Market Design Concepts to Prepare for Significant Renewable Generation

Flexible Ramping Product

Ethan D. Avallone, Energy Market Design

MIWG/ICAPWG/TPAS

March 7, 2018, Rensselaer NY

Integrating Public Policy

NYS Clean Energy Standard Goals

	Carbon Pricing in the Wholesale Markets	Market Design Concepts to Prepare for Significant Renewable Generation
Forum	Integrating Public Policy Task Force (IPPTF)	Market Issues Working Group (MIWG)
Led by	NYISO + NY DPS + NYSERDA "Joint Staff"	NYISO
Objective	To further explore options to incorporate the cost of carbon dioxide into wholesale energy markets with the goal of contributing to achieving New York State's public policies, while providing the greatest benefits at the least cost to consumers and appropriate price signals to incentivize investment and maintain grid reliability.	To propose, analyze and develop new energy and capacity market products and/or rule changes that would incent the participation of resources that can enhance the availability, flexibility, predictability, and dispatchability of the NY Power System.
2018 Deliverables	Proposal and supporting rationale for how carbon could be priced in NY's wholesale electricity markets.	1. Market Design Concept Proposals for viable near-term products and rule enhancements. 2. 3-5 year vision for market design.

MASTER PLAN

Q2 2018

Agenda

- Background
- Flexible Ramping Product Implementations at other ISOs
  - MISO
  - CAISO
- Timeline

Background

Background

- **The NYISO conducted a preliminary review of the market design concepts proposed in the Market Assessment with 50% Renewables Report.**
- **Concepts were evaluated according to the following criteria:**
  - Whether the product or rule change would incentivize performance attributes such as availability, predictability, flexibility, and dispatchability.
  - Need demonstrated by the results of the NYISO's 2017 Market Assessment.
  - Anticipated future system need based on observations from other control areas or other NYISO studies.
- **The NYISO recommends that concepts which may offer benefits but are not yet well defined be prioritized as future studies or longer-term market design efforts.**

Background

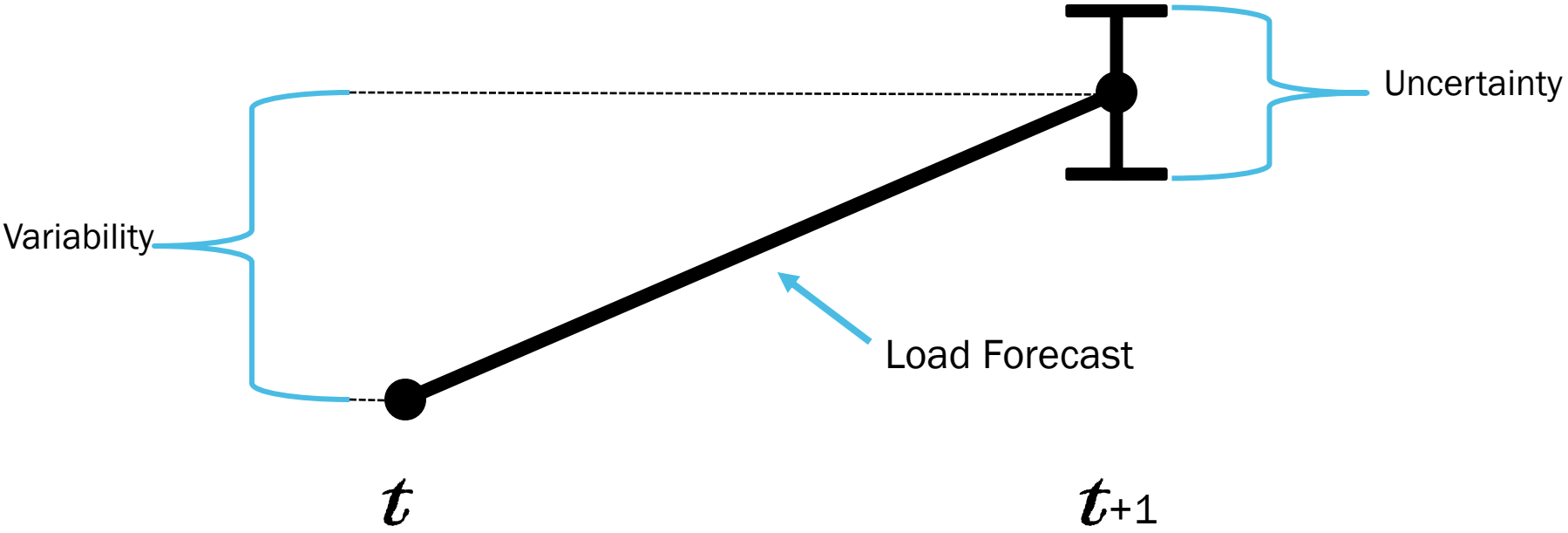
- **The NYISO recommends that the following design concepts be developed during Q1 and Q2 2018:**
    1. Flexible ramping product to address forecast uncertainty
    2. Re-evaluate shortage pricing for Ancillary Services
    3. Review performance incentives for negative LBMP's
    4. More frequent transaction scheduling
- **Market Design Concept Proposals for these products or rule changes will be considered for inclusion in the Master Plan**

