2024 Long-Term Resource Adequacy Assessment for NYSRC

A Report by the
New York Independent System Operator

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Executive Summary

The New York State Reliability Council's (NYSRC) Reliability Rule A.3 R2[1] requires the NYISO to prepare a biennial NYCA Long-Term Resource Adequacy Assessment covering a ten-year look-ahead period. The assessment includes findings from the latest NYISO Reliability Needs Assessment (RNA) or other comparable NYISO- resource adequacy reviews, such as the quarterly Short-Term Assessment of Reliability (STAR). Additionally, Reliability Rule A.3 R3 requires the NYISO to submit a report in the Intervening Year between NYCA Long-Term Resource Adequacy Assessments to inform the NYSRC of any significant updates to assumptions and, if available, findings from the latest final NYISO Comprehensive Reliability Plan (CRP) or other final NYISO reports that may include solutions to reliability needs identified in the Long-Term Resource Adequacy Assessment.

This 2024 NYCA Long-Term Resource Adequacy Assessment report is prepared to fulfill the Rule A.3 R2 requirements. This report summarizes the resource adequacy findings from the 2024 RNA[2] for 2028 through 2034 (year 4 through year 10) and from the 2024 Q3 STAR[3] for 2025 through 2029 (year 1 through year 5, with a focus on year 1 through year 3).

While this report is limited to summarizing the resource adequacy findings, the NYISO performed complete reliability criteria assessments, including transmission security evaluations, in both the RNA and STARs.

RNA Key Takeaways

The 2024 RNA was completed on November 19, 2024, and its key takeaways are below (includes transmission security findings):

New York City Transmission Security Reliability Need

- The 2024 RNA finds a transmission security Reliability Need beginning in summer 2033 within New York City primarily driven by a combination of forecasted increases in peak demand and the assumed retirement of the NYPA small gas plants. Accounting for these factors, the BTPFs will not be able to securely and reliability serve the forecasted demand in New York City. Zone J will be deficient by 17 MW for 1 hour in summer 2033 and rising to 97 MW for 3 hours in summer 2034 on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand.

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[1] NYSRC Reliability Rules & Compliance Manual, Version #47, June 14, 2024: https://www.nysrc.org/wp-content/uploads/2024/07/RRC-Manual-V47-final-7-2-24.pdf

[2] 2024 Final RNA:
Report: https://www.nyiso.com/documents/20142/2248793/2024-RNA-Report.pdff
Appendices: https://www.nyiso.com/documents/20142/48283847/2024-RNA-Appendices.pdf
Datasheet: https://www.nyiso.com/documents/20142/48283847/2024-RNA-Datasheet.pdf

[3] 2024 Q3 STAR Report: https://www.nyiso.com/documents/20142/16004172/2024-Q3-STAR-Report-final.pdf

- Furthermore, Con Edison has identified local transmission security reliability violations in the Greenwood 138 kV transmission load area. These violations are on non-BPTF elements and, therefore, are not identified as Reliability Needs in this RNA. However, it is important to holistically consider the reliability of the BPTF and non-BPTF when identifying solutions.

  The Reliability Need identified in the RNA could be met by combinations of solutions including new generation, retention of planned generation retirements, transmission, energy efficiency, demand response measures, or changes in operating protocols. Specifically, scenarios performed in the RNA indicate that the New York City transmission security deficiency could be resolved by resources currently under development but not yet in the Base Case. Other scenarios suggest that the transmission security deficiency could be much greater if the load higher load or there are more unplanned generator retirements than assumed in the Base Case.

