

Proposed Approach for Considering Grid In Transition Recommendations

Nicole Bouchez, PhD

Principal Economist, Market Design

ESPWG, ICAPWG, and MIWG

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Updated:

Slides 23, 32 formatting changes

Slide 27 added the \$40 reserve demand curve
step, identified underway items

Agenda

- **Background**
- **Approach for Considering Grid in Transition Recommendations**
- **The Recommendations**
- **Next Steps**

Background

Grid in Transition

- The NYISO's competitive wholesale markets provide a framework for a changing grid
- The NYISO's Grid in Transition Report:
 - Describes emerging reliability and economic challenges facing New York's electricity sector
 - Identifies gaps to address
 - Proposes a path forward



The Reliability and Market Considerations for a Grid in Transition report was published on December 20, 2019, and can be viewed here: <https://www.nyiso.com/documents/20142/2224547/Reliability-and-Market-Considerations-for-a-Grid-in-Transition-20191220%20Final.pdf/61a69b2e-0ca3-f18c-cc39-88a793469d50>

Reliability Gap Assessment

- New York's decarbonization policies are creating new challenges to meet NYISO's mission to support a reliable and economically efficient electric system.



Reliability Challenges

- Balance Supply & Demand
- Maintain Ten-Minute Operating Reserves
- Maintain Total Thirty-Minute Operating Reserves
- Manage Daily Energy Needs
- Secure Transmission Operations with Congestion Management
- Coordinate System Restoration and Black Start
- Manage Voltage Support
- Maintain Frequency Response
- Maintain Resource Adequacy
- Coordinate Supply Outages

The Reliability Gap Assessment can be found in Appendix B of the Reliability and Market Considerations for a Grid in Transition report published December 20, 2019
<https://www.nyiso.com/documents/20142/2224547/Reliability-and-Market-Considerations-for-a-Grid-in-Transition-20191220%20Final.pdf/61a69b2e-0ca3-f18c-cc39-88a793469d50>

Climate Change Study

- This study simulates the potential impacts of climate change and climate policy on the reliable operation of the New York power system
- **The Climate Change Phase II Report:**
 - Finds that climate disruption scenarios can lead to loss of load occurrences.
 - Finds that the variability of meteorological conditions that govern the output from wind and solar resources presents a fundamental challenge to relying on those resources to meet electricity demand.
 - Describes emerging climate change and reliability challenges facing New York's electricity sector
 - Describes the need for new technologies to balance the system seasonally.
 - Finds that differences in transmission assumptions lead to different resource sets and different vulnerabilities to climate disruptions.



The Climate Change Impact and Resilience Study – Phase II: An Assessment of Climate Change Impacts on Power System Reliability in New York State was published October 15, 2020 and can be found under Climate Change Study at <https://www.nyiso.com/ny-power-system-information-outlook>

Key Takeaways

- **These studies and findings provide the NYISO and its stakeholders much needed information about areas that must be considered as the grid transitions to become carbon-free. More analysis and study will be necessary as additional information about the pathways toward a carbon-free grid become clearer, however, the insights from these recent efforts are invaluable and help to start the conversation as we prepare for the future.**
- **The work done as part of the Grid in Transition study and Climate Change studies, along with other NYISO studies such as the CARIS and the RNA 70x30 scenarios, describe multiple resource pathways and resource mixes that may evolve to support the CLCPA. They conclude that the key attribute needed from the resource mix to meet reliability are carbon-free resources that can be dispatched to a rated output level for extended periods of time – in other words, they need to be flexible.**