Flexible Ramping Product to Address Forecast Uncertainty

- **Volatility in load ramp net of renewable generation was observed in the Real-Time Market Study.**
  - As output from intermittent generators changed, the power system had to respond quickly to un-forecasted swings in net load ramp.
- **A ramping product would enable the NYISO to procure additional ramp-up and ramp-down capability by holding a portion of wholesale generating capability to a high or low level of output.**
  - Could be procured similar to how the NYISO currently procures 10- and 30-minute Reserves.
  - Could be split into two distinct products: ramp-up and ramp-down.
  - This presentation reviews the implementation of ramping products by the MISO and CAISO as a starting point for the market design concept development.

NEW YORK INDEPENDENT SYSTEM OPERATOR

Flexible Ramping Product to Address Forecast Uncertainty



DRAFT – FOR DISCUSSION PURPOSES ONLY

MISO – Ramp Capability Product

MISO Ramp Capability Product – Reasons for Implementation

- **The RT optimization used by MISO for commitment and dispatch considers one 5-minute interval at a time.**
  - The ramp capability product helps the system position to meet ramping needs by setting aside ramp.
    - Avoids unnecessary shortage pricing events.

MISO Ramp Capability Product – Features

- **Ramp Capability Product features:**
  - Procured in DA and RT
  - The MW range output a resource can attain within 10 minutes beyond the next 10 minute target setpoint counts toward the ramp up or ramp down requirements
  - Cooptimized with energy and ancillary services
  - Requirement applies to the entire region (*i.e.*, not zonal)
  - Resources can provide only ramp up, only ramp down, or both
  - All online dispatchable resources are able to provide the product
    - Resources may opt out of providing the product, but most participate

MISO Ramp Capability Product - Requirements

- Ramp requirements determined by forecasted change in load for the region, wind generation, and interchange (*i.e.*, change in 'Net Demand'), plus
  - An additional amount of ramp up and ramp down are added to the requirement (*i.e.*, "Uncertainty," currently set to +/- 575 MW)
- DA hourly requirements are scaled to mimic the RT 10 minute Ramp up and Down Requirements
- Ramp Capability Up Requirement = max([Net Demand in future interval – Net Demand in current interval]+Uncertainty,0)
- Ramp Capability Down Requirement = max([Net Demand in current interval - Net Demand in future interval]+Uncertainty,0)

