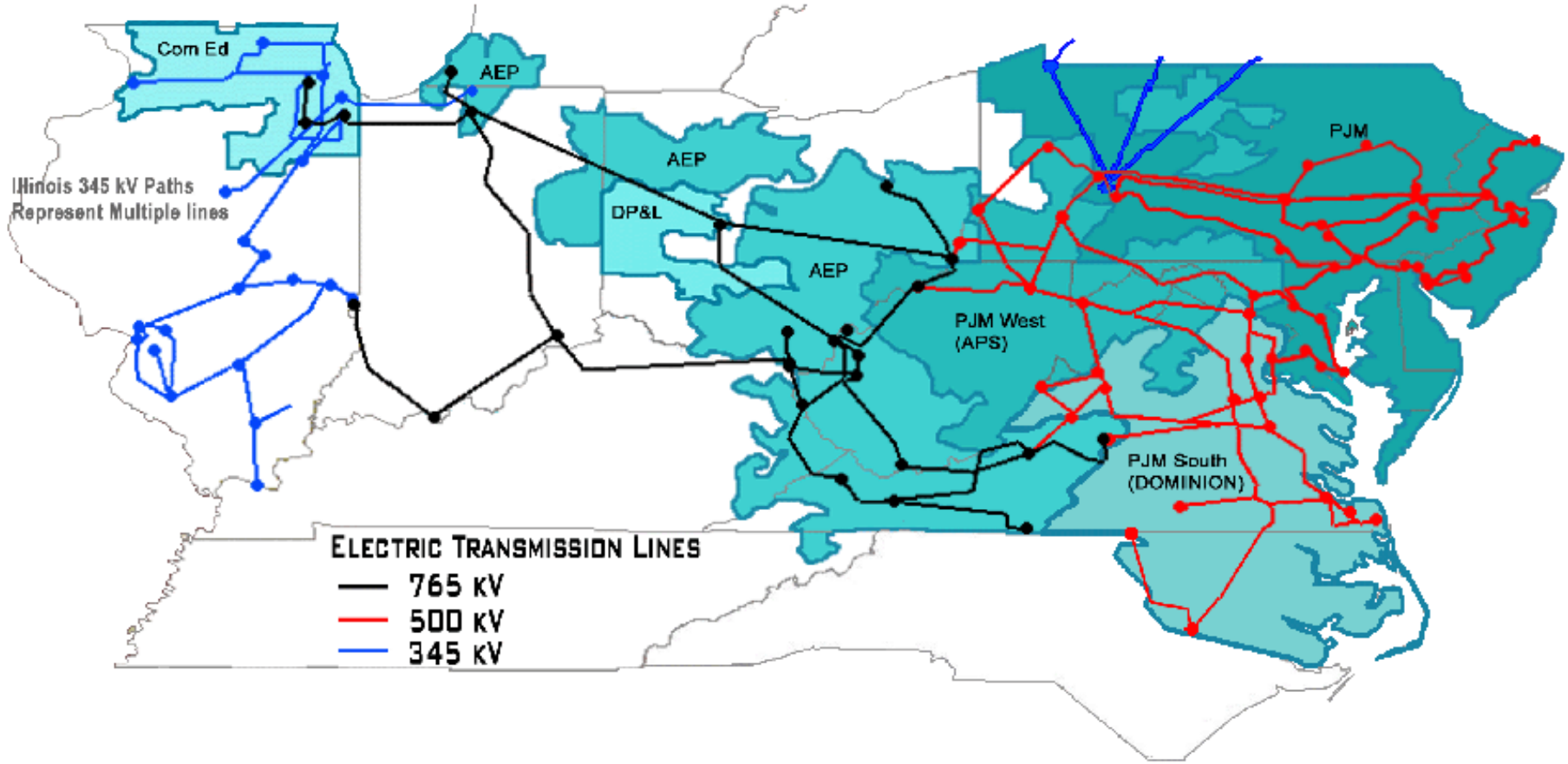
10,775 miles of High Voltage Transmission

360+ individual generating units.

Installed Capacity 35,000+ MW

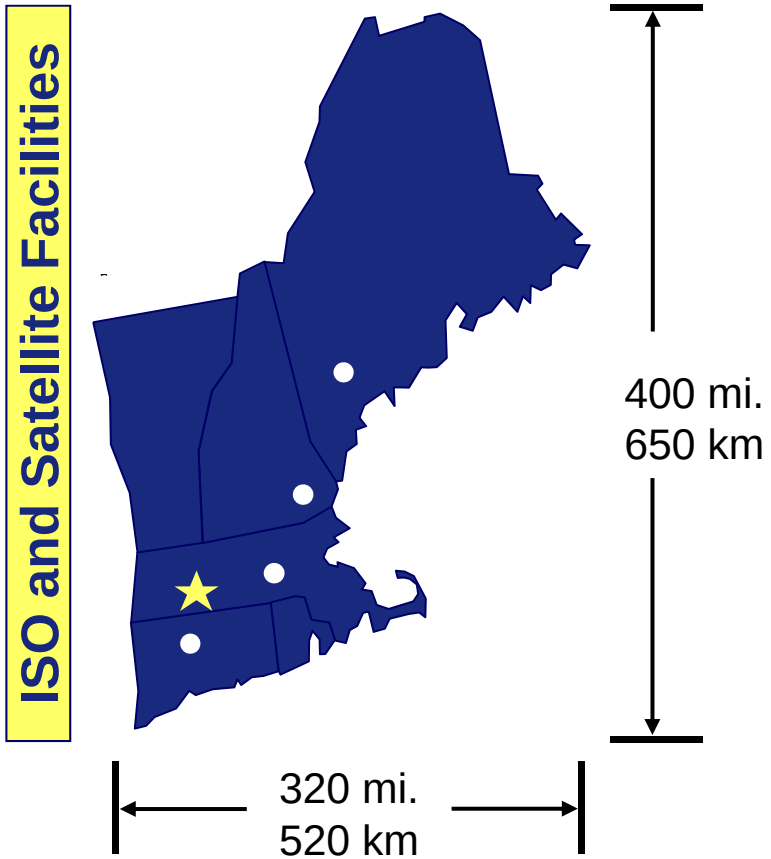


PJM - Backbone Transmission Systems (with expansions)