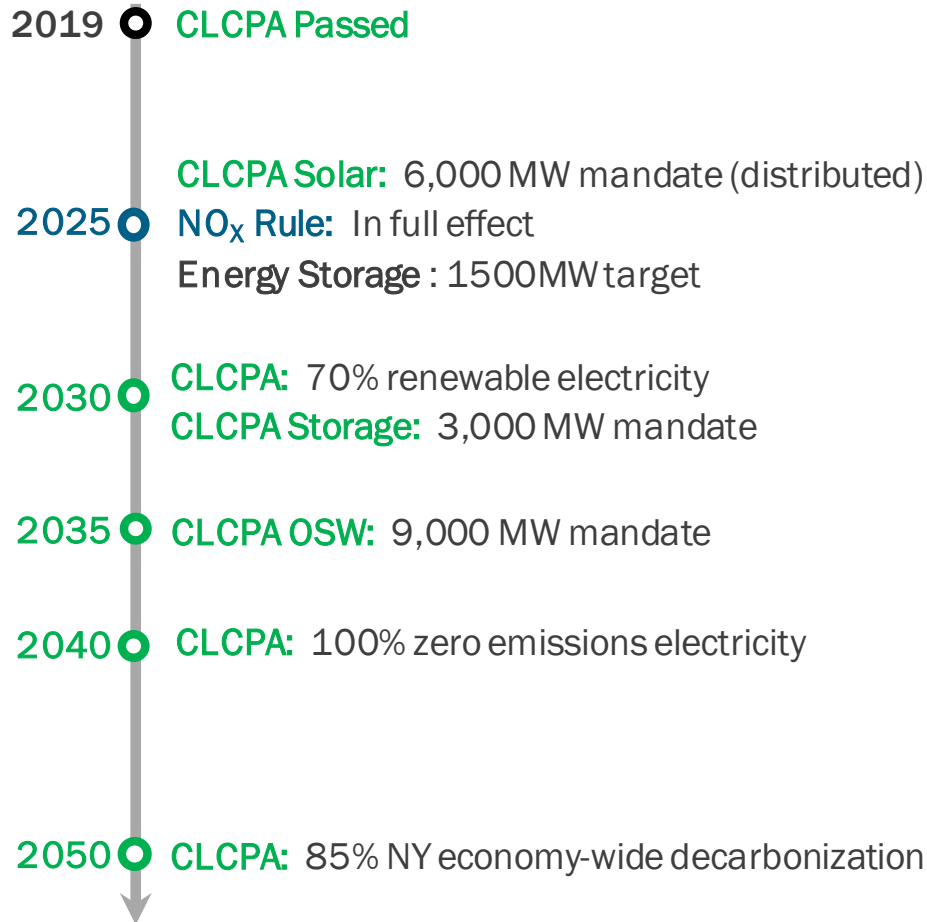
Key Takeaways (Cont.)

- **These studies and the Reliability Gap Assessment also focus on identifying the potential reliability risks that could be encountered as the grid changes over the next 20 years, including looking at possible climate change effects. The analyses focus on system attributes necessary to operate a reliable and resilient electric grid in the future and include recommendations to incentivize desirable characteristics and address the needs.**
- **The insights obtained from these efforts will be used to identify areas of risk that require ongoing monitoring, review and future study, as well as longer-term market enhancement considerations. This presentation presents the needed changes to the energy, ancillary services and capacity markets to address the challenges outlined in the studies and includes the need for market mechanisms such as Carbon Pricing and includes the NYISO's view of these changes.**