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

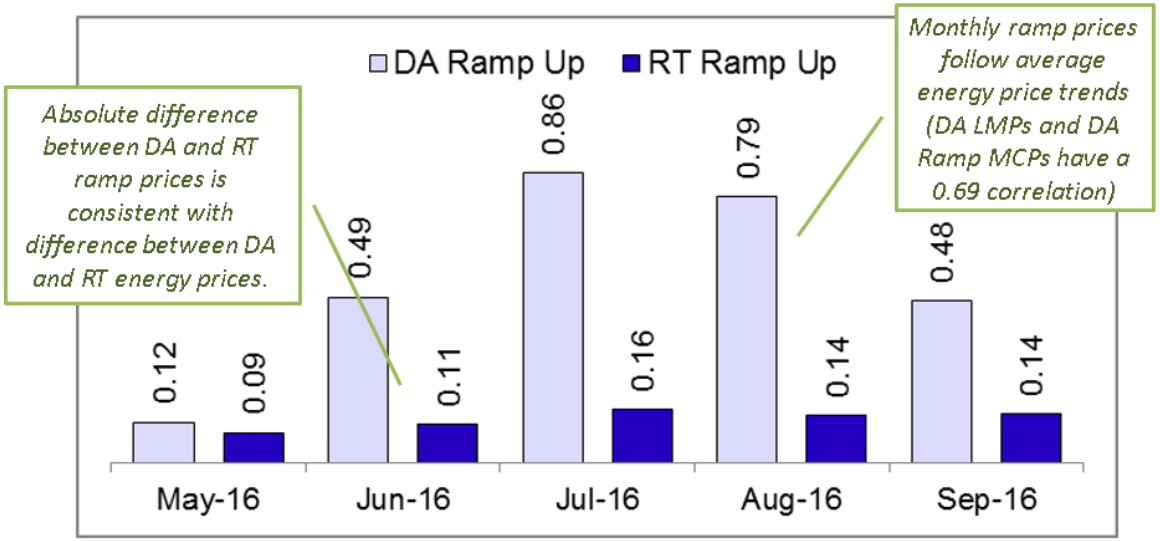
MISO Ramp Capability Product - Bidding

- **Units do not provide bids for this product**
  - The ramp capability clearing price is based on unit lost opportunity cost given the clearing price of other products
    - *E.g.*, if a unit bidding $30/MWh for energy is dispatched down from producing energy priced at $40/MWh by 1 MW in order to provide ramp up, then the clearing price of ramp will be $10/MWh, all else equal

MISO Ramp Capability Product – Demand Curve

- **Demand curve price currently set to $5/MWh for ramp up and ramp down**
  - Demand curve prices were determined by simulating with different demand curve price levels
    - Appropriate trade-offs with other products were considered
    - Cost of procuring the ramp requirement was considered

Monthly Average RCP Up Marginal Clearing Prices (MCPs)



Average DA MCP = $.55/MWh, RT MCP = $.13/MWh

Source: "Ramp Capability Product Performance Update" MISO Market Subcommittee, November 29, 2016:
https://cdn.misoenergy.org/20161129%20MSC%20Item%2005f%20Ramp%20Capability%20Post%20Implementation%20Analysis74816.pdf

Date range: 5/1/16 – 9/30/16

DRAFT – FOR DISCUSSION PURPOSES ONLY

CAISO – Flexible Ramping Product

CAISO Flexible Ramping Product – Reason for Implementation

- **CAISO advisory intervals were solving perfectly to the forecasted load that was input into the market software**
  - Relatively small forecast errors would result in high prices
    - Power balance violations occurred more often in the model and the energy price cap would set the price.
      - CAISO does not go short of reserve requirements in the 5-minute dispatch
    - This issue was expected to become more prevalent with increased intermittent renewables

CAISO Flexible Ramping Product - Features

- **Flexible Ramp Product features:**
  - Only in Real-Time Unit Commitment (RTUC), RTD
    - Market software includes a look-ahead capability
  - RTUC energy schedules binding at the Fifteen Minute Market (FMM) price from RTUC, re-optimized and settled in RTD
  - The MW output a resource can attain within 5 minutes counts toward the flexible ramping product requirement
  - Cooptimized with energy and ancillary services
  - Requirement applies to the entire region (*i.e.*, not zonal)
  - Resources can provide only ramp up, only ramp down, or both

CAISO Flexible Ramping Product - Requirements

- **Hourly requirements calculated every day and posted the day prior**
- **RTD Net Load Forecast Error is the difference between the binding interval and the prior advisory for the same interval**
  - 30-day histogram tracks the net forecast error for each hour of the day
  - Flex up uncertainty requirement is the 97.5 percentile
  - Flex down uncertainty requirement is the 2.5 percentile