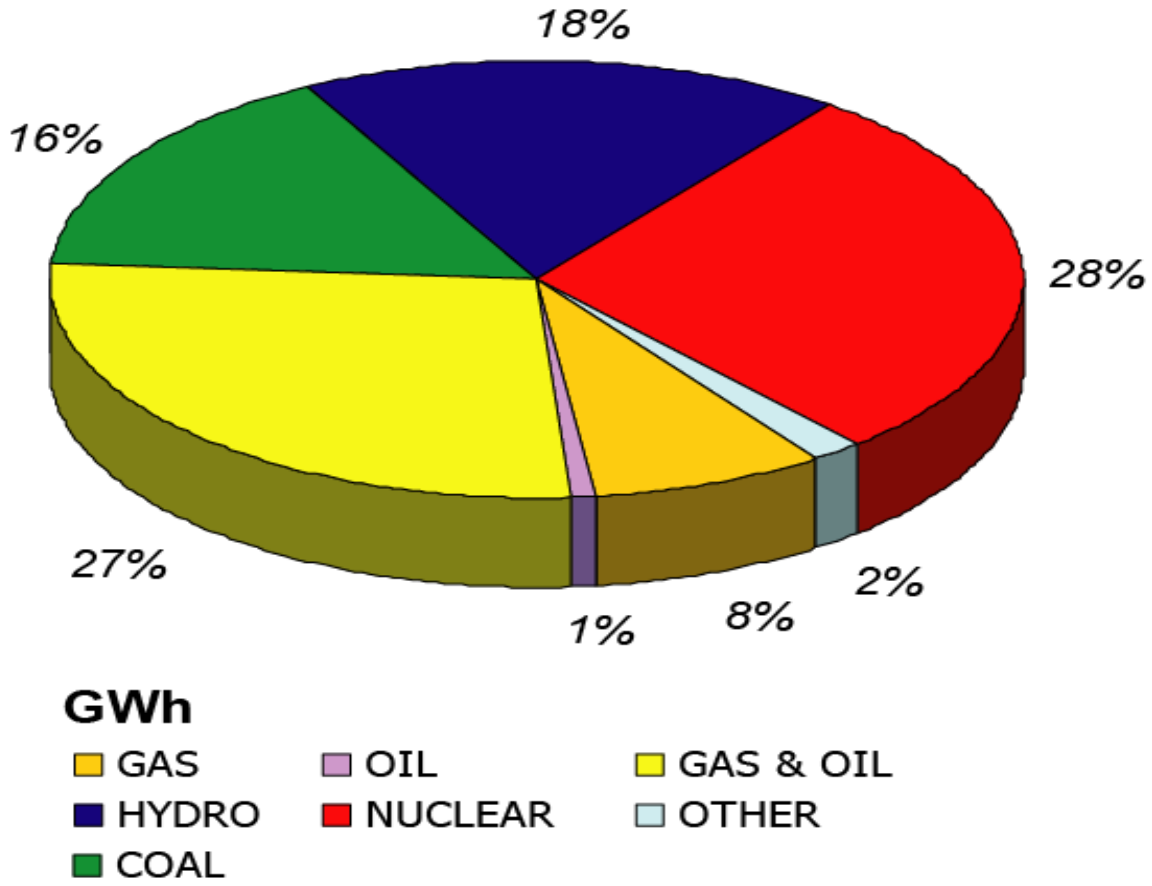


New England's Electric Power System

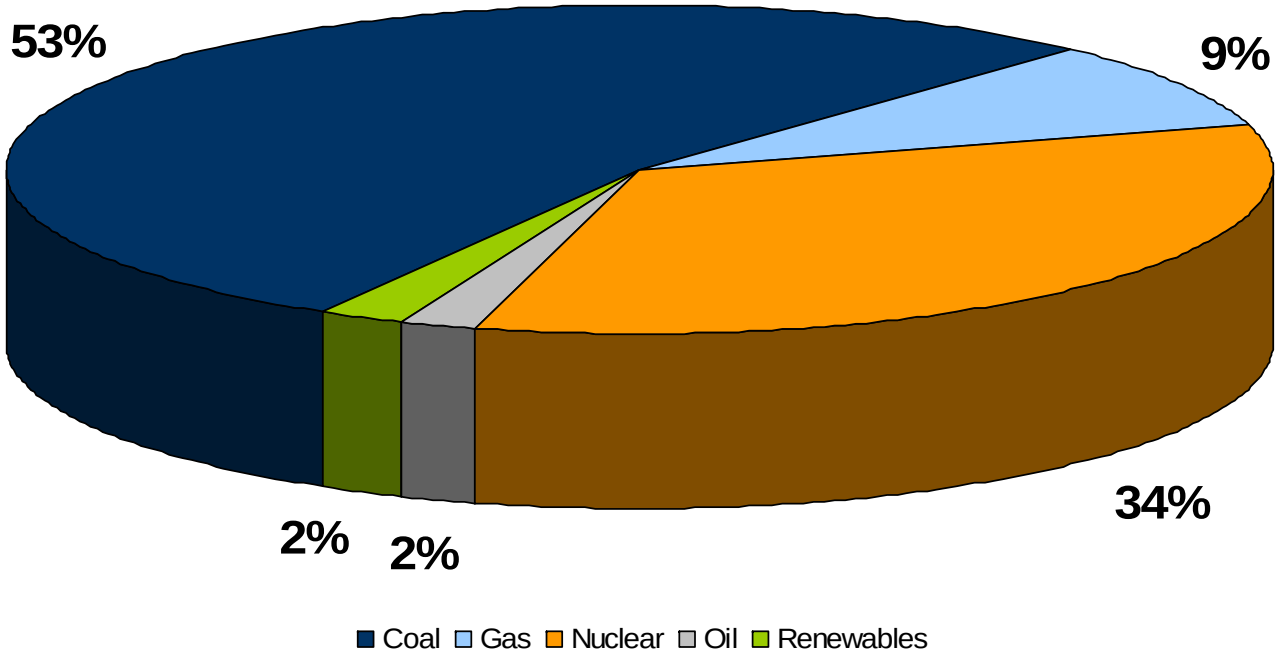
- 350+ Generators
- 8,000+ miles of transmission lines
- 4 Satellite Control Centers
- Peak load: 25,348 MW on August 14, 2002
- Capacity – 31,000 MW



New York's Energy Supply Mix - 2003



PJM's Energy Supply Mix - 2003



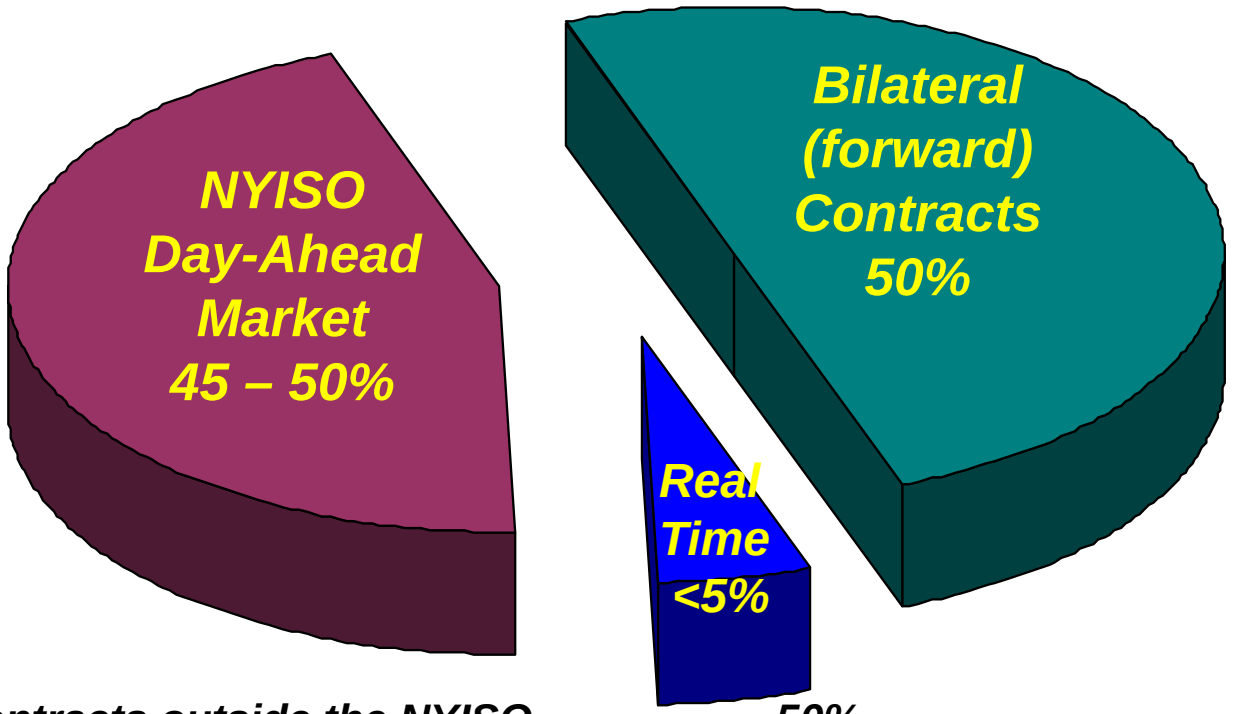
Comparison of NE, NY, & PJM Electric Power System

	ISO-NE	PJM	NYISO
Peak Demand	**25,348 MW**	**107,820 MW**	**30,983 MW**
Generation Capacity	**31,000 MW**	**134,250 MW**	**36,500**
High Voltage Transmission Lines	**8,000 + miles**	**49,300 miles**	**11,000 miles**
Population	**14 million**	**44 million +**	**19 million+**
Locational Marginal Pricing	**YES**	**YES**	**YES**
Financial Transmission Rights	**YES**	**YES**	**YES**
Responsibility for System Planning	**YES**	**YES**	**YES**

Market Overview

- **Two Settlement System**
  - *Day-Ahead Market*
  - *Real-Time Market*
- **Locational Marginal Pricing**
  - *Nodal congestion management pricing system*
  - *Includes marginal losses*
  - *Locational pricing for Energy and Reserves*

Buying Power in New York



Bilateral Contracts outside the NYISO	***50%***
NYISO Day-Ahead Market	***45 - 50%***
NYISO Real-Time Market	***<5%***
	100%

NYISO Market Overview

- **Bid- and Offer-Based Markets**
  - *Co-optimized Energy, Regulation and Reserves*
  - *Multi-part supplier offers*
  - *Load bids, including firm and price-sensitive components*
  - *Hourly variation in offers*
  - *Voluntary – bilaterals & self-supply accommodated*
- **Other Markets**
  - *Installed Capacity*
  - *Transmission Congestion Contracts*

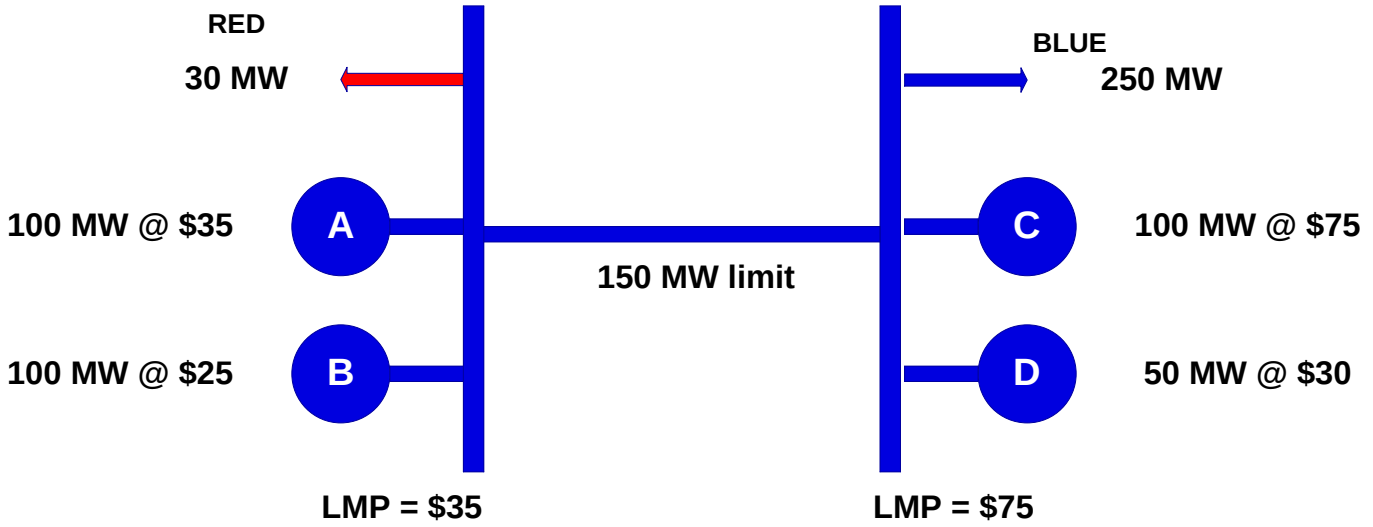
Generation Bids

- Generator Modes
- Minimum Run Time & Minimum Down Time
- Maximum Stops per - Day
- Start-up Notification Time Curve
- Start-up Cost Curve
- Minimum Generation $
- Incremental Operating $
- Operating Limits

Day-Ahead Energy Market

- Security Constrained Unit Commitment (SCUC) scheduling software simultaneously co-optimizes energy and ancillary services for least cost solution
- Hourly Locational Marginal Prices (LMP)
- Issues binding forward contracts to Suppliers and Loads
- Bilateral transaction scheduling accommodated concurrently with supply and load bids
- Deviations settled against Real-Time Market
- Installed capacity suppliers required to bid in