Approach for Considering Grid in Transition Recommendations

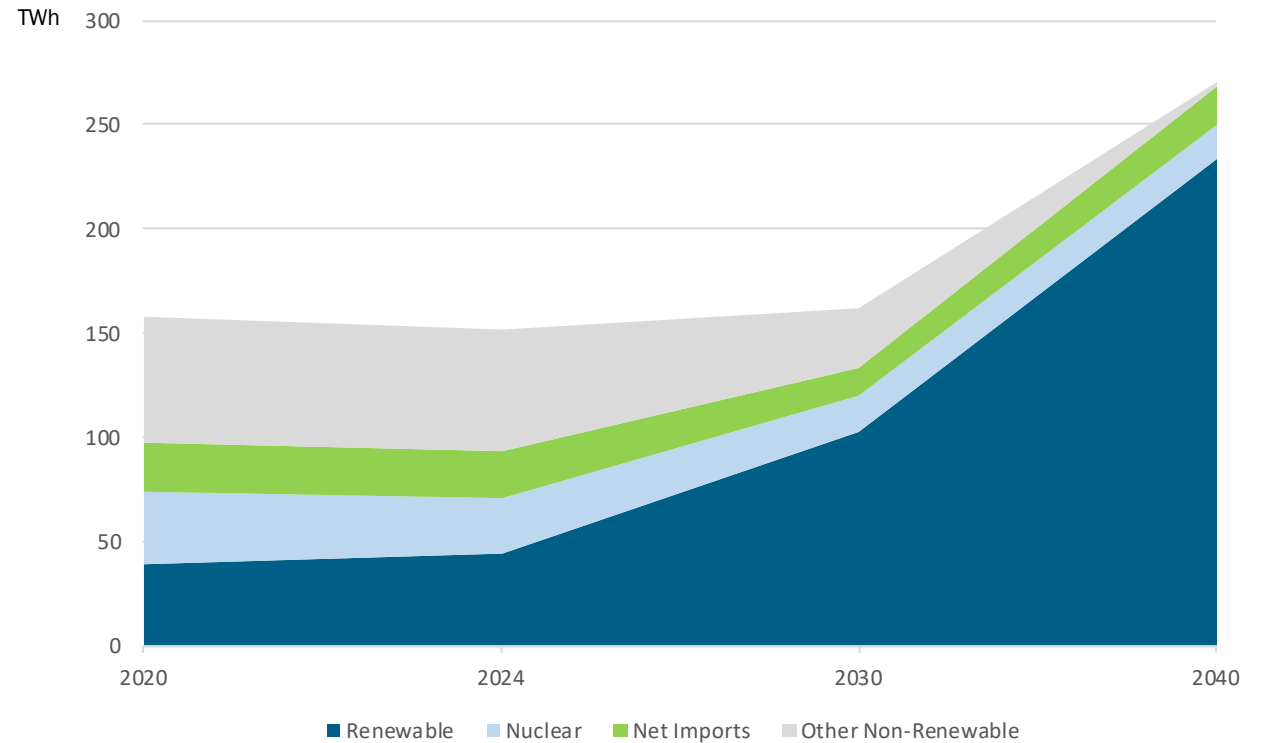
New York's Clean Energy Policies

Policy Timeline



Annual Generation

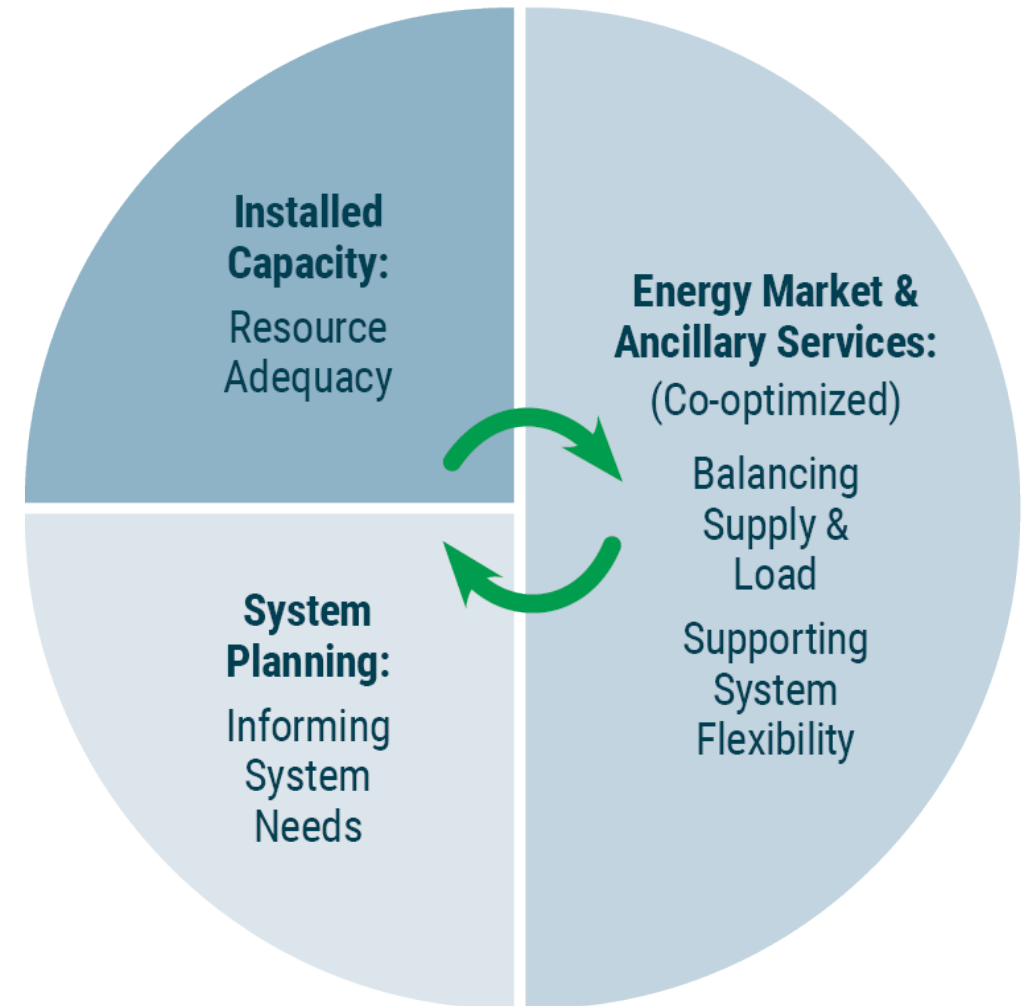
A possible decarbonization path assuming a capacity addition model with “high electrification” load forecast, NYS policies and current wholesale market rules.