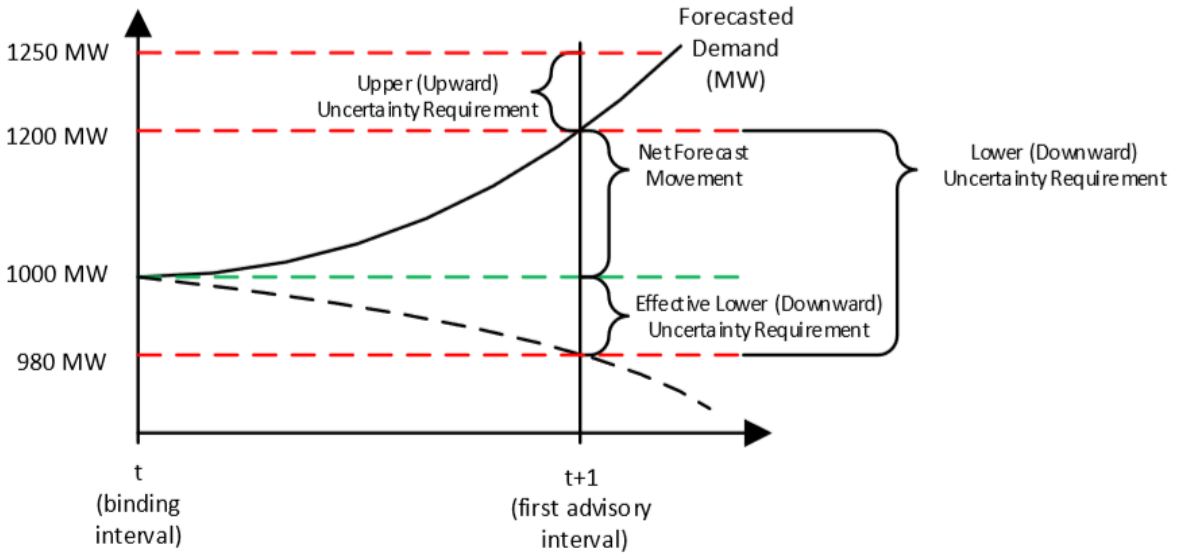


Figure 1 Flexible Ramping Product Uncertainty Requirements

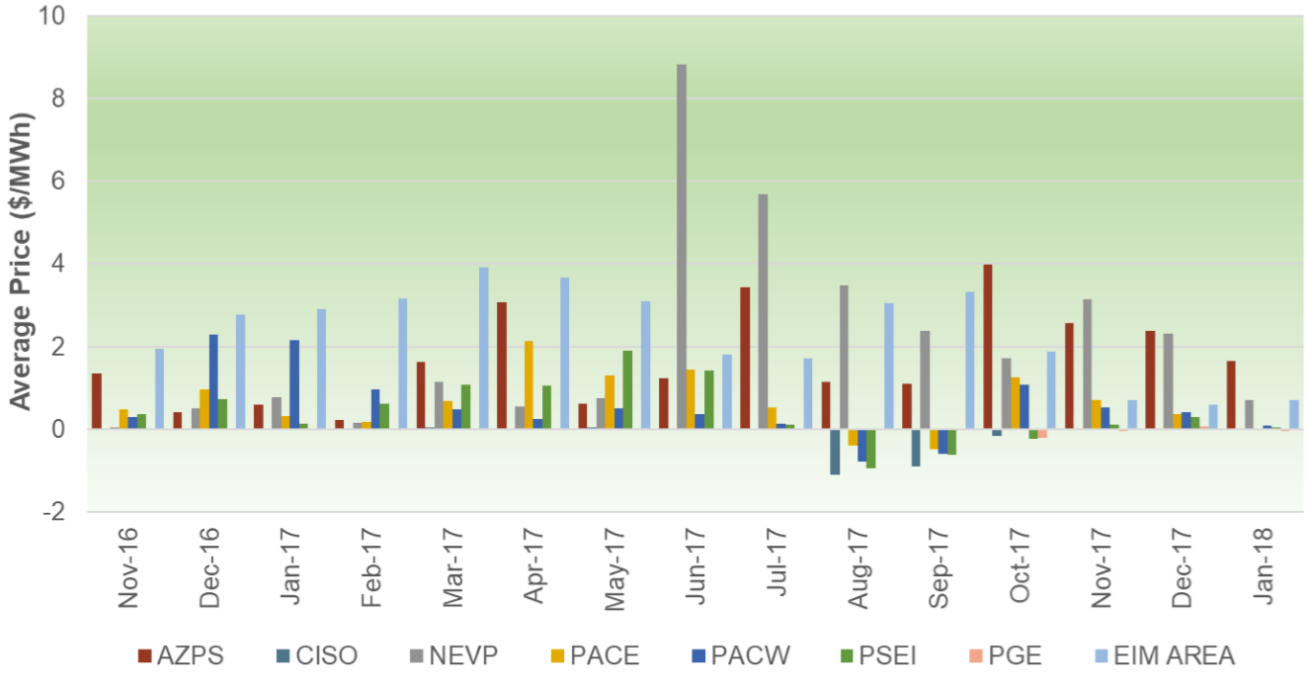
Source: CAISO Business Practice Manual for Market Operations: https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Operations

