Brief descriptions of the individual recommendations.

Updated: Page 3 added the $40 reserve demand curve step. Pages 7 & 8 to conform with presentation.

This has been prepared to accompany the December 7 2020 "Proposed Approach for Considering Grid in Transition Recommendations" presentation to a joint meeting of ESPWG, ICAPWG, and MWIG. It is intended to be a quick reminder of the different recommendations discussed in the presentation. For more information, please see the descriptions of current projects in the project prioritization process, the prior Grid in Transition presentations, and the discussions in the Grid in Transition report, the Gap Analysis, and the Climate Change Phase II reports.

Slide	Consideration	Item	Description/Notes
Aligning Competitive Markets and New York State Clean Energy Objectives			
Aligning Market Incentives			
22	Short-Term	Carbon Pricing	Underway. Aligning wholesale electricity market signals with New York State decarbonization policies.
22	Short-Term	Comprehensive Mitigation Review	Underway. Examining the current Buyer-Side Mitigation (BSM) framework and principles to determine whether the rules efficiently mitigate concerns of buyer-side market power.
Prepare for New Technologies			
23	Short-Term/ Medium-Term	Distributed Energy Resources (DER) • Sunset DADRP, DSASP	Underway. The DER Participation Model project is seeking to enable participation of small distributed and demand response resources in the wholesale markets to provide more dispatchable resources and support grid flexibility needs.
23	Short-Term	Co-Located Storage Resources	Underway. Market participation rules for large-scale intermittent power and energy storage resources (ESR) to participate behind a single interconnection point.
23	Short-Term	Hybrid Storage Resources	Underway. Market participation rules for an ESR and other Generator(s) to be co-located at a single point of interconnection and participate as a single market resource with the same market identifier (PTID).
23	Medium-Term	Non-continuous and Long Duration Energy Storage Resources	What market rules are needed to accommodate new types of ESRs?

Slide	Consideration	Item	Description/Notes
23	Medium-Term	Enabling improved Demand Participation • Evolve SCR and EDRP Programs	Underway. Many studies, including the Climate Change Phase II and the Grid in Transition studies, have indicated the need for flexible resources. Consider what could facilitate additional demand participation in the Energy and AS markets. The Engaging the Demand Side project will continue to look for ways to improve demand-side participation in the wholesale markets to emerging support grid reliability needs.
23	Medium-Term	Sunset other market products	Consider ending unused or lightly used products such as multi-hour block transactions
Planning for the future			
Planning for the future - Providing transparency and information to promote market efficiency			
24	Short-term	Perform system assessments for future resource mix scenarios	100x40 and 70x30 scenarios have been evaluated as part of Climate Change Phase II, CARIS, and RNA studies with additional scenarios to be considered going forward.
24	Short-term	Provide transparent behind the meter solar forecasts	Complete.
24	Short-term	Consider providing more granular forecasts further out	Underway. See the changes in the 2020 Gold Book.
24	Short-term	Revise the Economic Planning Process to include broader identifications of constraints and assessments of energy deliverability of future resources	Underway. The NYISO is proposing revisions to the Economic Planning Process to include broader identifications of constraints and assessments of energy deliverability.
Planning for the future - Assessing Reliability Issues			
24	Short-term	Consider if the impact of grid forming inverters requires changes in existing processes	Continue to leverage reliability planning studies to consider the impact of grid forming inverters.
24	Medium-term	Consider need for inertia response	Continue to leverage reliability planning studies to consider if there is a threshold need for inertia response within the New York Control Area.
24	Medium-term	Evaluate voltage support and system strength needs	Continue to leverage reliability planning studies to evaluate voltage support and system strength needs.

Valuing Resource and Grid Flexibility			
Valuing Resource and Grid Flexibility – Potential Tracking and Metrics			
27	Short-term	Net forecast uncertainty Consider tracking thermal unit commitments and revenues • Consider tracking flexible resource uplift • Consider tracking self-scheduling of flexible resources	This would provide information about the signals to incent flexibility.
27	Short-term	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	This would provide information about how we are meeting our regulation requirements and will provide information on the impact of the evolving resource mix and their ability to provide regulation service.
27	Short-term/ Medium-term	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?	This would provide information about how we are meeting our reserve requirements and if the market design is incentivizing the needed resources.
27	Medium-term	Consider tracking Energy Limited Resources' available energy over the operating day	This may help determine the amount of dispatchable energy limited resources that can help respond to load variability.

