New York ISO
Independent System Operator

Dynamic Reserves Market Design

Management Committee

December 18, 2024

Agenda

- Background
- Market Design Summary
- Draft Proposed Tariff Revisions
- Next Steps

Background

Project Background

- **The concept of Dynamic Reserves was first discussed in the 2021 Reserve Enhancements for Constrained Areas (RECA) study**
  - That initiative determined that the current static modeling of reserve regions and their associated requirements may not optimally reflect the varying needs of the grid to respond to changes in system conditions, such as consideration of the following:
    - Scheduling economic energy above 1,310 MW from individual suppliers when sufficient reserves are available, and/or
    - Shifting reserve procurements to lower-cost regions when sufficient transmission capability exists
- **The RECA study concluded that dynamically setting operating reserves requirements based on the single largest contingency system wide and using available transmission headroom was a feasible concept**
  - To dynamically set these requirements, the RECA study proposed formulations that were also considered during the 2022 Market Design Concept Proposed

Project Background Cont.

- **At the 12/13/23 BIC meeting, the NYISO presented proposed tariff revisions to support its Dynamic Reserves market design proposal**
  - Those tariff revisions were not voted on
- **During 2024, the NYISO continued conversations with Stakeholders about Dynamic Reserves which included:**
  - Incremental tariff revisions and design to support the Operating Reserve Constraint Charge or ORCC (a concept developed during the 2024 Stakeholder process)
  - Prototyping results for the Day-Ahead Market
  - Incremental tariff revisions to merge the design of Balancing Intermittency with Dynamic Reserves
  - Incremental tariff revisions and design to support compliance with reliability rules for minimum procurement of 10 minutes reserves in New York City and Long Island
  - Discussion and review of the full tariff required to implement Dynamic Reserves
- **Today's presentation serves as a summary of the complete Dynamic Reserves Market Design and associated tariff revisions**

Dynamic Reserves Market Design

NYISO Dynamic Reserves Proposal: Executive Summary

Dynamic Reserves Proposal

- **The NYISO proposes a Dynamic Reserves market design that will transition current static reserve requirements to dynamic reserve requirements that reflect market and grid conditions. Key features of this design include:**
  - Establishment of dynamic NYCA Operating Reserve requirements
  - Establishment of dynamic locational reserve requirements
  - Utilization of individual resource shift factors for reserve scheduling
  - Identification and monitoring of transmission elements which make up key interfaces across NYCA and factor into reserve area definitions
  - Establish Operating Reserve requirements considering the NYISO's DAM Forecast Load to facilitate reliability through market mechanisms

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Establishing Dynamic NYCA Operating Reserve Requirements

Securing Reserves for Largest Source Contingencies in the NYCA

- **A key feature of a dynamic reserve procurement is the ability to set reserve requirements based on the largest and second largest NYCA supply contingency in the current market interval as well as the ability to limit output generation when procuring required reserves is uneconomic**
- **Dynamically securing reserves for the largest supply contingencies within a given market interval ensures that those reserve requirements will meet the current needs of the grid**
  - NYISO's existing static requirements do not consider the real-time possibility of the largest source contingency changing from interval to interval based on current online generation
  - Having dynamic reserve requirements that accurately reflect system conditions allows those requirements to directly reflect the cost of maintaining system reliability at any point in time
- **The constraints for NYCA-wide reserve requirements would be:**
  - NYCA 10-Minute Spin Requirement =
    - ½ the largest supply contingency in the NYCA
  - NYCA 10-Minute Total Requirement =
    - The largest supply contingency in the NYCA
  - NYCA 30-Minute Total Requirement =
    - The largest supply contingency in the NYCA + Second largest supply contingency + max(0,(Forecast Load – Scheduled Load))
      - The max function is only included in the NYCA 30-Minute Total Requirement in the DAM

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Establishing Dynamic Locational Reserve Requirements

Establishing Dynamic Locational Requirements

- **Dynamic Reserves will integrate reserve constraints into its DAM and RT optimization models that determine reserve requirements to meet reliability criteria following N-1 and N-1-1 contingencies**
  - For Loss of Transmission and Loss of Generation, the defined contingencies would ensure that flows across transmission lines satisfy applicable post-contingency limits, considering energy supplier, reserve supplier, and load shift factors.
- **Including dynamic locational operating reserve constraints in the optimization will allow the optimization software to more precisely calculate the tradeoffs between energy and reserves scheduling, and will more accurately calculate the amount of MWs needed to relieve post-contingency flows**
  - These enhancements will also allow the shifting of Reserve procurements to lower-cost regions when sufficient transmission capability exists, and ensure the NYISO procures enough Reserves to restore post-contingency flows below acceptable limits within the appropriate timelines
  - Similarly, the optimization may schedule zero reserves if energy flows are not predicted to exceed applicable limits post-contingency or if the cost of reserves exceeds the production cost savings of increasing energy flows
- **Additionally, NYISO proposes to maintain the static 500MW and 120MW 10-Minute Total Operating Reserve Requirements for NYC and LI respectively**
  - These static requirements ensure NYISO continues to comply with NERC/NPCC/NYSRC rules regarding reliable operation of the NYS power grid
  - These static requirements will act as reserve procurement floors in the afore mentioned localities – dynamic operating reserve constraints will still develop reserve requirements above the static floors (for example a 530MW requirement in NYC) if it is economic to do so
  - NYISO shall conduct periodic reviews of Dynamic Reserves program performance, including a review of the continued necessity of these static requirements