DRAFT – FOR DISCUSSION PURPOSES ONLY

CAISO Flexible Ramping Product – Demand Curve

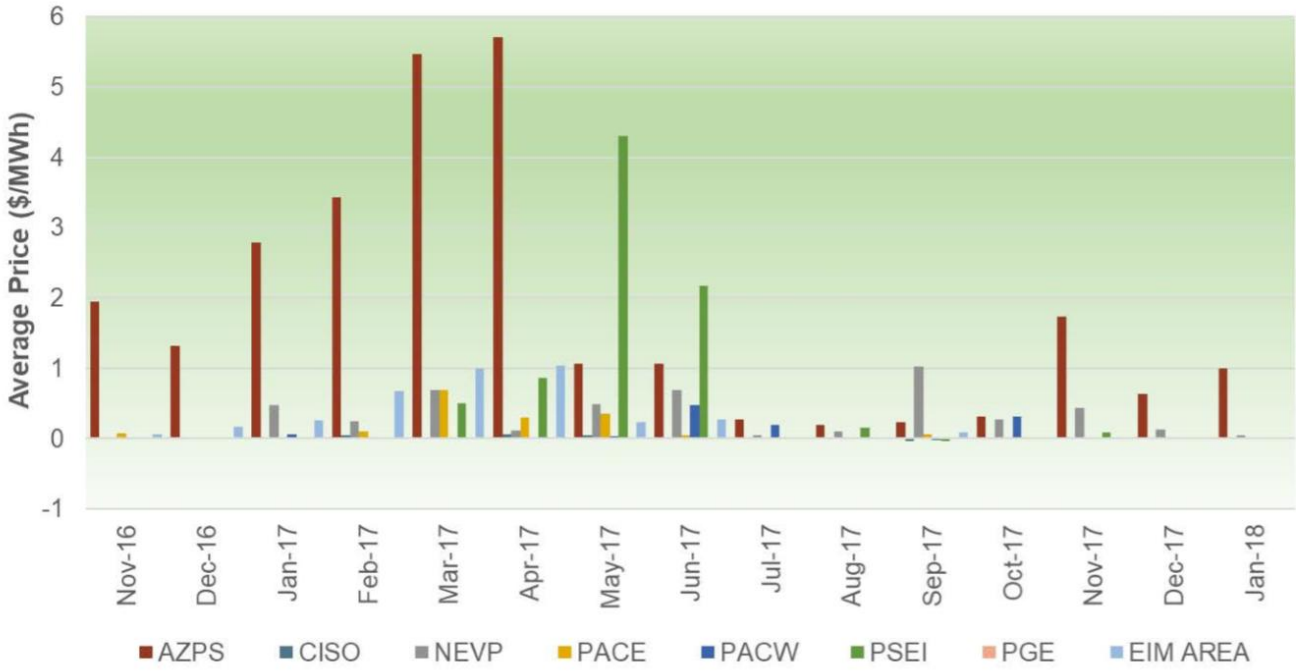
- **Units do not provide bids for this product**
  - Clearing price is based on lost opportunity cost
- **Ramp up demand curve price capped at $247/MWh**
  - This is a value slightly less than the contingency reserve relaxation parameter
    - Allows for appropriate trade-offs
  - The probability of a load balance constraint binding a certain level of procured flexible ramp is multiplied by $247/MWh
    - Multiple levels of procured ramp are used in this calculation to form the ramp up demand curve
- **Ramp down demand curve price is capped at $152/MWh**
  - This value is slightly more than the regulation down relaxation parameter
    - Allows for appropriate trade-offs
  - Ramp-down demand curve calculated using the same methodology as that used for the ramp up demand curve, but at a price of $152/MWh