Sources and Notes: [RGGI Auction Allowance Price and Volumes Results](#), [New York Public Service Commission Order Adopting a Clean Energy Standard. August 1, 2016](#), [New York DEC Adopted Subpart 227-3, New York Senate Bill S6599](#), Chart adapted from [New York's Evolutions to a Zero Emission Power System, Modeling Operations and Investment Through 2040 Including Alternative Scenarios, ICAP/MIWG, June 22.](#)

Grid in Transition - Role of Markets

- **The NYISO supports reliability through three complementary markets for energy, ancillary services, and capacity.**
 - Each addresses distinct reliability needs through competitive market pricing that benefit New York consumers while reducing costs.
 - Together, energy, ancillary services, and capacity market revenues provide economic signals for new investment, retirement decisions, and participation by demand response providers.



A Grid in Transition – Path Forward

- **The NYISO’s wholesale markets can serve as an effective platform for achieving New York State environmental objectives.**
 - Through active engagement with stakeholders and policymakers, the NYISO is developing design improvements to meet the future challenges expected to arise with high levels of intermittent renewable and distributed energy resources.
- **The plan includes a set of enhancements that work together coherently and efficiently to satisfy New York’s changing grid reliability needs.**
 - These opportunities are organized across three main points of focus (discussed on the next slide)
 - Some opportunities will require immediate attention while others might be something to consider as more information and experience becomes available.



A Grid in Transition – A Multifaceted Approach

- **Aligning Market Incentives**
 - Carbon Pricing
 - Comprehensive Mitigation Review
- **Prepare for New Technologies**
 - DER Participation Model
 - Energy Storage Participation Model
 - Hybrid Co-Located Model
 - Hybrid Aggregation Model
- And more....

Aligning Competitive Markets and New York State Clean Energy Objectives



- **Review Energy & Ancillary Services Design for Incenting Flexibility**
 - More Granular Operating Reserves
 - Regulation Up & Down Services
 - Ramping Services
- **Evolve the Day Ahead and Real-Time Markets to improve managing Forecast Uncertainty**
- **Track certain market metrics to evaluate incentives for flexible resources**
- And more...

Valuing Resource & Grid Flexibility



- **Enhancements to Resource Adequacy Modeling**
- **Improving Installed Capacity Market Incentives**
- **Review Capacity Market Resource Ratings to Reflect Reliability Contribution**
 - Expanding Capacity Eligibility
 - Tailored Availability Metric

Improving Capacity Market Valuation



Three Objectives

Aligning Competitive Markets & New York State Clean Energy Objectives

- **Focused on aligning wholesale market economic incentives for NYS policies and integrating new technologies into the wholesale market including:**
 - Carbon Pricing
 - Comprehensive Mitigation Review
 - New Technology Participation Models
 - Planning for the Future

Valuing Resource & Grid Flexibility

- **Focused on Reviewing and Improving the wholesale energy market design including:**
 - Tracking Forecast Uncertainty
 - Understanding energy and ancillary service revenues for flexibility resources
 - Enhancing energy and reserve shortage pricing
 - Review energy and ancillary service product design
 - Consider opportunities for evolving the functionality of the day-ahead and real-time market processes

Improving Capacity Market Valuation

- **Focused on evolving resource adequacy modeling and efficient capacity market pricing including:**
 - Enhancing resource adequacy models used for planning studies and establishing the state-wide installed reserve margin
 - Revising capacity resource ratings to better reflect their reliability contribution for meeting New York's 1-day in 10-year loss of load expectation
 - Consider improvements to the installed capacity market pricing that ensure robust market outcomes through the resource mix changes envisioned over the next few decades

Recommendations

The Recommendations

- **This presentation pulls together the recommendations from the Grid in Transition report, the Gap Analysis, and the Climate Change Phase II report.**
- **The aim is to develop a plan to methodically, and in a timely way, evolve the wholesale markets in preparation for the changes expected over the next decade. To achieve this we are proposing to categorize the different recommendations as short-term, medium-term and long-term.**
 - This will inform the 2021 Master Plan and the 2022 Project Prioritization Process.

The Approach

- **To begin this process, individual items and recommendations have been categorized and color coded as:**
 - **Short-Term or Underway:** items that should be considered over the next 3+ years
 - **Medium Term:** items that should be considered beyond 3+ years or after all Short-Term items have been considered
 - **Long Term:** items that are not pressing and should be considered after Short-Term and Medium-Term items have been considered
- **The NYISO's proposed categorization is based on the information available to the NYISO at this time and will be revised, if needed, as more information becomes available.**
- **The NYISO is seeking stakeholder input on the classification of the recommendations. Feedback can be provided at today's meeting or in writing after today's meeting.**

Aligning Competitive Markets and New York State Clean Energy Objectives

Aligning Market Incentives

- Carbon Pricing
- Comprehensive Mitigation Review

- Short-Term or Underway
- Medium Term
- Long Term

Prepare for New Technologies

- Implement a cohesive set of market rules to accommodate new resource technologies such as:

- Distributed Energy Resources (DER)
 - Sunset DADRP, DSASP
- Co-Located Storage Resources
- Hybrid Storage Resources
- Non-continuous and Long Duration Energy Storage Resources
- Enabling improved Demand Participation
 - Evolve SCR and EDRP Programs
- Sunset other market products

- Short-Term or Underway
- Medium Term
- Long Term

Planning for the Future

- Short-Term or Underway
- Medium Term
- Long Term

- **Providing transparency and information to promote market efficiency**
 - Perform system assessments for future resource mix scenarios
 - Provide transparent behind the meter solar forecasts
 - Consider providing more granular forecasts further out
 - Revise the Economic Planning Process to include broader identifications of constraints and assessments of energy deliverability of future resources
- **Assessing Reliability Issues**
 - Continue to leverage Reliability Needs Assessments and other planning studies to:
 - Consider if the impact of grid forming inverters requires changes in existing processes
 - Consider need for Inertia Response
 - Evaluate voltage support and system strength needs

Valuing Resource and Grid Flexibility

Valuing Resource & Grid Flexibility

- **This section has been grouped onto the following sub-sections:**
 - Potential Tracking and Metrics
 - Potential Energy Market Design Improvements
 - Improve managing resource variability and forecast uncertainty
 - Evaluate improvements to forecast latency and accuracy
 - Revisit interregional coordination improvements
 - Real-time Dispatch (RTD)
 - Real-Time Commitment (RTC)
 - Day Ahead Market (DAM)
 - Track run-limited resources
 - Other
 - Potential Ancillary Service Market Improvements
 - Operating Reserves
 - Regulation
 - Frequency Response
 - Cost-based Ancillary Services
 - Expanded Ancillary Services
 - Potential Other Market Process Improvements

Potential Tracking & Metrics

■ Establishing a baseline and an early warning system

- Net forecast uncertainty
 - Consider tracking thermal unit commitments and revenues
 - Consider tracking flexible resource uplift
 - Consider tracking self scheduling of flexible resources
- Regulation and the providers of regulation
 - Consider tracking if increasing imbalances in RT are being met with regulation service
 - Consider tracking evolving demands for regulation service
 - Consider tracking characteristics of regulation providers
- Reserves and the providers of reserves
 - Is the NYISO getting significant amounts of DR providing reserves? If not why not?
 - Are synchronous resources providing 30 minute reserves receiving uplift payments?
 - Does the stepwise construct of the demand curves create inefficiencies with resource commitments?
 - Unit commitment in RTD/RTC: Are units being committed in RTC with high shadow prices?
 - Is the \$25/\$40 demand curve step setting prices in DAM, RTC, RTD?
- Consider tracking Energy Limited Resources' available energy over the operating day
- Track real-time interchange transaction offers and projected prices from RTC and neighbors look-ahead tools and address any consistent biases to improve liquidity

- Short-Term or Underway
- Medium Term
- Long Term

Potential Energy Market Design Improvements

■ Improve managing resource variability and forecast uncertainty

- Reduce load forecast latency
- Reduce intermittent resource forecast latency
- Account for increased RT load forecast uncertainty
- Potential gains from partnering with neighboring ISOs to participate in the regional NPCC ACE diversity program
- Evaluate more frequent and/or 5-minute interchange scheduling protocols with neighbors
- Revisit broader regional markets (BRM) and regional dispatch to improve regional coordination and enable external resources to support NYCA's flexibility needs
- Real-Time Dispatch (RTD)
 - Consider enhancements to the Real-Time Dispatch Corrective Action Mode (RTD-CAM) that would allow for periodic quick dispatches to address high system volatility
 - Consider adjusting look-ahead evaluations of RTD and RTC to be more consistent with the timing of external transaction ramp and gas turbine commitment. (SOM-2012-13)
 - Consider if commitment of quick start units should be in RTD (less impacted by RTC forecast latency)
 - Determine whether all real-time interchange scheduling move to RTD

- Short-Term or Underway
- Medium Term
- Long Term

Potential Energy Market Design Improvements (Cont.)

■ Improve managing resource variability and forecast uncertainty (cont.)

- Real-Time Commitment (RTC)
 - Consider ways to improve 15-minute and CTS scheduling by reducing forecast latency and/or move the process into RTD
 - Consider adjusting look-ahead evaluations of RTD and RTC to be more consistent with the timing of external transaction ramp and gas turbine commitment. (SOM-2012-13)
 - Does RTC need to look out further to commit slower resources due to changes in weather conditions from the Day Ahead (this may require another settlement)
 - This may help with real-time price formation concerns following SREs or other commitments that lead to depressed RT prices

- Short-Term or Underway
- Medium Term
- Long Term

Potential Energy Market Design Improvements (Cont.)

■ Improve managing resource variability and forecast uncertainty (cont.)

- Day Ahead Market (DAM)
 - Are changes in the forecast load and the reliability commitment pass needed?
 - Revisit using maximum forecast for the hour to ensure the DAM commits resources to meet the maximum ramping needs across the hours and day
 - Alternatively consider understating the ramp rates of resources in SCUC
 - Consider explicitly modeling ramp in DAM
 - What are locational ramp requirements?
 - Evaluate whether sub-hourly commitments might be needed in critical parts of the day
 - Are mid-hour schedules needed to balance predictable solar ramp?

- Short-Term or Underway
- Medium Term
- Long Term

Potential Energy Market Design Improvements (Cont.)

- Short-Term or Underway
- Medium Term
- Long Term

■ Track run-limited resource

- Need for cataloging/tracking energy/run-limited resources such as ESRs, demand response, emissions restricted output, noise restricted output, etc.
 - Determine whether constraints can be effectively managed through existing market participation rules
- Energy/Run Limited Resource Management
 - Develop new concepts: dispatch price based on energy in storage
 - Develop the ability to manage energy limits over a day or more (i.e., more than 24 hours)
 - Are additional market power mitigation measures needed?

■ Other

- Consider increasing the energy offer floor for internal resources (SOM-2019-2)

Potential Ancillary Service Market Improvements

■ Operating Reserves

- Increasing statewide 10- and/or 30-minute operating reserve requirements
 - Ancillary Services Shortage Pricing
 - Reserves for Resource Flexibility
- More Granular Operating Reserves
 - Increasing locational thirty-minute total operating reserve requirements
 - Consider modeling local reserve requirements in New York City load pockets (SOM-2017-1)
- Monitor and manage sustainability of resources providing 10-minute and 30-minute reserves
- Reserve Enhancements for Constrained Areas
 - Develop reserve requirements dynamically including dynamic modeling of reserve locations and transmission congestion (includes SOM-2015-16)
- Consider whether real-time offers should allow costs for providing reserves
- Expand provider eligibility and improve modeling of existing resources to ensure reserves are deliverable
 - Consider allowing aggregations of DERs and hybrid resources to supply reserves
 - Improve combined cycle (CC) Modeling of Slow Ramp region
 - Evaluate Treatment of response rates use in scheduling/deploying reserves
- Consider more sloped/continuous demand curves
- Determine need for longer lead time replacement reserves

- Short-Term or Underway
- Medium Term
- Long Term

Potential Ancillary Service Market Improvements (Cont.)

- Short-Term or Underway
- Medium Term
- Long Term

■ Regulation Service

- Continue to monitor fleet changes and appropriately update statewide regulation procurement requirements
- Consider improvements to resource requirements for providing regulation
- Investigate benefits of separate “up” and “down” service
- Revisit regulation pricing
- Investigate how to include transmission congestion when awarding regulation capacity
- Investigate the potential for new resource types to supply frequency response capability
- Investigate the ability to use regulation to meet sustained imbalances up or down without large ACE imbalances

Potential Ancillary Service Market Improvements (Cont.)

- Short-Term or Underway
- Medium Term
- Long Term

■ Frequency Response

- Depending on findings of long term studies, consider whether market or cost-based mechanisms are necessary to compensate for inertial response

■ Cost-based Ancillary Services

- Reactive Supplier Requirements
- Improve Voltage Support Incentives
- Review NYCA-wide and Local Black Start Requirements and Incentives

■ Expanded Ancillary Services

- Ramping Services
 - Investigate the need for ramping services
 - Investigate the need for a zonal ramping product
- Consider valuing system strength and/or short circuit capabilities
 - Do we need to pay grid forming capabilities?

Other Potential Market Process Improvements

- Short-Term or Underway
- Medium Term
- Long Term

- **Considering shortening the Real-time Market close process from 75-minutes before the top of the operating hour**
 - In the alternative, consider allowing updating certain offer data closer to the binding RTC/RTD evaluation window
- **Consider resource outage scheduling improvements to accommodate shifts in net load variations due to intermittent resource penetration**
 - This has implications with defining the Peak Load Windows, used for enforcing capacity supplier obligations

Improving Capacity Market Valuation

Enhancing Resource Adequacy Modeling

- Short-Term or Underway
- Medium Term
- Long Term

- **Investigate and where needed evolve current models and methods to account for**
 - Growth in Load Forecast Uncertainty
 - Load Shapes represented in the RA model
- **Investigate and where needed evolve current modeling of energy limited resources especially during periods of multi-day needs**
 - Modeling the variability of Wind and Solar
 - Additional BTM Solar modeling
 - Winter only resources
 - Co-located Storage Resources
- **Review NYISO's Resource Adequacy design versus other control areas and build off of the lessons learned/recommendations from that review**

Improving Installed Capacity Market Incentives

- Short-Term or Underway
- Medium Term
- Long Term

- Explore multiple-value pricing, a fundamental capacity market redesign where different resource classes have different demand curves based on their characteristics
- Explore capacity requirements based on transmission security considerations
- Consider updates to the Demand Curve structure
 - Review the shape and zero crossing point
 - Consider modifying the translation of the annual revenue requirement for the demand curve unit into monthly demand curves that consider reliability value. (SOM-2019-4)
- Consider what would be needed to expand software to support additional localities
- Update design to allow for transition from summer peaking to winter peaking control area

Review Capacity Market Resource Ratings

- Expanding Capacity Eligibility
- Tailored Availability Metric
- Capacity value study while considering Effective Load Carrying Capability (ELCC) methodology for valuing all resources contribution to reliability
- Evaluate using performance based measures for resources that currently rely on availability based metrics like EFORd
- Consider deliverability study assumptions for capacity suppliers to ensure all capacity can be delivered during gross and net load peaks

- Short-Term or Underway
- Medium Term
- Long Term

Next Steps

Next Steps

- **The NYISO is seeking stakeholder input on the recommendations, the classification of the recommendations, and on any additional items that should be included. Feedback can be provided at today's meeting or in writing after today's meeting.**
 - Please send any written feedback to Debbie Eckels DEckels@nyiso.com
- **The aim is to develop a plan to methodically, and in a timely way, evolve the wholesale markets in preparation for the changes expected over the next decade.**