LMP Example

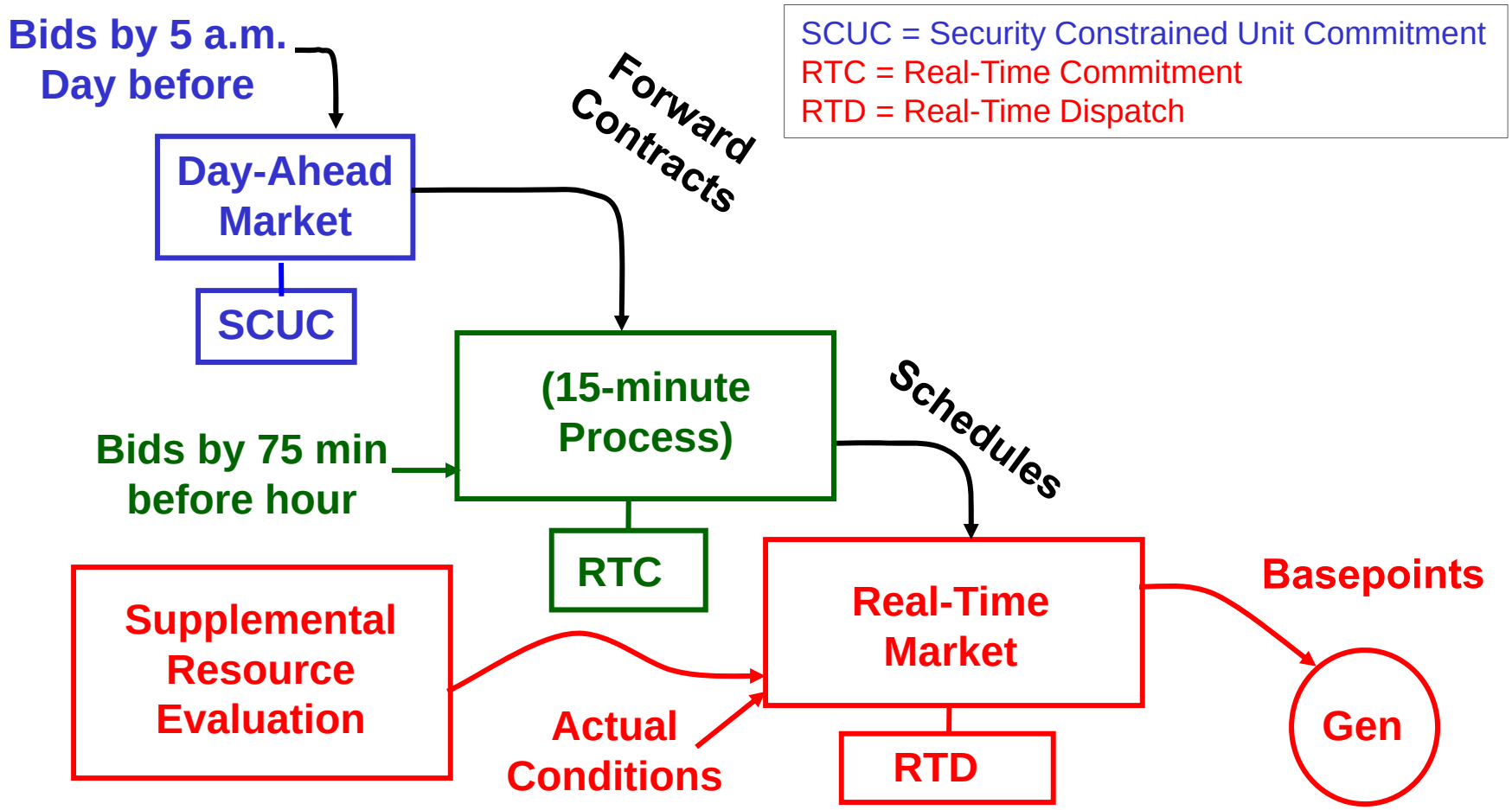


Generator	MW	LBMP	Paid
A	80	$35	$2800
B	100	$35	$3500
C	50	$75	$3750
D	50	$75	$3750
			$13800

Load	MW	LBMP	Pays
RED	30	$35	$1050
BLUE	250	$75	$18750
			$19800

Δ = $6000 paid to congestion contract holders

New York's Two-Settlement Process



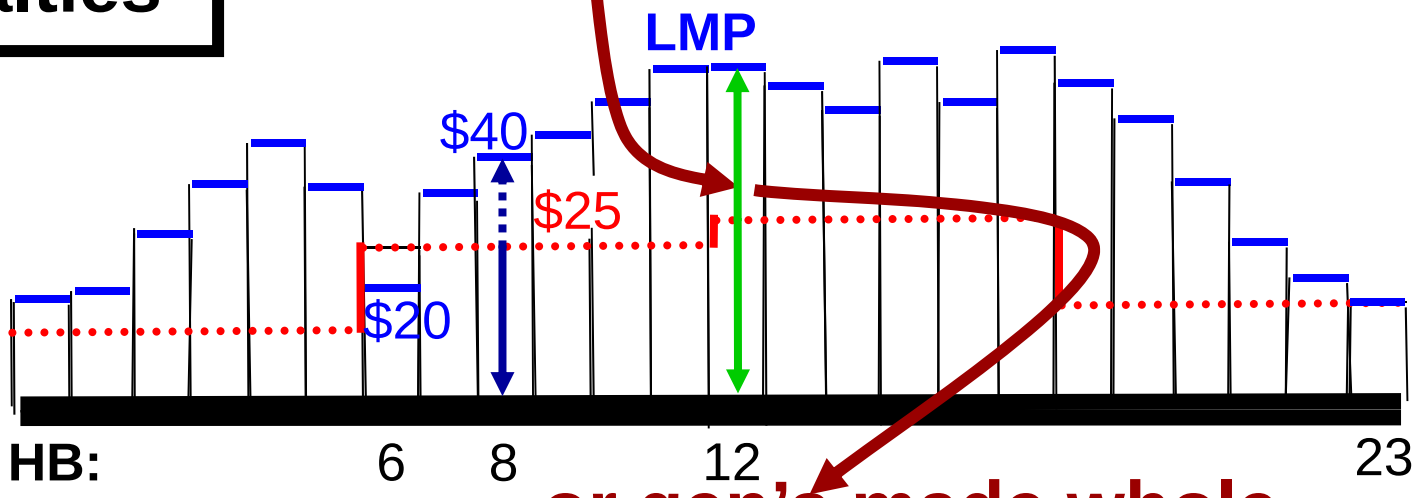
Bid Production Cost Guarantee (BPCG)

Bid "Costs"...

- Start
- Min Gen
- Energy
- less penalties

All based on entire day!

Must be retrieved through...



Generator Offer

... or gen's made whole

Ancillary Service Markets

- **Market-Based Services**
  - ✓ *Regulation*
  - ✓ *10-Minute Spinning Reserve*
  - ✓ *Total 10-Minute Reserve*
  - ✓ *30-Minute Reserve*
- **Cost-Based Services**
  - ✓ *Scheduling, Control and Dispatch*
  - ✓ *Voltage Support*
  - ✓ *Black Start*

Operating Reserve

Backup Generation available in the event of:

- ✓ *Loss of any major Generating Unit*
- ✓ *Loss of transmission*
- ✓ *Significant "dragging" of the Pool Control Error*

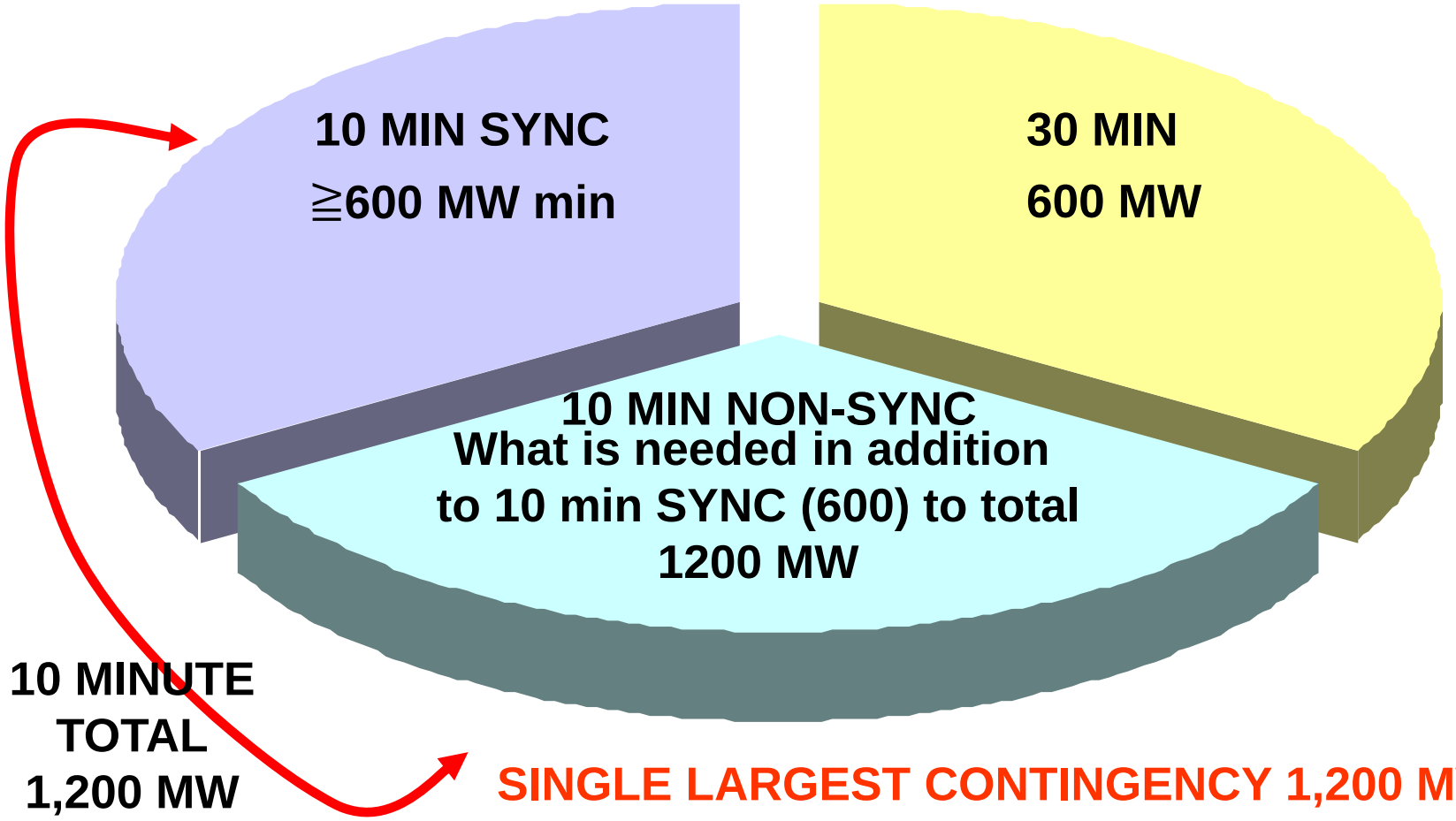
Three Markets

- ✓ *10 Minute Spinning Reserve*
- ✓ *10 Minute Non-Synchronized Reserve*
- ✓ *30 Minute Reserve: non-sync & spinning*

Locational Requirements:

- ✓ *Long Island*
- ✓ *East of Central East*
- ✓ *Entire Control Area*

NYISO Operating Reserve Requirements



SINGLE LARGEST CONTINGENCY 1,200 MW

RESERVE REQUIREMENT: 1,800MW

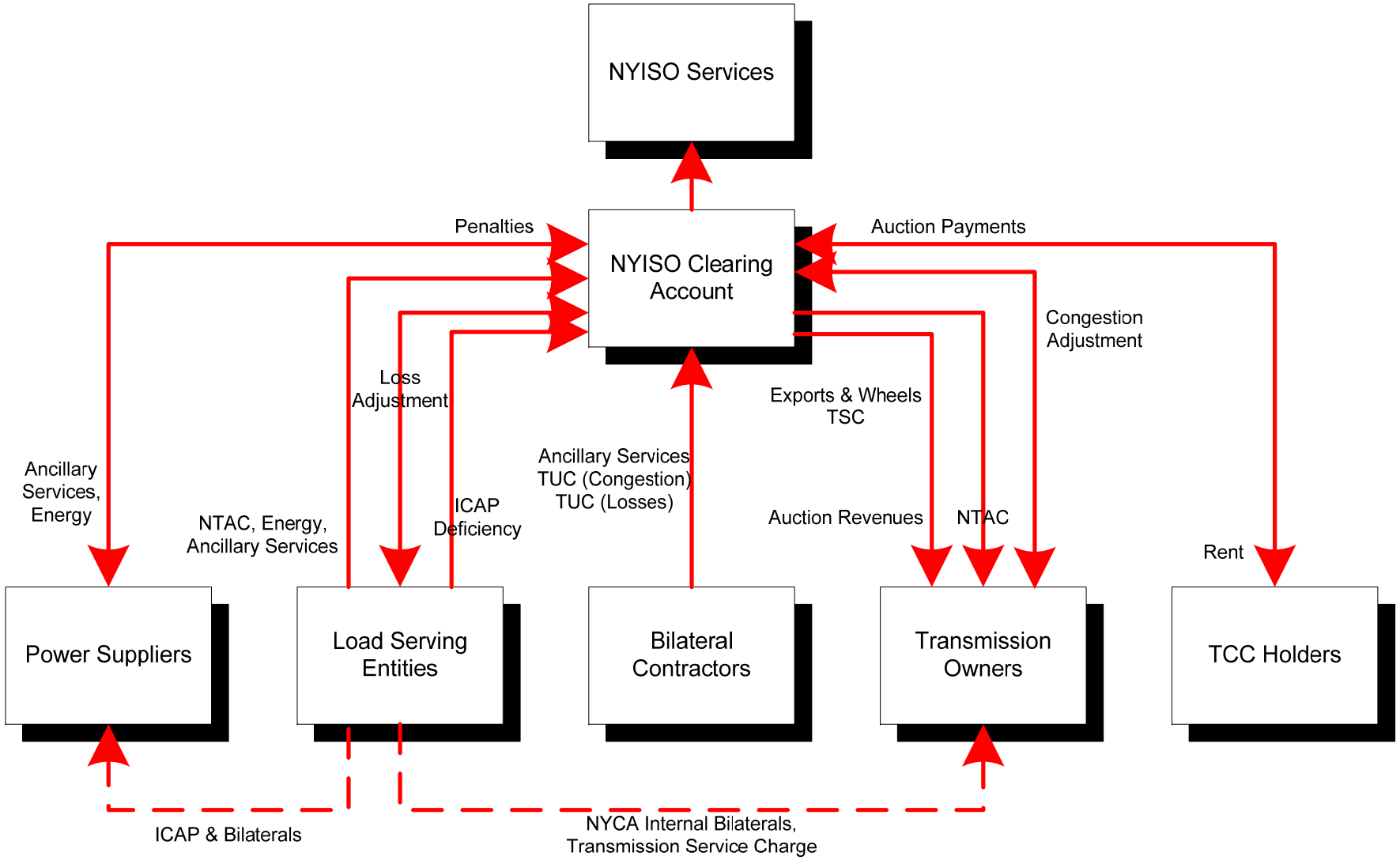
Regulation Service

- Necessary for continuous balancing of load and generation – maintain 60 Hz frequency
- Performed on a 6-second basis through automatic generation control (AGC)
- North American Electric Reliability Council (NERC) reliability requirement – tracked via CPS2 index
- Full two-settlement for regulation
- Regulation service will be scheduled and settled, nominally on a 5-minute basis
- Single, statewide price

Long Term Capacity Markets

- **Installed Capacity (ICAP) Requirements are set in advance for the upcoming Capability Year by the New York State Reliability Council.**
- **Load-serving entities (LSEs) meet their ICAP requirements by:**
  - ✓ *Self-Supply*
  - ✓ *Bilateral Transactions with Suppliers*
  - ✓ *Capability Period Auctions (6-month strip)*
  - ✓ *Monthly Auctions (for balance of Capability Period)*
  - ✓ *Deficiency/Spot Market Auction (1-month)*

Clarifying Questions?


NYISO Services
NYISO Clearing Account
Penalties
Auction Payments
Congestion Adjustment
Loss Adjustment
Exports & Wheels TSC
Ancillary Services, Energy
NTAC, Energy, Ancillary Services
ICAP Deficiency
Ancillary Services TUC (Congestion) TUC (Losses)
Auction Revenues
NTAC
Rent
Power Suppliers
Load Serving Entities
Bilateral Contractors
Transmission Owners
TCC Holders
ICAP & Bilaterals
NYCA Internal Bilaterals, Transmission Service Charge

Market Monitoring and Performance

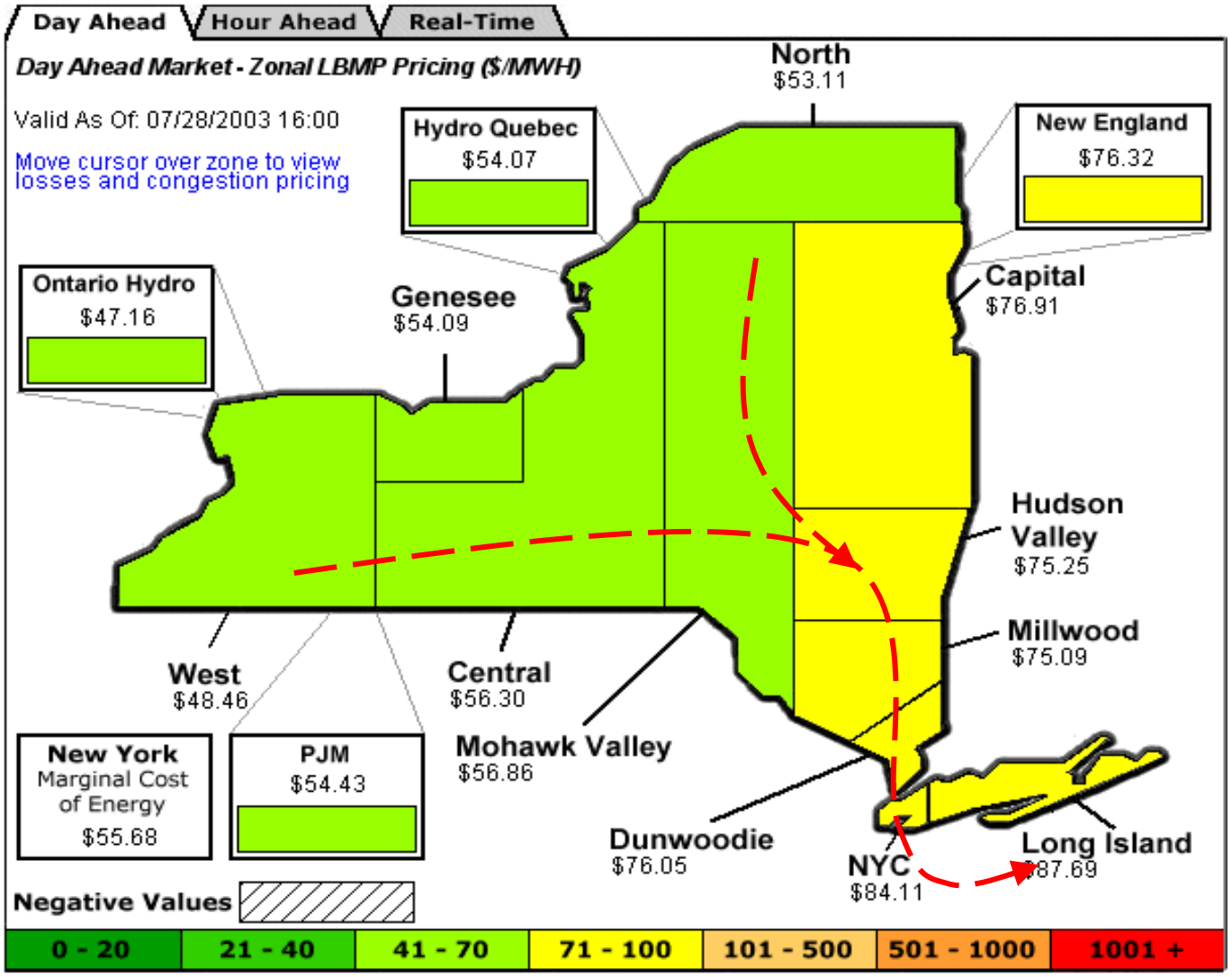
Daily Monitoring

- Mitigation (Economic Withholding)
- Reference prices
- Mitigation reporting
- ICAP bidding compliance
- Daily market analysis/reports
- Price validation
- Physical withholding screening
- Load bidding

Economic and Long Range Analysis

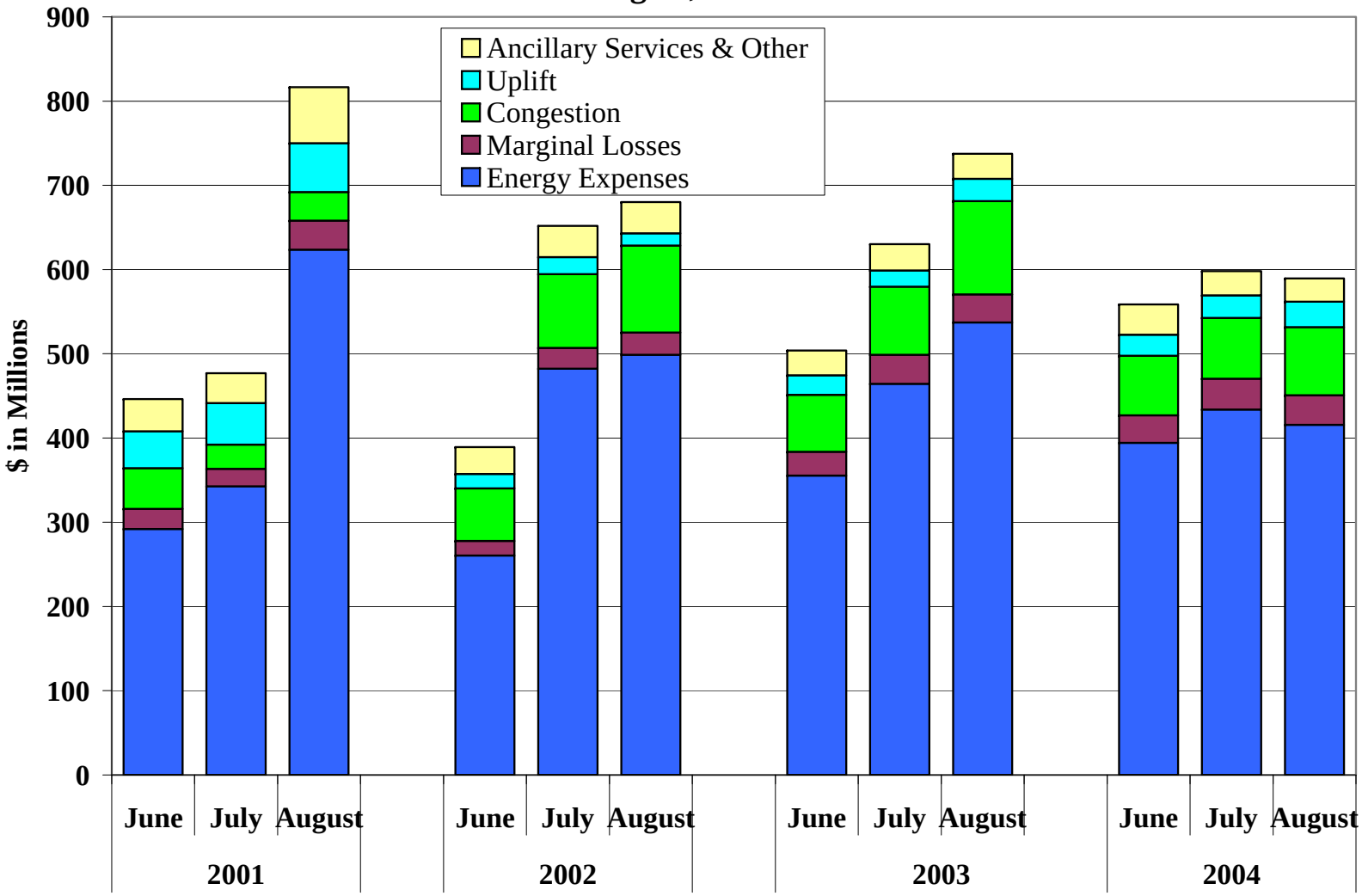
- Tool development/maintenance and daily processing (e.g. SCUC, PROBE)
- Special reports (FERC, PSC, NYISO, etc)
- Transactions Monitoring
- VT monitoring
- Portfolio analysis/tracking
- Price validation audit
- Weekly Report
- ICAP auction monitoring
- TCC auction monitoring
- Market design/requirements
- Performance tracking

Market Experience - *Sample Day*



New York Electricity Market Expenses

June to August, 2001 to 2004



Source: Summer 2004 Review of the New York Electricity Markets – David B. Patton, Ph.D., Independent Market Advisor

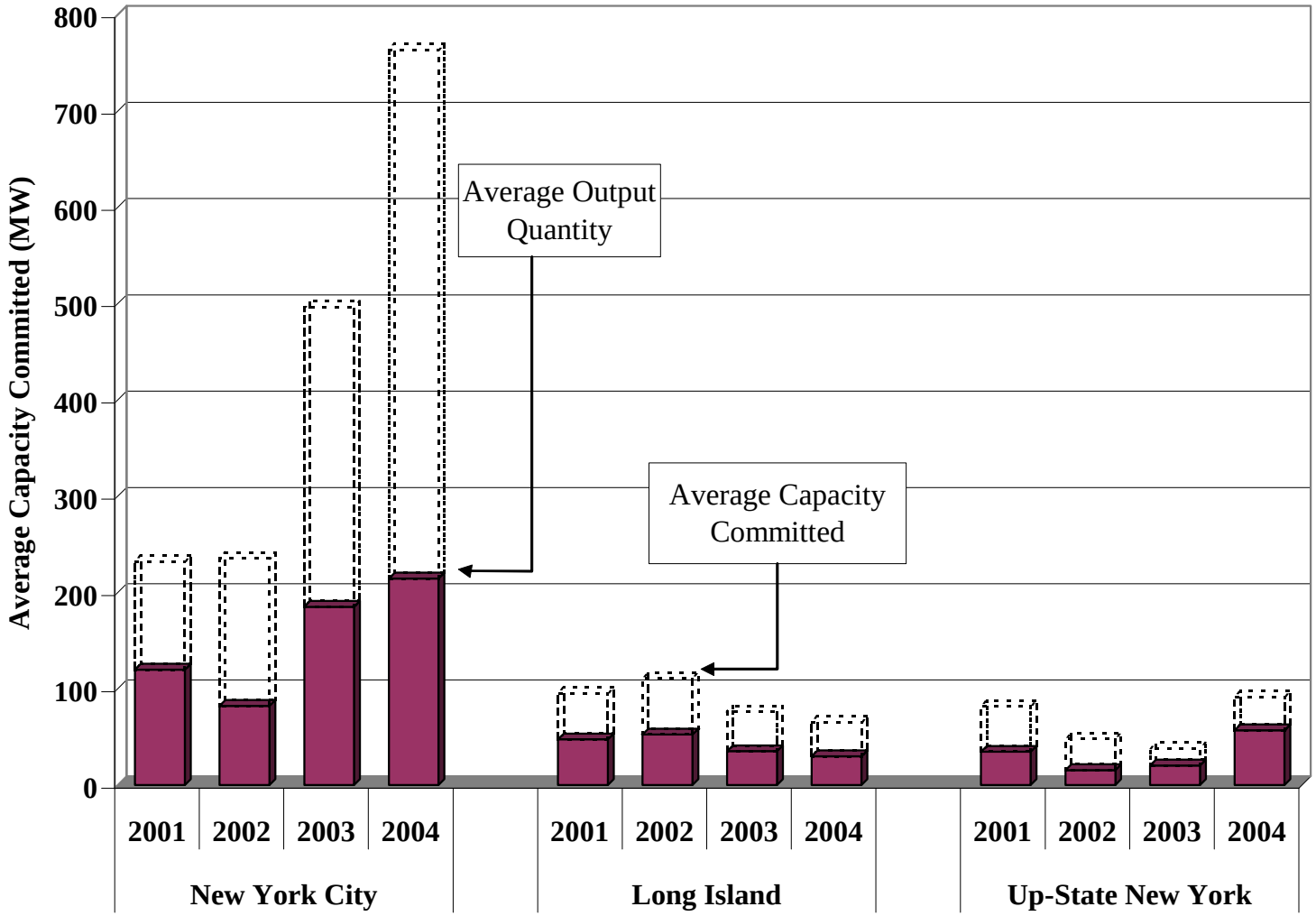
Current Key Issues - Regional Market Initiatives

- **Energy Markets**
  - ✓ *Elimination of pancaked through and out charges throughout the Northeast region*
  - ✓ *Improve the efficiency of inter-market energy trading – Coordinate energy dispatches between ISOs and move toward single area LMP dispatch efficiency and financial versus physical transactions (VRD-like concept)*
  - ✓ *Reduce risks for inter-market energy trading – Cross-border congestion hedges*
  - ✓ *Establish greater consistency of bidding protocols – Single point regional transaction entry*
  - ✓ *Coordination and compatibility of billing and settlements for regional trading*
- **Capacity Markets**
  - ✓ *Regional ICAP trading improvements - greater market rules compatibility*
  - ✓ *Renewable resource valuation methods*

RGGI Reliability Considerations

- Supplemental commitments are often required to meet NOx requirements in NYC
- Certain units on 115, 138 and 230 kV networks provide voltage support on underlying network (Western NY, Long Island)
- 11 of 66 Transmission Owner Applications of New York State Reliability Council Reliability Rules directly address the need for specific thermal units to meet reactive power support and local power system requirements
- Dual-fuel units (gas/oil) are important during peak winter demand periods
- Operating range flexibility is important

Supplemental Resource Evaluation Commitment
Summer 2001 to 2004



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Note: August 2003 blackout hours excluded.

Wind Power Reliability Considerations

Operational Issues:

- Reactive power demands increase with increasing MW output (acts as an induction generator)
- Dynamic response to power system faults
- Potential regulation impact

Mitigation Strategies:

- Voltage regulation at the Point-of-Interconnection, with a guaranteed power factor range.
- Low voltage ride-through.
- A specified level of monitoring, metering, and event recording.
- Power curtailment capability.

Current Market Rules for Intermittents

In New York, intermittents existing as of 11/19/1999 and 500 MW of new resources are:

- **paid for all energy produced regardless of their Day-Ahead schedule (Imbalance Charges)**
- **excused from paying penalties for generating at less than their basepoints (Under-Generation Penalties)**

- **Wind and solar resources are paid for their capacity in a valuation based on historic capacity factors, adjusted for maintenance**

Rule Changes Contemplated:

- **Adjust the manner in which intermittents are balanced against their Day-Ahead Schedules, Including Real-Time Payments for Delivered Energy**

- **Adjust the Method Used to Measure the Capacity Value of All Generation**
  - ✓ ***Including correlation of resource availability with system peak hours***

- **Adjust the exemption from Regulation Penalties**

- **How will the 500 MW "Exemptions" be applied?**

RGGI Design and Electricity Market Intersection

- **Allocation of allowances**
  - ✓ *If allowances must be purchased by suppliers, will the total cost be reflected in energy market offers?*
  - ✓ *If so, will the clearing price be such that the units are committed?*
  - ✓ *If allowance costs are not fully reflected in energy offers, will capacity prices increase?*
  - ✓ *What if costs are not recovered? Will we be faced with retirements of baseload units otherwise needed for reliability?*

RGGI Design and Electricity Market Intersection

- **Cap size**
  - ✓ *Regional, state-by-state allocations*
  - ✓ *Possible impacts are similar to those associated with handling of allowances, i.e., too tight a cap may result in units needed for reliability being uneconomic*
  - ✓ *Caps should be designed in a manner that shapes future performance without creating immediate financial problems for suppliers – this will have a ripple effect on new construction*
  - ✓ *Phased-in caps can signal new construction in a market-friendly manner*

RGGI Design and Electricity Market Intersection

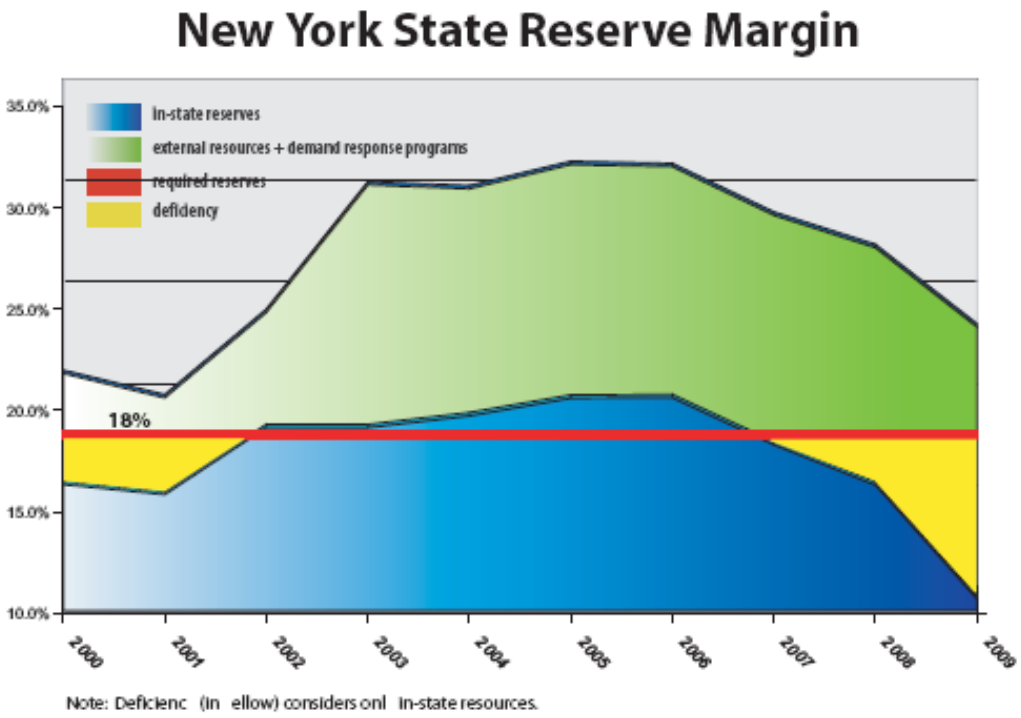
- **Temporal Flexibility**
  - ✓ *Borrowing*
    - **Would be necessary in situations where reliability may otherwise be jeopardized (similar arrangement for NOx in 6 NYCRR 237-6.5f)**

RGGI Design and Electricity Market Intersection

- **Leakage**
  - ✓ *Uncertainty of supply from Ontario (~5 years out)*
  - ✓ *What is the impact on PJM commitment if only portions of the control area are subject to RGGI?*
  - ✓ *How will new coal facilities outside the RGGI region impact the overall program effectiveness?*

RGGI Design and Electricity Market Intersection

- **Implementation Timing / Phase-In**
  - ✓ *Consider predicted installed reserve margin*
  - ✓ *Need to keep in mind other scheduled and proposed regulations, the timing and cost of which create significant supplier uncertainty:*
    - **NY's revised NOx (NYCRR 237) and SOx (NYCRR 238) rulemakings**
    - **Potential mercury rules**
    - **Water permits (outages for fish protection, etc.)**



RGGI Design and Electricity Market Intersection

- **Concluding thoughts on cap-and-trade system**
  - ✓ *Needs to be flexible*
  - ✓ *Should be in a form that can be widely adopted in other regions, countries, etc.*
  - ✓ *Should, to the extent possible, adopt standard approaches in use elsewhere*
  - ✓ *Design should drive market solutions*