Average Flexible Ramp Up Price ($/MWh)



Source: Market Performance and Planning Forum, February 20, 2018:
http://www.caiso.com/Documents/AgendaandPresentation-MarketPerfomanceandPlanningForum-Feb202018.pdf

Average Flexible Ramp Down Price ($/MWh)



Source: Market Performance and Planning Forum, February 20, 2018:
http://www.caiso.com/Documents/AgendaandPresentation-MarketPerfomanceandPlanningForum-Feb202018.pdf

Timeline

2018 Project Plan - Market Design Concepts to Prepare for Significant Renewable Generation

2018 Working Group Meeting	Topic
~~January 10~~	~~Discuss report and 2018 project plan~~
~~January 25~~	~~Address requests for additional analysis~~
~~February 02 06~~	~~NYISO to propose prioritization of market design concepts~~
~~February 21~~, March ~~06~~ 07, April 3	Analysis/ discussion of recommended market design concepts
April 24	Analysis/ discussion of recommended market design concepts
	Present draft outline of Master Plan
May 09	Analysis/ discussion of recommended market design concepts
	Present rough draft of Master Plan
May 23	Discuss rough draft and any proposed revisions to Master Plan
June 13	MDCP: Present Final Master Plan

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

Appendix: Previous Presentations

Previous Presentations

Date	Working Group	Discussion points and links to materials
9-12-16	Budget & Priorities Working Group (BPWG)	Presentation of stakeholder feedback, proposed scope of the project
10-19-16	Market Issues Working Group (MIWG)	Presentation providing more detail on the scope and timeline of the project
11-22-16	Market Issues Working Group (MIWG)	Presentation updating project status
1-31-17	Market Issues Working Group (MIWG)	Integrating Public Policy Update (Phases 1 and 2)
2-16-17	Market Issues Working Group (MIWG)	Phase 2: Study Description and Assumptions Review
3-28-17	Market Issues Working Group (MIWG)	Phase 2: Study Description and Assumption Update
4-24-17	Market Issues Working Group (MIWG)	Phase 2: Preliminary DAM Results
6-21-17	Market Issues Working Group (MIWG)	Phase 2: Real-time Study Description and Assumptions
7-13-17	ICAP Working Group (ICAP WG)	The ICAP Market - Preliminary Findings (Phase 2)
8-22-17	ICAP Working Group (ICAP WG)	IPP Phase 2 Capacity Market Results and background information
8-25-17	Market Issues Working Group (MIWG)	IPP Phase 2: Simulation Progress
9-25-17	Market Issues Working Group (MIWG)	IPP Phase 2: RT Energy Market Simulation Results
10-3-17	Market Issues Working Group (MIWG)	Presentation discussing market assessment paper
10-16-17	Market Issues Working Group (MIWG)	IPP Phase 3: Initial Concepts under Consideration
11-02-17	Market Issues Working Group (MIWG)	IPP Phase 3: Stakeholder Feedback Posted
12-5-17	Market Issues Working Group (MIWG)	IPP Phase 3: Review of Potential Market Product and/or Structure Enhancements
12-20-17	Market Issues Working Group (MIWG)	Market Assessment for Accommodating Public Policy
1-10-18	Market Issues Working Group (MIWG)	Market Assessment for Accommodating Public Policy: Stakeholder Feedback
1-25-18	Market Issues Working Group (MIWG)	Accommodating Public Policy: Initial Prioritization

Questions?

We are here to help. Let us know if we can add anything.

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

www.nyiso.com

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY