



# NYISO Presentations

- Voltage Control
- Future Market Design

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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 projects proposed to meet those needs*

## Advancing the technological infrastructure of the electric system

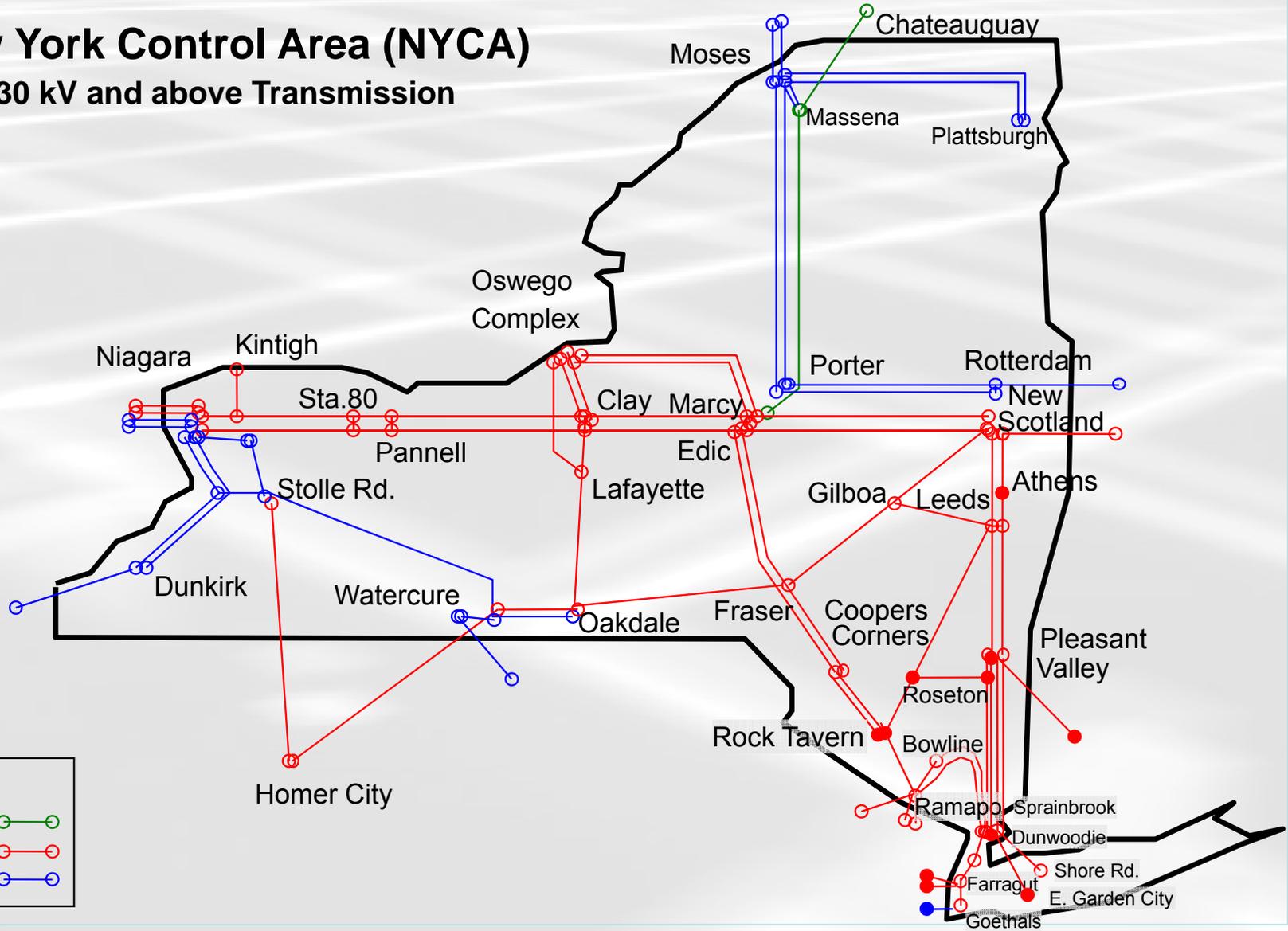
- *Developing and deploying information technology and tools to make the grid smarter*

# Voltage Control at the NYISO

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# New York Control Area (NYCA)

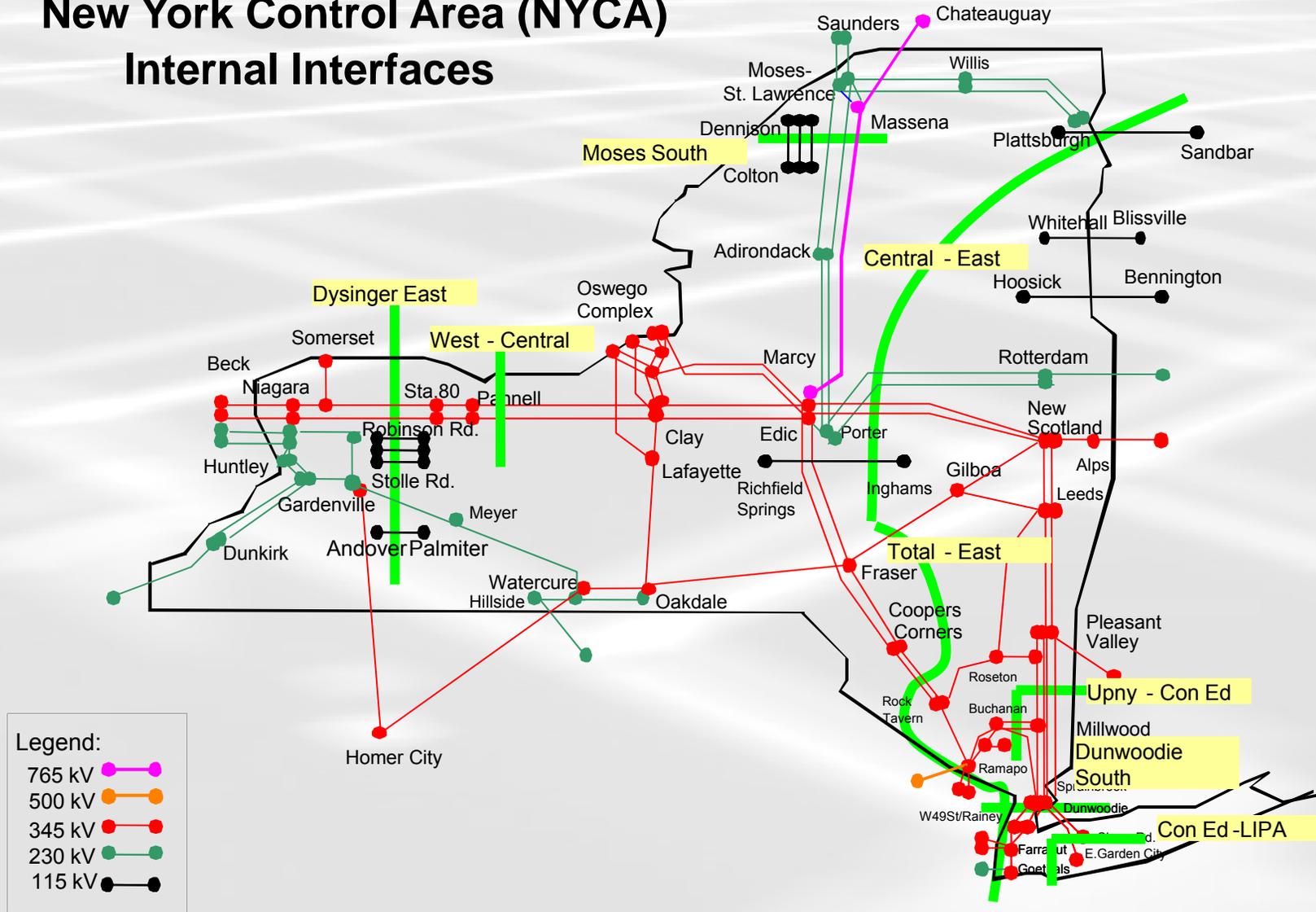
## 230 kV and above Transmission



**Legend:**

- 765 kV
- 345 kV
- 230 kV

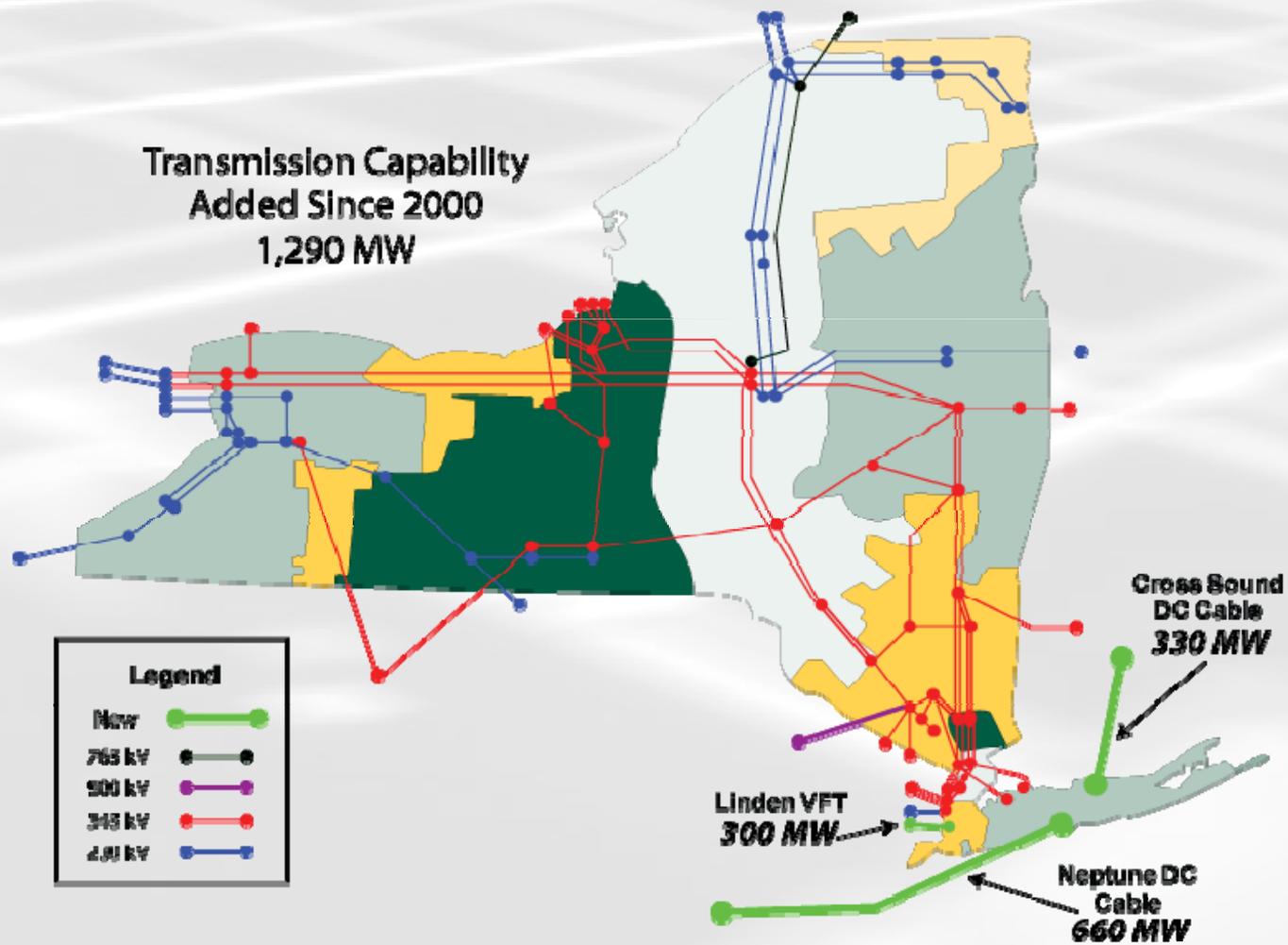
# New York Control Area (NYCA) Internal Interfaces



**Legend:**

- 765 kV ●
- 500 kV ●
- 345 kV ●
- 230 kV ●
- 115 kV ●

# New Interstate Transmission



# Transmission Reactive Limits

- ◆ **Pre-contingency and post-contingency transmission voltage high limits are established by the New York Transmission Owners (NYTOs) based on substation equipment ratings**
- ◆ **Post-contingency transmission voltage low limits are established by the NYTOs based on customer voltage requirements**
- ◆ **Pre-contingency transmission voltage low limits are established by the NYISO based on maintaining voltage limits post contingency**
- ◆ **Post-contingency voltage collapse limits are established and secured in the form of transfer limits**
- ◆ **Desired voltage limits are mutually developed by the NYISO and NYTOs to minimize transmission losses**

# Pre-Scheduling Reactive Resources

- ◆ **The NYISO coordinates reactive resource maintenance outages with Transmission Owners (TOs) based on loads, predicted transfers, and in coordination with adjacent Balancing Authorities**
  - *Rarely does the NYISO require generation commitment for the sole purpose of securing reactive resources. There were two events in 2011 and both for extreme weather.*
- ◆ **Occasionally, TOs require pre-scheduling of local generation to secure lower voltage transmission substations**
  - *Con Edison Local Reliability rule units are submitted to the day ahead market to meet local transmission reactive requirements.*
- ◆ **The NYISO's Security Constrained Unit Commitment (SCUC) process considers the impact of transmission losses when determining optimal generating unit day-ahead commitment schedules.**
  - *The resulting Day-Ahead Locational Marginal Based Prices (LBMP) includes a marginal loss pricing component.*

# Real-Time Reactive Resources

- ◆ **Security Constrained Economic Dispatch (SCD) reflects the impact of transmission losses when determining optimal generating dispatch schedules.**
  - *The resulting Real-Time Locational Marginal Based Prices (LBMP) includes a marginal loss pricing component.*
- ◆ **OPF technology could be used to aid in loss reductions on the transmission system. The expected outcome of OPF technology is that the transmission system should normally be operated at the highest operating levels allowable by equipment ratings. The NYISO has worked with the NYTOs to develop “Desired High Voltage Limits” and has modified procedures to operate reactive resources to maintain actual transmission voltages as close to Desired High Voltage Limits as possible.**
- ◆ **The Blenheim-Gilboa Pumped-Storage Project is used occasionally as a resource to absorb reactive power during off-peak high-voltage periods.**

# Reactive Evaluation Applications

- ◆ **Real Time Voltage Monitoring**
  - *State estimator applications*
  - *Contingency evaluations*
  - *EMS SCADA monitoring and alarming applications*
  
- ◆ **Real Time Interface Flow Monitoring**
  - *Security Constrained Dispatch secures all interfaces, including voltage collapse interface limits, every five minutes with pre and post contingency secure basepoints*
  - *EMS SCADA monitoring and alarming*

# Reactive Resource Limitations

- ◆ **There are situations where the voltage at one transmission substation cannot be increased because an electrically adjacent substation would exceed a pre-contingency high limit**
  - *It is possible during non-peak load conditions for transmission bus voltages to be at, or are approaching, pre-contingency high voltage limits at the same time actual Central East power flows are at, or are approaching, the Central East Voltage Collapse interface limits prior to all transmission capacitors being in-service.*
- ◆ **In off-peak time periods, transmission voltages are close to pre-contingency high limits with all reactive resources switched out of service**

# Central East Limit

- ◆ **The Central East Voltage Interface limit is a function of many variables including:**
  - *Oswego Complex unit commitment*
  - *Status of Upstate 345 kV transmission lines*
  - *Capacitors & reactors status*
  - *Status of two Static Var Compensators and one Statcom device*
  - Tables have been developed defining these limits for all these variables and these tables are submitted to the day ahead & real-time market systems and the on-line security programs.
  
- ◆ **The Central East Stability limit is only about 200–300 MW higher than the Voltage Interface Limit**

# Interface Limits by Constraint Type

Interface	Limitation	Comment
Dysinger East	Thermal	Voltage Limit > Thermal Limit Voltage Limit based on pre-contingency substation low limit
Central East	Voltage	Voltage Limit based on voltage post contingency
UPNY-Con Ed	Thermal	Previously limited by pre-contingency substation limits but since the installation of the new 345 kV M29 cable limited by thermal
IESO-NYISO	Thermal	
PJM-NYISO	Thermal	
Mosses South	Stability	
ISO-NE	Thermal	

- ◆ Many thermal (line on line) constraints exist and become limiting prior to the above interfaces limiting

# Voltage Related Settlements

- ◆ **Voltage Support Service**
  - *Payments for demonstrated / tested capability*
- ◆ **Lost Opportunity Costs**
  - *Payment when ISO directs resource to reduce power output below economic levels to increase reactive power options*
    - Payments totaled \$2100 in 2010, \$0 in 2011
- ◆ **Bid Production Cost Guarantees**
  - *Make whole payments when unit is directed to run, including time scheduled due to voltage control needs*

# Future Market Design & Software Enhancements

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# Topics

- ◆ **NYISO Market Design**
- ◆ **Recent Market Enhancements**
- ◆ **Future Market Enhancements (3-5 years)**

# NYISO's Comprehensive Set of Market Rules

- ◆ **Two-Settlement System: Day-Ahead Market and Real-Time**
- ◆ **Bid Based Security-Constrained Economic Dispatch (SCED) and Commitment (SCUC)**
- ◆ **Locational Based Marginal Pricing (LBMP)**
- ◆ **Simultaneous co-optimization of Energy, Operating Reserves and Regulation**
- ◆ **Allowing GTs to set price when they are economic**
- ◆ **Scarcity pricing for operating reserves**
- ◆ **Bid Production Cost Guarantees (Uplift)**
- ◆ **Virtual Bidding**
- ◆ **Transmission Congestion Contracts (TCC)**
- ◆ **Installed Capacity Markets (ICAP)**
- ◆ **Demand Side Participation**
- ◆ **Market Power mitigation with conduct and impact tests and Automated Mitigation Procedure (AMP)**

# Recent Market Design Enhancements

- ◆ **Broader Regional Markets**
  - *HQ on Dispatch*
  - *Coordinated Transaction Scheduling – ISO-NE*
- ◆ **Weekly Invoicing**
- ◆ **Solar in the Capacity Market**
- ◆ **SCR Baseline / Aggregations**
- ◆ **MARS High Performance Computing**

# Future Market Design Enhancements

- ◆ **Broader Regional Markets**
- ◆ **Implementation of FERC Order 745 on DR Resources**
- ◆ **Capacity Market Enhancements**
- ◆ **Implementation of Mixed Integer Programming (MIP)**
- ◆ **Scarcity Pricing Enhancements**
- ◆ **Multi Duration TCCs and Balance of Period Auction**

# Broader Regional Markets

## ◆ **Market Solutions**

- ***Enhanced Interregional Transaction Coordination***
  - ***15-Minute Transaction with PJM***
  - ***CTS with ISO-NE***
  - ***CTS with PJM***
- ***Market-to-Market Coordination***
- ***Interface Pricing***

# Current Demand Response Initiatives

- **Direct telemetry to demand response resources (*including aggregated resources*) providing ancillary services**
- **Rules for demand response participation in real-time energy markets (*Implementation of FERC Order 745*)**
- **Enhance Demand Response Information System**
- **Dynamic Pricing vs. Demand Response**

# Current Capacity Market Initiatives

- **Creation of Additional Capacity Zones**
- **Evaluation of Forward Capacity Market Constructs**
- **Inter-RTO Capacity Transaction and Wheeling**

# MIP Study Conclusions

## ◆ Study

- *MIP was evaluated for feasibility within the New York Day Ahead market process*

## ◆ Benefits Identified

- *Lower support and maintenance costs*
- *Faster and easier implementation of new market features (flexibility)*
- *Slight improvements in Total Production Cost*

## ◆ Challenges/Resolutions

- *Solution time performance was an issue until MIP was moved to a High Performance Computing (HPC) platform*

# NYISO MIP Approach

## ◆ Implementation Plan

- *Develop an unified MIP based commitment and dispatch approach for the DA and RT markets*
- *Leverage low cost HPC systems to gain >300% improvement in performance over traditional servers*
- *Creation of enhanced functionality to allow for scenario based market simulation(s)*
- *Parallelization of Ideal and Physical dispatch*
- *Allows for enhanced market planning and analysis through a near human language interface*
- *Targeted implementation Q2 2014*

# Pricing Demand Response

- ◆ **Replace existing scarcity pricing rule-based logic for emergency demand response deployments with flexible design integrated with dispatch and price setting software**
  - *Move price setting from the ex-post software to the ex-ante pricing in the RTS optimization*
  - *Minimize divergence between the physical and pricing pass of the RTS*
    - Ensures consistent transaction scheduling
  - *Create flexibility for pricing to occur, regardless of the reliability reason for activation*

# Multi-Year TCC Product Development Plan

- Phase 1 – Introduce to market new product - Non-Historic Fixed Price TCC (NHFPTCC)
- Phase 2 - Balance-of-Period
- Phase 3 - Short Term Multi-Duration Centralized Auctions – 6 month & 1 year only
- Phase 4 - Long Term Multi-Duration Centralized Auctions



**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](http://www.nyiso.com)**