Utilizing Resource Shift Factors

Utilizing Generation Shift Factors

- **Modeling reserve constraints to explicitly represent reliability requirements associated with post-contingency power-flow requires the optimization model to estimate the effect of post-contingency reserve deployment on post-contingency energy flows**
- **Dynamic Reserves will therefore utilize individual Operating Reserve supplier shift factors to reflect each supplier's ability to affect post-contingency flows and thus their ability to satisfy reserve requirements. This provides several key benefits:**
  - Allows the appropriate modeling of the relief that each individual resource could provide on each constraint using their energy and/or reserve schedules, as a resource's shift factor measures the relief that said resource could have on a constraint based on current system conditions
  - Allows NYISO to determine the locational value of the reserves that each Resource could provide, and models that resource's contribution to post-contingency congestion relief
- **This design will result in a nodal reserve price, the Locational Marginal Operating Reserve Price (LMORP), that reflects the locational value of a resource's reserve schedule at each generator node**
  - Operating Reserve constraints that can be resolved by either energy or operating reserves will also affect energy prices, specifically via the Congestion component of LBMP
  - The reserve constraint shadow prices will be included in both the energy and reserve pricing as both the energy and reserve schedule from a generator can be used to satisfy the reserve constraints

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Utilizing Generation Shift Factors - Pricing

- **The LMORP will be calculated using the following equation:**

$$\gamma_{i,p} = \lambda_p^R - \sum_{k \epsilon K} GF_{ik}\mu_k$$

- Where:
  - $\gamma_{i,p}$ = LMORP for Operating Reserve product *p* at bus *i* in $/MWh
  - λ_p^R = the system marginal Operating Reserve product *p* price for the NYCA
  - $\sum_{k \epsilon K} GF_{ik}\mu_k$ = the congestion component of the LMORP
  - K = the set of locational Operating Reserve Constraints (“LORC”) that Operating Reserve product *p* satisfies;
  - GF_{ik} = Shift Factor for bus *i* on LORC *k* in the Post-Contingency case which limits flows across LORC *k* (the Shift Factor measures the incremental change in flow on LORC *k* for an injection at bus *i* and a corresponding withdrawal at the Reference Bus); and
  - μ_k= the Shadow Price of LORC *k*, expressed in $/MWh; provided however, that this Shadow Price shall not exceed the price that corresponds to the quantity of Operating Reserve product *p* procured on the applicable Operating Reserve Demand Curve.

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Identify and Monitor Key Transmission Elements

Identify Key Transmission Elements

- **The NYISO will identify a list of key transmission elements that would need to be monitored for post-contingency conditions under Dynamic Reserves**
  - These modeled transmission elements shall be referred to as "Secured Facilities for Reserves"
  - The NYISO will initially model approximately 20 lines which make up key interfaces across NYCA and factor into existing reserve area definitions on which the post-contingency power flows will be modeled and managed using LORCs
  - The NYISO may choose new or new types of elements (e.g., load pockets) to be managed with reserve constraints in the future
  - Any updates to the list of these Secured Facilities for Reserves will be posted on the NYISO public website
- **The Dynamic Reserves formulations would model these transmission elements similar to how power flow constraints are modeled today**
  - The reserve constraints would be based on the projected overload and timing requirements to restore the flows on the facility post-contingency

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Consider DAM Forecast Load

Establish Operating Reserve Requirements to Secure NYISO's DAM Forecast Load

- **Dynamic Reserves will include reserve constraints as part of its DAM that will allow NYISO to secure energy and operating reserves to the NYISO's DAM Forecast Load**
  - These forecast reserve constraints will only be for 30-minute Operating Reserve products (i.e., 10-minute Operating Reserve products will only secure to Scheduled Load)
  - Therefore, DAM 30-minute Operating Reserve products will secure to the higher of Scheduled Load versus Forecast Load
    - Reliable system operations requires the NYISO to consider both scheduled and forecast load in its DAM run
    - Scheduled load represents market participant positions and expectations for the upcoming operating day
  - The forecast reserve constraints will, at least-cost, procure additional reserves or reserve transmission headroom to ensure sufficient energy exists in real time to serve NYISO DAM Forecast Load
- **Forecast reserve constraints provide multiple benefits to ensure that Dynamic Reserves best represents expected system conditions:**
  - Supports reliable operations by assigning DAM schedules to needed resources
  - Signals market need and values for flexibility and dispatchability
  - Mitigates the need for Forecast Pass commitments

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Design Summary

Design Summary

- Dynamic Reserves will allow the optimization to more precisely calculate the tradeoffs between energy and reserves compared to the static reserve area approach, as well as to more accurately calculate the amount of MW needed to relieve post-contingency flows
- Dynamic Reserves will introduce additional constraints into the optimization based on the previously identified foundational concepts to evaluate if post-contingency energy flows, less reserves, will respect post-contingency line limits and operating criteria
- Post-contingency energy flows will be calculated by considering the applicable shift factors for generation and load
- Please see the Reserve Criteria slides at the end of this presentation for the constraint formulations which would be implemented to facilitate Dynamic Reserves for each reserve area

Design Summary cont.

- **Dynamic Reserve design aligns with the criteria used to procure Operating reserves today**
  - NYCA-wide requirements will ensure enough 10-min reserves to secure for loss of gen with largest schedule. 30-min reserve requirement will ensure enough reserves to replenish the 10-min reserve requirement following the largest contingency
  - Locational 10-min reserve requirements will facilitate appropriate distribution of 10-min reserves such that loadings on transmission circuits/interfaces are brought down to appropriate limits in 15-minutes following a contingency
  - Locational 30-min reserve requirement will facilitate appropriate distribution of 30-min reserves to ensure the ability to bring such that loadings on transmission circuits/interface to Normal Operating criteria within 30-minutes following a contingency

Proposed Tariff Changes

Market Services Tariff

Proposed MST Revisions

- **MST 2.5**
  - Removed reference to “Scarcity Reserve Region” from the definition of “Expected EDRP/SCR MW”
- **MST 2.12**
  - Added the definition for the Locational Marginal Operating Reserve Prices (LMORP)
- **MST 2.19**
  - Eliminated the definition of Scarcity Reserve Region and removed references to Scarcity Reserve Region in the definitions of other terms
- **MST 4.2**
  - Minor revisions referencing Rate Schedule 4 of the MST

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Proposed MST Revisions Cont.

- **MST 15.4**
  - Introduced rules for the establishment of dynamic DAM and RTM NYCA + Locational reserve requirements
  - Introduced rules for the establishment of the NYCA and Locational Operating Reserve Constraints
    - Introduced rules for the establishment of Secured Facilities for Reserves, which shall be secured via the new Locational Operating Reserve Constraints
  - Introduced rules for RTM and DAM nodal Reserve pricing – Locational Marginal Operating Reserve Price
    - Sunset special pricing rules for Long Island, that shall be superseded by nodal reserve pricing
  - Revised Scarcity Pricing rules for Dynamic Reserves
  - Revised NYCA, Locational, and Scarcity Operating Reserve Demand Curves to utilize quantities associated with new reserve requirement methodologies
- **MST 17**
  - Revised LBMP calculation to consider NYCA 30-Minute Operating Reserve Constraints when determining the congestion component of LBMP

Open Access Transmission Tariff

Proposed OATT Revisions

- **OATT 6.5**
  - Revised the formula associated with the Operating Reserve Charge applicable to Transmission Customers, Customers Engaging in Export Transactions (not including CTS or wheels through w/ ISO-NE), and LSEs
  - Introduced the Forecast Reserve Charge, which seeks to recover costs associated with the procurement of DAM Forecast Reserves separately from LSEs, Virtual Supply, and Imports
  - Introduced the Operating Reserve Constraint Charge, which addresses TCC shortfalls brought on by the introduction of dynamic reserve constraints
- **OATT 19.9**
  - Added language excluding the consideration of Dynamic Reserve constraints from the process that determines the winning set of bids in the Centralized TCC Auction
- **OATT 20.1**
  - Excluded Dynamic Reserve constraints from the definition of the DAM Constraint Residual
  - Added language regarding the new Operating Reserve Constraint Charge
- **OATT 20.2**
  - Added language incorporating the ORCC into the Net Congestion Rents settlement calculation and associated rules

Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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Questions?

Appendix

Energy and Reserve Price Formation

Reserve Constraint Shadow Prices

- **Each binding reserve constraint will produce a shadow price, which will be used to calculate the LMORP**
  - The LMORP calculation will be based on the shadow prices of all binding locational Operating Reserve Constraints and the shift factor of gen/load bus with respect to these constraints
  - The reserve constraint shadow prices will be included as an input to both energy (LBMP) and reserve (LMORP) pricing calculations, as both energy and reserve schedules can be used to satisfy said reserve constraints
  - Reserve constraints and their associated shadow prices will represent the locational value of reserves
  - The shadow prices of these reserve constraints will also be included in the congestion component of Nodal and Zonal LBMPs based on the shift factor of gen/load bus with respect to these constraints
- **Reserves scheduled when Forecast Load > Scheduled Load ("forecast reserves") to meet the 30-Minute requirements will also produce a shadow price that represents the cost to secure to Forecast Load in the DAM**
  - These shadow prices will be included in the nodal generator LBMP and zonal LBMP

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Pricing for Reserve Providers on Long Island

- **Long Island Operating Reserve prices are currently set by tariff to be equivalent to SENY Operating Reserve prices, and total Operating Reserve schedules on Long Island are capped**
- **Dynamic Reserves will determine dynamic locational Operating Reserve requirements and nodal reserve prices on Long Island, consistent with other locations throughout the NYCA**
- **Dynamic Reserves will model the ability for Long Island Operating Reserves to reduce inflow into Long Island and thereby support reliability in other locations through the introduction of a Long Island export constraint for reserve scheduling to the model (i.e., recognize the value of scheduling Operating Reserves above the Long Island requirement)**
  - Operating Reserves may be scheduled until post-deployment inflow onto Long Island reaches zero across the relevant transmission lines
  - Long Island reserve prices will also account for the Long Island export constraint

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Correlated Loss of Multiple Generators

Correlated Loss of Multiple Generators

- **The NYISO will need to account for the correlated loss of multiple generators when evaluating generator contingencies under Dynamic Reserves**
  - The correlated loss of multiple generators can occur when the loss of equipment at a generation complex whose failure would result in the loss of multiple generating resources simultaneously
  - The NYISO will model Loss of Generation contingencies to capture the potential risks associated with the correlated loss of multiple generators whose combined output would be treated as a single source-generator, and therefore must be secured for reserves
  - NYISO has identified groups of Generators that would fall into this category
  - To monitor the correlated loss of multiple generators, the post-generator contingency energy flow of a given group of correlated generators would be modeled as:
    - $Gen_A * Shift_A + Gen_B * Shift_B \ldots + Gen_n * Shift_n$

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DRAFT – FOR DISCUSSION PURPOSES ONLY

Thunderstorm Alerts (TSAs)

Thunderstorm Alert (TSA) Activations

- **During TSA events today, the system is operated as if the first contingency has already occurred (NYSRC Reliability Rules, Section I)**
  - Power transfer into SENY and NYC is lowered by increasing generation in SENY and NYC
  - In the event of a contingency, line flows could be increased to deliver more power into SENY and NYC
  - TSAs only occur in real-time
- **Given that sufficient headroom exists to import power during a TSA, NYISO currently reduces the 10-Minute Total requirement for NYC and 30-Minute Total Requirements for SENY and NYC to 0 MW**
- **The Dynamic Reserve constraints can measure the importability of reserves into a given area using line flows**
  - Within the context of Dynamic Reserves, under TSA conditions, decreased line flows resulting from increased generation in NYC and SENY would implicitly decrease the amount of reserves needed to secure the Secured Facilities for Reserves in SENY and NYC
- **The NYISO is therefore proposing that no modifications or changes be made to the dynamic reserve constraints during a TSA**
  - As explained, it is anticipated that the solution would implicitly set a lower reserve requirements that reflect the additional transmission headroom created during the TSA
- **However, the NYISO's static NYC 10-Minute Total Requirement of 500MW must still be set to zero during a TSA event**

NYCA Operating Reserve Demand Curves

NYCA Operating Reserve Demand Curves (ORDCs)

- **The total quantities of reserves procured by each of the current NYCA ORDCs is tied directly to the NYISO's static NYCA-wide reserve requirements for 30 Minute Total, 10 Minute Total, and Spinning reserves respectively**
  - The total quantities of reserves procured by these ORDCs must be revised to instead reflect the new dynamic NYCA Operating Reserve Requirements defined on slide 13
- **In the real-time market, the NYCA 30-Minute Total, NYCA 10-Minute Total and NYCA Spin ORDCs shall secure the following quantities of reserves:**
  - NYCA 30T ORDC = $The\ Largest\ Supply\ Contingency + Second\ Largest\ Supply\ Contingency$
    - Scarcity will be included in the 30T ORDC in real-time whenever NYISO is experiencing a scarcity event
  - NYCA 10T ORDC = The Largest Supply Contingency
  - NYCA Spin ORDC = ½ The Largest Supply Contingency
- **In the DAM, the NYCA 30-Minute Total ORDC shall also incorporate any Forecast Reserves:**
  - NYCA 30 ORDC (DAM) = Largest Supply Contingency + Second Largest Supply Contingency + max(0,(Forecast Load – Scheduled Load))
- **The NYISO proposes to maintain the current pricing values associated with each step of each of the NYCA Operating Reserve Demand Curves**
  - However, the quantity of reserves procured at each price point must also be revised to reflect the new dynamic total reserve procurements associated with each curve

NYCA 30-Minute Total Operating Reserve Demand Curves

- **The quantity of reserves procured via the first $750/MW step of the NYCA 30-Minute ORDC would be equal to:**
  - = Largest Supply Contingency + ½ Second Largest Supply Contingency
    - This is analogous to today's requirement that a quantity of reserves equivalent to 1.5x the largest contingency be procured via this first step
- **In the RTM, the remaining 8 steps of the NYCA 30-Minute ORDC, referred to as the "ORDC tail", shall procure a quantity of Operating Reserves equal to:**
  - = ½ Second Largest Supply Contingency
  - This quantity shall also include any applicable Scarcity Reserve Requirements in real-time only
  - In the DAM only, this quantity will also include Forecast Reserves:
    - = ½ Second Largest Supply Contingency + max(0,(Forecast Load – Scheduled Load))
- **The MW quantity associated with each step of the "ORDC tail" shall be further broken down formulaically, as defined on the next slide**

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NYCA 30-Minute Operating Reserve Demand Curve: Formulaic Calculation

Shortage Price ($/MW)	Reserve Level (MW)	Demand Curve Step (MW)	Percent of Reserve Procurement Greater than 1.5x Largest Contingency Existing ORDC "Tail" = 655 MW	
750	≤ 1,965 to 0	1,965	N/A	N/A
625	1,965 to 2,020	55	=55/655	8%
500	2,020 to 2,075	55	=55/655	8%
375	2,075 to 2,130	55	=55/655	8%
300	2,130 to 2,185	55	=55/655	8%
225	2,185 to 2,240	55	=55/655	8%
175	2,240 to 2,295	55	=55/655	8%
100	2,295 to 2,420	125	=125/655	20%
40	2,420 to 2,620	200	=200/655	32%

- The existing NYCA 30-Minute ORDC has 9 steps, as shown in the table above. Reserve procurement levels between 1965 and 2620 MW are broken down into 8 different steps representing the remaining 655 MW of the demand curve after securing 1.5 times the largest contingency
- To develop a dynamic ORDC, NYISO calculated the percent of the 655 MW “tail” held on each step
  - For example, the $625/MWh shortage price would occur if the reserve level was between 1,965 and 2,020 MW. Those 55 MW represent 8% of 655 MW
  - This ensures that the same proportion of reserves are being priced at the existing shortage prices

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NYCA 10-Minute Total and NYCA Spinning ORDCs

- The current NYCA 10-Minute Total and NYCA Spinning ORDCs each consist of a single step, priced at $750/MW and $775/MW respectively
- These curves will continue to feature a single step under dynamic reserves, and will continue to utilize the same pricing values
    - The dynamic quantity of reserves associated with each of these ORDCs is defined on slide 40

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Other Operating Reserve Demand Curves

Operating Reserve Demand Curves

- NYISO currently has ORDCs defined for each of its existing Operating Reserve products (e.g., NYCA, SENY, NYC)
  - Changes to the NYCA ORDCs were discussed previously in this presentation
- An ORDC will be applied to each of the LORCs
- NYISO's proposal is to utilize the structure developed for Secured Facilities for Reserves and map the appropriate shortage values in place today (e.g., M51 into NYC would have the existing NYC shortage demand curve applied to relief on that element)
  - A resource average weighted shift factor would be applied to calculate relief from the demand curve for each respective ORDC.
- NYISO is not proposing any changes to the shortage prices associated with the locational ORDCs as part of Dynamic Reserves. A supplier average shift factor will be applied to the ORDC to represent what 1 MW of relief from the ORDC would cost.
- The SENY 30-Minute Reserve Requirement currently has a two-step demand curve, with reserves incremental to the 1300 MW requirement priced at \$40/MWh. Under Dynamic Reserves, there will be no incremental reserves, and the applicable demand curve price for Secured Facilities mapped to SENY for 30-Minute reserves will be \$500/MWh

Scarcity Pricing

Scarcity Reserve Requirements

- **NYISO will calculate a Scarcity Reserve Requirement each time an SCR/EDRP activation occurs within a given zone or locality**
  - SCR/EDRP activations can only occur in Real-Time – therefore, Scarcity Reserve Requirements are Real-Time only
- **NYISO determines the Scarcity Reserve Requirement (SRR) associated with a given SCR/EDRP activation as the difference between:**
  - $SRR = (Expected\ SCR/EDRPMWs - Available\ Zonal\ Operating\ Capacity)$
    - Available Operating Capacity is unscheduled energy production capability that could be provided by available resources in greater than 30 minutes and less than or equal to 60 minutes
- **The Scarcity Reserve Requirement shall be added to the NYCA 30-Total reserve constraints as follows:**
  - $NYCA\ 30T \geq Largest\ Schedule + Second\ Largest\ Schedule + Scarcity\ Reserve\ Requirement$
- **Under Dynamic Reserves, a Scarcity Reserve Requirement shall also be added as Load to each 30-Minute LORC for which the Load associated with an EDRP/SCR activation has a shift factor for:**
  - $\sum Generation\ * ShiftFactor + \sum(Loads + Scarcity\ Reserve\ Requirement)\ * ShiftFactor - \sum Reserves\ * ShiftFactor \leq LineLimit$
- **The 30-minute demand curve for each affected constraint will be adjusted in real-time to account for the Scarcity Reserve Requirement. The Scarcity Reserve Requirement MWs will be priced at $500/MW**

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Posting of Dynamic Reserve Requirements

Posting of Dynamic Reserve Requirements

- **Postings will be analogous to posting for energy prices and schedules**
  - NYCA, Zonal and Generator Bus reserve prices will be published
    - $NYC\ Zonal\ 30T\ Price = NYCA_{30TPrice} + \sum_K (NYCShift_k * ShadowPrice_K)$
    - Dunwoodie $Zonal\ 30T\ Price = NYCA_{30TPrice} + \sum_K (DunwoodShift_k * ShadowPrice_K)$
  - NYCA requirement for 10S, 10T and 30T will be published for every interval
  - Active constraints will be published for each interval
- **NYISO shall explicitly indicate when demand curves are binding in its postings**
- **NYISO will maintain a secured transmission facilities for reserves list similar to its secured transmission facilities list1**

1: https://www.nyiso.com/documents/20142/32280631/M-29-OSM-Att%20A-v2023-05-08-Final.pdf/3df1d8f2-abbb-8449-07b2-2b21413c53a5

Posting of Dynamic Reserve Requirements: Descriptions

- NYCA and Zonal Reserve Prices will be posted in the same format as posted today, with the following fields in one report:
  - Time Stamp, Time Zone, Name, PTID, 10 Min Spinning Reserves ($/MWhr), 10 Min Non-Synchronous Reserve ($/MWhr), 30 Min Operating Reserve ($/MWhr), NYCA Regulation Capacity ($/MWHr)
- Generator Bus Reserves Prices will be posted with the following fields:
  - Time Stamp, Time Zone, Name, PTID, 10 Min Spinning Reserves ($/MWhr), 10 Min Non-Synchronous Reserve ($/MWhr), 30 Min Operating Reserve ($/MWhr)
- Reserve Procurements will be posted with the following fields:
  - Time Stamp, Time Zone, NYCA 10 Min Spinning Reserve (MW), NYCA 10 Min Non-Synchronous Reserve (MW), NYCA 30 Min Operating Reserve (MW)
  - Analogous data shall be posted for each former Reserve Area for each relevant Reserve product – NYC 30 & 10 Total Reserves, Eastern NY Spinning/30 Total/10 Total Reserves, SENY 30 Total Reserves, and LI 30 & 10 Total Reserves
- Limiting Reserve Constraints will be posted
- Static NYC and LI Reserve Procurement Floors
  - Time Stamp, Time Zone, Static Reserve Procurement Floor (MW)

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Settlements: Forecast Reserve Shadow Prices

Forecast Reserve Shadow Prices

- **Forecast reserve shadow prices will be reflected in both DAM LBMPs and LMORPs**
  - There are no forecast reserves in the RTM
- **Dynamic reserves will:**
  - Create a Forecast Reserve Charge, which will be applicable to Virtual Supply, RT Load that did not schedule in the DAM, and imports that do not materialize in real-time
    - The Forecast Reserve Charge ($/MWh) will be the NYCA forecast reserve shadow price plus the sum-product of the applicable locational forecast reserve shadow prices and shift factors
  - Apply these revenues to offset the total reserve charges to LSEs (i.e., offset Rate Schedule 4)
- **The Forecast Reserve Charge ensures that:**
  - Only the suppliers that satisfy the forecast reserve constraints are paid the shadow prices of these constraints
    - Virtual Supply cannot solve any 30M constraints which utilize Forecast Load, consistent with its current treatment in the DAM Forecast Pass
  - All loads including the loads that do not have a DA schedule are charged the cost of procuring Forecast reserves in DAM
  - Scheduling "virtual" imports does not generate arbitrage profits

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Forecast Reserve Charge

- **The Forecast Reserve Charge to Virtual Supply**
  - $\text{ForecastReservePrice}_{\text{ZN}} = \text{NYCA 30F price} + \sum_{l \in L} \left(Sf_l^{ZN} * 30FShadowPrice_l \right)$
    - This price is used in both the FRC to VS and to LSEs
  - The Forecast Reserve Charge to Virtual Supply:
    - $ForecastReserveCharge_{VS} = ForecastReservePrice_{ZN} * DA \text{ Scheduled Virtual Supply}$
- **The Forecast Reserve Charge to LSEs:**
  - $ForecastReserveCharge_{\text{LSE}} = ForecastReservePrice_{ZN} * \max(0, Actual\ Energy\ Withdrawals - DA\ Scheduled\ Withdrawals)$
- **The Forecast Reserve ChargeProxy to imports will be derived as:**
  - $\text{ForecastReservePrice}_{Proxy} = \text{NYCA 30F price} + \sum_{l \in L} \left(Sf_l^{Proxy} * 30FShadowPrice_l \right)$
  - The Forecast Reserve Charge to Imports will be calculated as:
    - $ForecastReserveCharge_{\text{Imports}} = Forecast\ Reserve\ Price_{Proxy} * \max(0, (DASImports - \text{Actual Imports}))$

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Interaction with Transmission Congestion Contracts (TCCs)

Interaction with TCCs

- Dynamic Reserves may change the quantity of congestion rent accrued
  - For example, the optimization may reduce line flows to avoid scheduling expensive reserves, leaving additional transmission capacity available but uneconomic
- Dynamic reserves does not change the settlement of TCCs. TCC holders will continue to be paid or charged the full value of DAM congestion for their TCCs
- Dynamic reserves could result in DAM congestion shortfalls that will need to be paid to ensure adequate funding for TCCs

Operating Reserve Constraint Charge

- **The ORCC will utilize a similar process to the existing mechanisms for identifying the financial impact of transmission facility outages, returns-to-service, uprates, and/or derates in the DAM**
- **For each hour of the DAM, the NYISO will identify all binding Dynamic Reserves constraints**
  - Dynamic Reserves will have separate constraints than energy scheduling constraints
- **For each binding Dynamic Reserves constraint, the NYISO will determine if that constraint led to an associated DAM congestion shortfall. To do this, NYISO will:**
  - Simulate the Dynamic Reserve constraint in the TCC auction model of the most recently held TCC auction that includes the relevant period in which the Dynamic Reserves constraint is binding and evaluate the flows in the DAM
    - This is consistent with the process that is used to evaluate existing shortfalls for the existing OATT Attachment N shortfall calculations
- **The costs associated with DAM congestion shortfalls due to binding Dynamic Reserves constraints shall be allocated via OATT Rate Schedule 5**
  - Specifically, the ORCC seeks to reallocate the cost of DAM congestion shortfalls associated with Dynamic Reserves from transmission owners pursuant to the OATT Attachment N process to the Loads
  - The details of the ORCC calculation are included in the OATT 6.5 tariff revisions

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DAM Congestion Rents

DAM Congestion Rent

- Operating Reserve cost recovery (i.e., Rate Schedule 4) will remain as it is today
- NYISO may continue reviewing the DAM Congestion Rent and Operating Reserve supplier cost recovery in 2025 as part of the "Dynamic Reserves - Review Operating Reserve Supplier Cost Recovery" project

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Reserve Criteria

Reserve Criteria (10 Spin)

	NYCA	East	SENY	NYC	LI
10-Minute Spinning Reserves Static Value Reliability Rule Dynamic Reserves Calculation	1/2*A = 655 MW 10-minute spinning reserve is equal to at least one-half of the 10-minute total reserve. [NYSRC Reliability Rules, Section E] DR: ½ Largest Schedule (The Largest Schedule is formulated as the capability of the largest generator, as the combined energy, regulation, 10-Minute Spin, 10-Minute Total, 30-Minute Total schedules)	1/4*A = 330 MW* 10-minute spinning reserve is based on the NERC requirement to plan to meet energy reserve requirements, including the deliverability/capability for any single Contingency and the NPCC requirement that reserves be distributed to ensure that they can be used without exceeding individual element ratings or transfer limitations. [NERC TOP-002-2.1b; NPCC Reliability Directory No. 5, Section 5.6] Hold a portion of 10-min Total requirements as Spin. Please refer to 10-min Total requirement criteria on next slide a. For one transmission contingency (Gen Energy + Gen 10S Reserves/0.5 + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit – (N-1) Derate b. For one Generation contingency Gen Energy + Gen 10S Reserves/0.5 – Largest Gen Schedule + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit	0	0	0

https://www.nyiso.com/documents/20142/3694424/Locational-Reserves-Requirements.pdf
https://www.nysrc.org/wp-content/uploads/2023/07/RRC-Manual-V46-final.pdf

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Reserve Criteria (10 Total)

	NYCA	East	SENY	NYC	LI
10-Minute Total Reserves Static Value Reliability Rule Dynamic Reserves Calculation	A = 1310 MW 10-minute total reserve is equal to the operating capability loss caused by the most severe contingency under normal transfer conditions. [NYSRC Reliability Rules, Section E] DR: Largest Schedule	1200 MW 10-minute total reserve is based on Reliability Rules that require immediate measures (activation of EAST 10-minute reserves) be applied to bring loadings on an internal NY transfer interface to within limits in 15 minutes. [NYSRC Reliability Rules, Section D] a. Hold enough 10-min Total reserves such that all modelled EAST Interface lines can be brought down to the lower Central East VC limit in 10-minutes following one transmission contingency that can derate the limit (Gen Energy + Gen 10T Reserves + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit – (N-1) Derate b. Hold enough 10-min Total reserves such that all modelled EAST Interface lines can be brought down to the Central East VC limit following one generation contingency (Gen Energy + Gen 10T Reserves – Largest Gen Schedule + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit	0	500 MW 10-minute total reserve is based on Reliability Rules that require a calculated percentage of the NYCA 10-minute total reserve requirement be procured within NYC. [NYSRC Reliability Rules, Section G] During Thunderstorm Alerts, will be reduced to zero. Hold enough 10-min Total reserves such that all modelled NYC Interface lines can be brought down to LTE in 10-minutes following the one transmission or generation contingency in NYC a. For one transmission contingency: (Gen Energy + Gen 10T Reserves + Load) * Shift Factor <= LTE limit b. For one generation contingency: (Gen Energy + Gen 10T Reserves – Largest Gen Schedule + Load) * Shift Factor <= LTE limit c. A static minimum of 500 MW	1/10*East = 120* [NERC TOP-002-2.1b; NPCC Reliability Directory No. 5, Section 5.6] a. A static minimum of 120 MW

Reserve Criteria (30 Total)

	NYCA	East	SENY
30-Minute Total Reserves Static Value **Reliability Rule** **Dynamic Reserves Calculation**	2*A = 2620 MW 30-minute total reserve is equal to two times the 10-minute reserve necessary to replace the operating capability loss caused by the most severe contingency under normal transfer conditions. [NYSRC Reliability Rules, Section E] DAM : Largest Schedule + 2nd Largest Schedule + max(0, Forecast Load – Scheduled Load) RTM : Largest Schedule + 2nd Largest Schedule	1200 MW Hold 30-Minute total reserve to bring loadings on an internal NY transfer interface to within limits in 30 minutes. [NERC TOP-002-2.1b; NPCC Reliability Directory No. 5, Section 5.6] a. Hold enough 30-min Total reserves such that all modelled EAST Interface lines can be brought down to the lower Central East VC limit in 30-minutes following two transmission contingencies. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit – (N-2) Derate b. Hold enough 30-min Total reserves such that all modelled EAST Interface lines can be brought down to the Central East VC limit in 30-minutes following two generation contingencies. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: (Gen Energy + Gen 30T Reserves - Largest Schedule – Second Largest Schedule + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit c. Hold enough 30-min Total reserves such that all modelled EAST Interface lines can be brought down to the Central East VC limit in 30-minutes following one transmission and one generation contingency. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: (Gen Energy + Gen 30T Reserves - Largest Schedule + Load) * Shift Factor <= Central East Voltage Collapse(VC) limit – (N-1) Derate	1300-1800 30-minute total reserve is, depending on the hour, based on Reliability Rules that require the ability to restore a transmission circuit loading to Emergency or Normal Transfer Operating Criteria within 30 minutes of the contingency. Hold enough 30-min Total reserves such that all modelled SENY Interface lines can be operated to Normal Transfer criteria following one transmission or one generation contingency in SENY. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: a. For one transmission contingency: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= Normal Limit b. For one generation contingency: (Gen Energy + Gen 30T Reserves –Largest Schedule+ Load) * Shift Factor <= Normal Limit c. For two transmission contingencies: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= LTE Limit d. For two generation contingencies: (Gen Energy + Gen 30T Reserves – Largest Schedule –Second Largest Schedule + Load) * Shift Factor <= LTE Limit e. For a combination of one transmission and one generation contingency: (Gen Energy + Gen 30T Reserves – Largest Schedule + Load) * Shift Factor <= LTE Limit

Reserve Criteria (30 Total) cont'd

	NYC	LI
30-Minute Total Reserves Static Value Reliability Rule Dynamic Reserves Calculation	1000 MW 30-minute total reserve is based on Reliability Rules that require the ability to bring transmission line loadings to Normal Operating Criteria within 30 minutes following a contingency. [NYSRC Reliability Rules, Section C] During Thunderstorm Alerts, will be reduced to zero. Hold enough 30-min Total reserves such that all modelled NYC Interface lines can be operated to Normal Transfer criteria following one transmission or one generation contingency in NYC. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: a. For one transmission contingency: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= Normal Limit b. For one generation contingency: (Gen Energy + Gen 30T Reserves –Largest Schedule+ Load) * Shift Factor <= Normal Limit c. For two transmission contingencies: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= LTE Limit d. For two generation contingencies: (Gen Energy + Gen 30T Reserves – Largest Schedule –Second Largest Schedule + Load) * Shift Factor <= LTE Limit e. For a combination of one transmission and one generation contingency: (Gen Energy + Gen 30T Reserves – Largest Schedule + Load) * Shift Factor <= LTE Limit	270-540 MW [NYSRC Reliability Rules, Section D] Hold enough 30-min Total reserves such that all modelled LI Interface lines can be operated to Normal Transfer criteria following one transmission or one generation contingency in LI. In DA, the Load considered for the calculation would be higher of Scheduled and Forecast load: a. For one transmission contingency: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= Normal Limit b. For one generation contingency: (Gen Energy + Gen 30T Reserves –Largest Schedule+ Load) * Shift Factor <= Normal Limit c. For two transmission contingencies: (Gen Energy + Gen 30T Reserves + Load) * Shift Factor <= LTE Limit d. For two generation contingencies: (Gen Energy + Gen 30T Reserves – Largest Schedule –Second Largest Schedule + Load) * Shift Factor <= LTE Limit e. For a combination of one transmission and one generation contingency: (Gen Energy + Gen 30T Reserves – Largest Schedule + Load) * Shift Factor <= LTE Limit

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