27	Medium-term	Track real-time interchange transaction offers and projected prices from RTC and neighbors' look-ahead tools and address any consistent biases to improve liquidity	This may help identify additional resources to meet load at times when intermittent output is low.
Valuing Resource and Grid Flexibility – Potential Energy Market Design Improvements			
	Improve managing resource variability and forecast uncertainty		
28	Short-term	Reduce load forecast latency	Latency is associated with the length of the dispatch interval, solution time and the frequency at which new data gets incorporated. Latency can cause market inefficiencies and/or concerns when dispatch signals for generation are based on information that does not account for load or net load changes (or does not account for dynamic weather changes impacting renewable generation output, see next item). Latency can cause the generation load balance to remain out of balance for long periods of time. This can lead to relying more heavily on regulating capacity to provide large amount of generation balancing. When information latency is unavoidable, additional market products or features will need to be considered to support the needed grid flexibility to manage the uncertainty between when the forecast was performed and when the dispatch instructions are determined.
28	Short-term	Reduce intermittent resource forecast latency	Latency in the output forecasts for intermittent resources has a similar effect as load forecast latency.
28	Short-term	Account for increased RT load forecast uncertainty	Are there changes that could help account for unavoidable RT load forecast uncertainty? Consider the challenge of not just the mean but also the variability (*i.e.*, distribution).
28	Medium-term	Potential gains from partnering with neighboring ISOs to participate in the regional NPCC ACE diversity program	Could provide additional flexible resources in the RT dispatch to balance variations in intermittent resource output.

28	Medium-term	Evaluate more frequent and/or 5-minute interchange scheduling protocols with neighbors	Consider if this would provide additional flexible resources in the RT dispatch.
28	Long-term	Revisit broader regional markets (BRM) and regional dispatch to improve regional coordination and enable external resources to support NYCA's flexibility needs	Consider if there are changes to regional coordination that could provide more flexible resources.
	• **Real-Time Dispatch (RTD)**		
28	Short-term	Consider enhancements to the Real-Time Dispatch Corrective Action Mode (RTD-CAM) that would allow for periodic quick dispatches to address high system volatility	Today, RTD-CAMs are designed to send dispatch instructions to generation quickly and then expects the generation to respond to meet that instruction. With a high renewable system, RTD-CAM functionality may need to be revisited to account for the varying output of renewable and energy limited resources.
28	Short-term	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)	The MMU's evaluation found that different ramp assumptions in RTC and RTD contribute to divergence between RTD and RTC as well as transient price volatility. Consider if changes to RTC and/or RTD are needed.
28	Long-term	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	Consider if RTC latency is of sufficient concern to move quick start units and/or interchange scheduling into RTD. Consider if there are consequences or other changes that would need to be made
	• **Real-Time Commitment (RTC)**		
29	Short-term	Consider ways to improve 15-minute and Coordinated Transaction Scheduling (CTS) by reducing forecast latency and/or move the process into RTD	
29	Short-term	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)	(same item as above on slide 28) The MMU's evaluation found that different ramp assumptions in RTC and RTD contribute to divergence between RTD and RTC as well as transient price volatility. Consider if changes to RTC and/or RTD are needed.

29	Long-term	Does RTC need to look out further to commit/de-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	This might also allow the energy balances over the day to be taken into account.
	• **Day Ahead Market (DAM)**		
30	Short-term	Are changes in the forecast load and the reliability commitment pass needed?	This is a pass that does not consider bid load or virtual load/generation and instead looks if there is sufficient commitment to meet the forecast load and forecast wind. Consider if there is a need to more explicitly account for the potential variability and unpredictability of intermittent output in the forecast load commitment.
30	Short-term	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	For hours when the system load varies greatly between the beginning of the hour and the end of the hour, it becomes more important to consider what load the DAM is committing resources to.
30	Long-term	Consider explicitly modeling ramp in DAM • What are locational ramp requirements?	Consider if adjustments are needed to reflect both the amount of ramp needed and the capability of dispatchable units. There may be benefits to having a ramping product available on a locational basis to address those areas subject to transmission constraints (similar to RTD ramp item).
30	Long-term	Evaluate whether sub-hourly commitments might be needs in critical parts of the day • Are mid-hour schedules needed to balance predictable solar ramp?	Consider if mid-hour schedules are needed to balance predictable solar ramp (or other predictable ramp needs). It is important that units come online as they are needed and not all at the top of the hour.

• **Potential Energy Market Design Improvements – Track run-limited resources**			
31	Short-term	Need for cataloging/tracking energy/run-limited resources such as ESRs, demand response, emissions restricted output, noise restricted output, etc.	Consider tracking energy/run-limited resources to inform design and operational decisions.
31	Medium-term	• Determine whether constraints can be effectively managed through existing market participation rules	Consider looking at the impact of the quantity of energy/run-limited resources on reliability and market products.
31	Medium-term	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?	What is needed to integrate more Energy Limited Resources?
• **Potential Energy Market Design Improvements – Other**			
31	Short-term	Consider increasing the energy offer floor for internal resources (SOM-2019-2)	The MMU recommends raising the offer floor to a level closer to the range of potential avoided costs of supply for generation resources to avoid the rare conditions when the reduction of external interface limits requires the "buying" of power at low price levels resulting in uplift for NYISO customers.
Valuing Resource and Grid Flexibility – Potential Ancillary Service Market Improvements			
• **Potential Ancillary Service Market Improvements- Operating Reserves**			
32	Short-term	Increasing statewide 10- and/or 30-minute operating reserve requirements	Underway. Develop a process to increase statewide reserve requirements due to, for example, increased RT load forecast uncertainty.
32	Short-term	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)	Underway. The MMU found that modeling local reserve requirement N-1-1 needs could increase unit revenues and impact the capacity demand curve for NYC and reduce the need to retain older fossil-fueled generation in NYC.

32	Short-term	Monitor and manage sustainability of resources providing 10-minute and 30-minute reserves	As the units providing reserve change, consider if there is a need to monitor and/or manage the sustainability of resources providing the reserves. For example, will Energy-Limited Resources have enough energy to sustain output for the one-hour period required? Is a one-hour requirement sufficient?
32	Short-term	Reserve Enhancements for Constrained Areas. Develop reserve requirements dynamically including dynamic modeling of reserve locations and transmission congestion (includes SOM-2015-16)	Consider if NYCA or locational reserve requirements change with transmission congestion. The MMU recommendation is to maintain requirements more reflective of real-time needs by dynamically adjusting operating reserve requirements to account for factors that increase or decrease the amount of reserves that must be held on internal resources.
32	Medium-term	Consider whether real-time offers should allow costs for providing reserves	Consider if there are marginal costs of providing reserves that are currently not accounted for as a means to extract more flexibility from resources supplying the system.
32	Medium-term	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	Consider what would be necessary, how they should be modeled and the risks of allowing DERs and hybrid resources to supply reserves.
32	Short-term	• Improve Combined-Cycle (CC) Modeling of Slow Ramp region	Consider if improving CC modeling of their slow ramp/duct-burner region would provide a better representation of the reserves available on these resources.

32	Medium-term	• Evaluate Treatment of response rates in scheduling/deploying reserves	Consider if normal response rates should be used in the deployment of energy during reserve pick-ups instead of Emergency Response Rates as a means to better manage transmission constraints during stressed conditions and if doing so would actually provide more opportunity for scheduling reserves on combined cycle units than is available today.
32	Medium-term	Consider more sloped/continuous demand curves	Consider if the discontinuous demand curves are having negative operational consequences such as commitments to meet load and reserve needs leading to system minimum generation situations in light load periods. Should demand curves be more or less sloped?
32	Medium-term	Determine need for longer lead time replacement reserves	Would additional resources be available with longer lead times?
• **Potential Ancillary Service Market Improvements- Regulation Service**			
33	Short-term	Continue to monitor fleet changes and appropriately update statewide regulation procurement requirements	Underway. Consider if additional statewide regulation procurement is needed as the variability of load increases.
33	Short-term	Consider improvements to resource requirements for providing regulation	Reconsider attributes required to be a regulation provider, such as duration and ramp rates, in order to ensure regulation providers continue to meet the evolving regulation service needs as variability increases between the 5-minute dispatch and the regulation signal.
33	Short-term	Investigate benefits of separate "up" and "down" service	Under current rules, regulation providers are required to be able to be dispatched up and down. Consider if there are benefits to separate "up" and "down" service given the increased variability and the availability of resources that may be unable to supply both up and down service.
33	Short-term	Revisit regulation pricing	Reconsider the regulation movement incentives and pricing.
33	Short-term	Investigate how to include transmission congestion when awarding regulation capacity	

33	Short-term	Investigate the potential for new resource types to supply frequency response capability	
33	Medium-term	Investigate the ability to use regulation to meet sustained imbalances up or down without large ACE imbalances	
• **Potential Ancillary Service Market Improvements- Frequency Response**			
34	Long-term	Depending on findings of long term studies, consider whether market or cost-based mechanisms are necessary to compensate for inertial response	
• **Potential Ancillary Service Market Improvements- Cost-based Ancillary Services**			
34	Medium-term	Reactive Supplier Requirements	Consider if changes are needed in the requirements for reactive suppliers.
34	Medium-term	Improve Voltage Support Incentives	With fewer thermal units online and more output provided by asynchronous resources it may be necessary to revisit voltage support incentives so that asynchronous resources provide needed voltage support. Also consider if voltage-support commitments should be included in the Day Ahead Market.
34	Medium-term	Review NYCA-wide and Local Black Start Requirements and Incentives	
• **Potential Ancillary Service Market Improvements- Expanded Ancillary Services**			
34	Long-term	Ramping Services • Investigate the need for ramping services • Investigate the need for a zonal ramping product	Today's market design has many incentives for resources to provide upward ramp capability. Consider, similar to CAISO and MISO, whether additional ramping services are needed in order to support/incent downward flexibility as the system evolves. Investigate the need and effectiveness in NYISO markets. In addition, there may be benefits to having a ramping product available locationally to address areas of the transmission system that are expected to be subject to transmission constraints.

34	Long-term	Consider valuing system strength and/or short circuit capabilities • Do we need to pay for system strength capabilities?	System strength (a combination of reactive support, short circuit support and inertia) is currently supplied by synchronous machines (hydro, gas generators, and synchronous condensers). As more inverter based resources are added to the grid consider is there the need to incentivize these capabilities?
Valuing Resource and Grid Flexibility – Other Potential Market Process Improvements			
35	Short-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	With more variability would there be more dispatchability with a shorter Real-time Market close process? Are there other benefits?
35	Medium-term	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	With increases in behind-the-meter intermittent resources and the associated shift in net load variation, how does outage scheduling need to change?
Improving Capacity Market Valuation			
	Improving Capacity Market Valuation – Enhancing Resource Adequacy Modeling		
37	Short-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	As the proportion of energy limited resources (wholesale and behind the meter) increases, investigate if changes to current resource adequacy modeling are needed.
37	Short-term	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	As the generation resources in the NYCA change, there is a need to evaluate the treatment of energy-limited resources in resource adequacy modeling to determine if changes are needed.

37	Medium-term	Review NYISO's Resource Adequacy design versus other control areas and build off of the lessons learned/recommendations from that review	What lessons learned and recommendations can the NYISO glean from other control areas' experience with increased level of intermittent resources?
	Improving Capacity Market Valuation – Improving Installed Capacity Market Incentives		
38	Short-term	Explore multiple-value pricing, a fundamental capacity market redesign where different resource classes have different demand curves based on their characteristics	This may be part of the Comprehensive Mitigation Review. A fundamental capacity market redesign proposal where different resource classes have different demand curves based on their characteristics and the need for those characteristics.
38	Medium-term	Explore capacity requirements based on transmission security considerations	Explore whether transmission security considerations are sufficiently incorporated in capacity requirements?
38	Medium-term	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)	Do the shapes of the capacity demand curves need to change? Should the annual revenue requirements be translated monthly so that there is a different demand curve every month?
38	Medium-term	Consider what would be needed to expand software to support additional localities	There may be a need to create additional localities in the future. What software changes would be needed?
38	Long-term	Update design to allow for transition from summer peaking to winter peaking control area	The transition from summer peaking to winter peaking control area requires changes to the current market construct. In addition, it is possible that the NYISO control area may change from summer peaking to winter peaking and back again multiple times which is likely to complicate the transition.
	Improving Capacity Market Valuation – Review Capacity Market Resource Rating		
39	Short-term	Expanding Capacity Eligibility	Underway. Reflect the reliability benefit of short-duration resources and send appropriate investment signals to investors.

39	Short-term	Tailored Availability Metric	Underway. Incentivizing resources to be available and perform during critical operating periods.
39	Short-term	Capacity value study while considering Effective Load Carrying Capability (ELCC) methodology for valuing all resources contribution to reliability	Study the capacity value of different resources and consider an Effective Load Carrying Capability methodology.
39	Medium-term	Evaluate using performance based measures for resources that currently rely on availability based metrics like EFORd	Consider a change in resource rating that would focus on performance to support reliability as the needs of the grid evolve.
39	Medium-term	Consider deliverability study assumptions for capacity suppliers to ensure all capacity can be delivered during gross and net load peaks	Transmission congestion at peak (gross and net) may decrease the actual capacity available for reliability. This study would look to see if any changes are needed in current processes to address this.