Narrowing Statewide Reliability Margins

- The RNA finds that the planned New York grid will meet the statewide resource adequacy criterion throughout the ten-year horizon for the base case assumptions. The findings are impacted by significant uncertainties associated with future demand growth and changing supply mix that will be continuously reviewed through the NYISO's quarterly short-term assessments and biennial long-term assessments. Although a violation is not identified, the loss of load expectation approaches the 0.1 event-days per year criterion in 2034, indicating that no surplus power would remain in ten years without further resource development.
- Beyond the resource adequacy criterion, which relies on emergency operating procedures, the NYISO also calculates statewide system margins under normal operating conditions. Statewide system margin measures the ability to supply firm load for specific system conditions (usually the summer peak and winter peak demand with typical generator availability) without the use of emergency operating procedures. Recent NYISO reliability studies have identified decreasing, and even negative, statewide system margins. This 2024 RNA continues to observe a declining statewide system margin due to increased demand, anticipated generation retirements without adequate new generation addition, and the unavailability of non-firm gas during winter peak conditions. A negative statewide system margin, on its own, is not a criteria violation, but it is a leading indicator of the system's inability to securely serve demand under normal operations while fully maintain operating reserves.
- While negative statewide system margins have been observed before, the magnitude of the negative statewide margins result in a unique challenge not seen before in NYISO's transmission security analyses. Transmission facility overloads are observed in 2034; not because of constraints on specific transmission facilities but because there is insufficient generation reserves statewide necessary to reliably serve the demand across the system. Planning for sufficient generation reserves is important to ensure operating reserve requirements can be met. It also provides the system with the flexibility necessary to respond to a wide range of potential system outages. This projected deficiency in generation reserves is a significant concern that the NYISO will closely monitor and re-evaluate in future planning studies.

Uncertainty in the Planning Horizon

- A key finding of this 2024 RNA is that there is increasing uncertainty about key system trends over the next 10 years. The scenarios performed demonstrate how the identified

Reliability Need in New York City and the tightening statewide resource constraints can be either resolved or exacerbated based on variety of factors.

- Through the Reliability Planning Process and Short-Term Reliability Process, the NYISO will continue to monitor system developments and update assumptions as new information becomes available. The RNA is followed by the Comprehensive Reliability Plan where the NYISO will continue to explore the grid trend uncertainties highlighted in this RNA. These trends could potentially lead to the identification of new reliability needs in the 2025 STARs, which will be conducted quarterly, and the 2026 RNA.

The following are key considerations for the 2025-2034 CRP and future planning studies:

- For the first time in NYISO planning studies, the RNA observed resource shortfalls in the year 10 power flow cases that resulted in overloads due to decreased system flexibility. The NYISO will coordinate with reliability organizations (i.e., NYSRC, NPCC, NERC) on best practices to address transmission security results driven by resource deficiencies.
- While the RNA Base Case included a limited set of new generation projects, there is significant development of new resources across New York State. Ongoing efforts—such as projects with interconnections requests undergoing study in Class Year 2023 and NYSERDA large-scale renewable, offshore wind, and storage procurements—are expected to result inclusion of many generator projects in future reliability studies.
- The flexibility of certain large loads is modeled in system peak conditions to reflect their characteristics based on communications with load developers and recent operating experience. However, this is a quickly evolving trend, and the NYISO will monitor the large load interconnections as they come into service and adjust modeling practices as necessary.
- Competitive wholesale energy, ancillary services, and capacity markets are fundamental to providing consumers reliable, lowest-cost power and are essential tools for achieving public policy. The winter reliability risks identified in the RNA demonstrate the importance of firm-fuel contracts and dual fuel generation based on its contribution to reliability during potential periods of gas fuel shortages during increasing winter peak demand. Capacity accreditation and energy security studies are expected to influence future winter risk assumptions.
- On the demand-side, potential market rule changes to SCRs and DERs could affect how demand flexibility (including large loads) can be reflected in reliability studies.

2024 Q3 STAR Conclusions

The 2024 Q3 STAR did not identify any reliability needs that the NYISO has not previously identified in past reliability assessments (as discussed below). The 2024 Q3 STAR did not identify any base case resource adequacy criterion violations for the study years 2025-2029.

However, in the 2023 Q2 STAR, the NYISO identified a transmission security margins short-term reliability need beginning in summer 2025 within New York City primarily driven by a combination of forecasted increases in peak demand and the assumed unavailability of certain generation in New York

City affected by the "Peaker Rule."[4] Specifically, the 2023 Q2 STAR identified that the New York City zone is deficient by as much as 446 MW for a duration of nine hours on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand. After accounting for the updated assumptions in the 2024 Q3 STAR, the New York City zone is deficient by as much as 461 MW for a duration of seven hours. On November 20, 2023, following a solicitation for solutions, the NYISO issued a Short-Term Reliability Process Report[5] identifying the temporary and permanent solutions to the identified 2025 New York City need. The NYISO determined that temporarily retaining the peaker generators on the Gowanus 2 & 3 and Narrows 1 & 2 barges is necessary to address the need, and that the permanent solution is the Champlain Hudson Power Express ("CHPE") project, currently scheduled to enter service in spring 2026. With the continued operation of these peakers until the earlier of the date a permanent solution is in place (*i.e.,* CHPE) or May 2027, the Need for the currently forecasted demand is addressed if CHPE is not delayed beyond 2026. Without the retention of these generators, the New York City area would not meet the mandatory reliability criteria during expected summer weather peak demand periods. The NYISO's designation of the Gowanus 2 & 3 and Narrows 1 & 2 generators will allow their continued operation beyond May 2025 until permanent solutions are in place, for an initial period of up to two years (May 1, 2027).[6]

Through the quarterly STAR studies, the NYISO has been continuously evaluating the reliability of the system as changes occur and carefully monitoring the progress of the Champlain Hudson Power Express project toward completion. The NYISO's designation of the Gowanus 2 & 3 and Narrows 1 & 2 generators to allow their continued operation beyond May 2025 continues to be necessary to address the reliability need identified in the 2023 Q2 STAR.

The NYISO continues to monitor and track system changes. Subsequent studies, such as the 2025-2034 Comprehensive Reliability Plan, quarterly STARs, and future economic and public policy transmission planning studies, will build upon the findings of the 2024 planning studies.

[4] In 2019, the New York State Department of Environmental Conservation adopted a regulation to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines, referred to as the "Peaker Rule" (here).

[5] https://www.nyiso.com/documents/20142/39103148/2023-Q2-Short-Term-Reliability-Process-Report.pdf

6 The DEC Peaker Rule provides for a potential additional two-year extension (to May 1, 2029) if reliability needs still exist.

1. NYISO Procedures

The findings in this 2024 NYCA Long-Term Resource Adequacy Assessment are based on the 2024 Reliability Needs Assessment (RNA) and 2024 Q3 Short Term Assessment of Reliability (STAR). The current Reliability Planning Process and Short-Term Reliability Process were approved by the Federal Energy Regulatory Commission (FERC), and their requirements are contained in Attachments Y and FF, respectively, of the NYISO's Open Access Transmission Tariff (OATT).[7] A process description is contained in the Reliability Planning Process Manual.[8]

Effective May 1, 2020, the study period addressed by the Reliability Planning Process is years 4 through 10 of the planning horizon, while the Short-Term Reliability Process addresses years 1 through 3 and also assesses years 4 and 5. The needs identified in the Short-Term Reliability Process in year 1 through year 3 will be addressed in the applicable quarterly STAR, while the needs identified in years 4 and 5 will only be addressed using the Short-Term Reliability Process if the identified reliability need cannot timely be addressed through the Reliability Planning Process.

The models and data employed in both the 2024 RNA and 2024 Q3 STAR are based on the NYISO's 2024 Load and Capacity Data Report (Gold Book), and the application of the reliability planning inclusion rules set forth in the Reliability Planning Process Manual. Additional modeling and results details are in the 2024 RNA report and appendices.

[7] NYISO's Tariff, *available at*: https://www.nyiso.com/regulatory-viewer.

[8] Reliability Planning Process Manual, *available at*: https://www.nyiso.com/manuals-tech-bulletins-user-guides.

2. Assumptions and Methodology

Resource Adequacy Base Case Assessments

The following discussion reviews the main findings of the 2024 RNA resource adequacy assessments applicable to the base case conditions for the RNA study period. Both the RNA and the STARs also include transmission security evaluations; however, those evaluations are addressed herein as they are not subject of this report.

Criterion

Under resource adequacy probabilistic simulation, the NYCA loss of load expectation (LOLE in event-days/year) through the ten-year planning horizon is compared with the NYSRC Reliability Rules and NPCC Directory 1 LOLE criterion to not exceed one event-day in 10 years, or LOLE < 0.1 event-days/year.

Resource Adequacy Model

The NYISO uses GE-MARS models and performs probabilistic simulations to determine whether adequate resources would be available to meet the NPCC and NYSRC reliability criteria of Loss of Load Expectation (LOLE) of one day in ten years (0.1 event-days/year). The results identify whether or not there are LOLE violations. The MARS models were also used to evaluate variations to the Base Case assumptions to identify, through the development of appropriate scenarios, factors and issues that might adversely impact the reliability of the Bulk Power Transmission Facilities (BPTF).

The NYISO conducts its resource adequacy analysis using the GE-MARS software package, which performs probabilistic simulations of outages of capacity and select transmission resources. The program employs a sequential Monte Carlo simulation method and calculates expected values of reliability indices, such as LOLE (event-days/year), and includes load, generation, and transmission representation. Additional modeling details and links to various stakeholders' presentations are in the assumptions matrix, which is included in the appendix to this report. In determining the reliability of a system, there are several types of randomly occurring events that are taken into consideration. Among these are the forced outages of generation and transmission, and deviations from the forecasted loads.

The 2024 reliability planning models reflected several changes highlighted below (additional details in the assumptions matrix of the RNA Appendix D):

- To account for winter uncertainties:
    - Dynamic LFU: on the demand side, increasing winter peak load forecast uncertainty

(throughout the study years) was modeled to account for the impacts of heating electrification, EV charging, and large loads.

- Winter gas unavailability: on the resources side, risk of gas unavailability mainly related with gas-only plants with non-firm fuel was implemented.

- New data sources: using 5 years (2017-2021) of hourly MW model-based data developed by DNV-GL for land-based and offshore wind, and front-of-the-meter solar.
- Further limiting reliance on external assistance: the top 5 (changed from 3 starting 2024 RNA as an additional method to further limit reliance) summer and winter peak load days of an external Control Area are modeled as coincident with the NYCA top five peak load days.
- SCR model: modeled as duration-limited resources with units being constrained to be called once in a day when a loss of load event occurs.
- Large loads: a total of about 1,200 MW of planned crypto-curraency minin and hydrolysis large loads were assumed flexible and will decrease demand on peak days. This was modeled in MARS as an emergency operating procedure (EOP) step before the SCR step.

Modeling Assumptions

LOLE is generally defined as the expected (weighted average) number of days in a given time period (*e.g.,* one study year) when at least one hour from that day, the hourly demand (for each of the seven load bins and per replication) is projected to exceed the zonal resources capacity (event day) in any of the seven load bins. Within a day, if the zonal demand exceeds the resources in at least one hour of that day (anywhere from hour 1 to 24, consecutive or not), this will be counted as one event day for the respective load bin and replication. The NYISO currently simulates 2,000 replications per study year and load level (seven load bins) for a total of 14,000 replications per study year. Weighted average is based on load bin probability, total bin event days, and total number of replications.

For each study year and in a single GE-MARS replication, the zonal MW hourly margins (MW surplus or deficit) are calculated for each bin using LFU-applied load, forced outage calculations, hourly shape values (*i.e.,* wind, solar, run-of-river hydro, landfill gas), contracts, and interface flows. In instances where there are a deficit in any area, EOP steps are completed until either the deficits are gone or there are no more EOP steps to call. Once all of this is complete, GE-MARS calculates the reliability indices (LOLE, LOLH, LOEE) for the replication. This occurs concurrently across all load levels simultaneously, and GE-MARS lumps them all together in a weighted sum to get a single value for each replication.

NYCA LOLE (days/ year) = $\frac{1}{N}\sum_{i=1}^{7} D_i\, P_i$

NYCA LOLH (hour/ year) =$\frac{1}{N}\sum_{i=1}^{7} H_i\, P_i$

NYCA EUE (MWh) = $\frac{1}{N}\sum_{i=1}^{7} E_i\, P_i$

where, $\boldsymbol{D_i}$ is the **event days** for bin i for the study year
$\mathbf{H_i}$ is the **event hours** for bin i
$\mathbf{E_i}$ is the MW deficit for bin i
$\mathbf{P_i}$ is the **probability of occurring of bin i** which is the LFU probability data
N is the total number of **replications** e.g., 2000

Noteworthy, the MARS simulations do not take into consideration potential reliability impacts due to unit commitment and dispatch, ramp rate constraints, other production cost modeling techniques, or impacts due to sub-zonal constraints on the transmission system.

Generation Model

The NYISO models the generation system in GE-MARS using several types of units. Thermal unit considerations include random forced outages, scheduled and unplanned maintenance, and thermal derates (minimum between CRIS and DMNC MW from the 2024 Gold Book is used for both summer and winter). Renewable resource units (*i.e.,* both utility and behind-the-meter solar PV, wind, run-of-river hydro, and landfill gas) are modeled using five years of historical production data. Co-generation units are also modeled using a capacity and load profile for each unit. To account for cold weather risks,[9] the 2024 RNA resource adequacy assessments made the following assumptions about 6,400 MW of gas plants (about 5,600 MW located in F through K): (1) all gas-only units with non-firm gas within the NYCA are unavailable and (2) certain dual-fuel units modeled at their alternate fuel capability. Both assumptions are triggered at the forecasted baseline winter coincident peak. This is a static value applied to all load levels.

Load Model

The NYISO's load model for the GE-MARS model consists of historical load shapes and load forecast uncertainty (LFU). The NYISO uses three historical load shapes (8,760 hourly MW) in the GE-MARS model in seven different load levels using a normal distribution. The load shapes are adjusted on a

[9] Winter gas derates April 30, 2024 presentation, *available at*: https://www.nyiso.com/documents/20142/44393357/03_2024RNA_WinterGasDerates_ESPWG_043024.pdf.

seasonal (summer and winter) basis to meet peak forecasts while maintaining the energy target from the Gold Book. The load forecast includes large loads from the NYISO interconnection queue with forecasted impacts in the 2024 baseline demand. The 2024 Gold Book baseline peak load forecast also includes the impact (reduction) of behind-the-meter (BtM) solar at the time of the NYCA peak. For the BtM solar adjustment, gross load forecasts that include the impact of the BtM generation are used for the RNA, which then allows for a discrete modeling of the BtM solar resources using 5 years of inverter data. LFU is applied to every hour of these historical shapes and each hour of the seven load levels is run through the GE-MARS model for each replication for resources availability evaluations.

Historical shapes used in the past (2002 for bin 2, 2006 for bin 1, and 2007 for bins 3 through 7) were replaced by 2013, 2017, and 2018 historical shapes starting with the 2022 RNA and based on detailed analysis performed by the NYISO.[10] The load bin distribution in MARS is below:

- Load Bins 1 and 2: 2013
  - 2013 had a hot summer peak day and a steep load shape and was selected to represent LFU Bins 1 and 2. Years with significantly hot peak-producing weather (analogous to Bin 1 and Bin 2 LFU temperatures) have fairly steep load duration curves.
- Load Bins 3 and 4: 2018
  - 2018 had fairly average peak-producing weather and a relatively flat load shape, nd was selected to represent Bins 3 and 4. Bin 4 represents the expected (average) weather and load level.
- Load Bins 5 through 7: 2017
  - 2017 had a cool summer peak day and a relatively flat load shape. 2017 is selected to represent Bins 5 through 7, which represent summers with milder than expected peak weather conditions.

Additionally, starting with the 2024 RNA, and to account for forecast uncertainty during winter due to electrification and large loads, a winter dynamic load forecast uncertainty[11] has been implemented in the MARS model for the 2024 RNA.

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[10] The changes to the historical shapes were presented at the March 24, 2022 LFTF/TPAS/ESPWG and available at: https://www.nyiso.com/documents/20142/29418084/07%20LFU%20Phase%202_Recommendation.pdf and https://www.nyiso.com/documents/20142/29418084/08%20MARS_PlanningModel-NewLoadShapes.pdf.

[11] Dynamic LFU April 18, 2024 presentation, *available at*: https://www.nyiso.com/documents/20142/44204719/03_DynamicLFU_April18LFTF-ESPWG-TPAS.pdf.

External Areas Model

The NYISO models the four external Control Areas interconnected to the NYCA (ISO-New England, PJM, Ontario, and Quebec). The transfer limits between the NYCA and the external areas are set in collaboration with the NPCC CP-8 Working Group. Additionally, the probabilistic model used in the RNA to assess resource adequacy employs a number of methods aimed at preventing the NYISO's overreliance on support from the external Control Areas. These include imposing a limit of 3,500 MW to the total emergency assistance from all neighbors, modeling simultaneous five peak days (changed from 3 days to further limit reliance), and modeling the long-term purchases and sales with neighboring control areas. Furthermore, the external Control Areas are kept within a LOLE range of 0.10 to 0.15 event-days/year throughout Study Period.

Additionally, various grandfathered or firm contracts and Unforced Deliverability Rights (UDRs) links with the neighboring systems are generally modeled using the "contracts" feature in the GE-MARS model.

Emergency Operating Procedures

The New York model evaluates the need to implement in sequential order a number of EOPs, such as operating reserves, Special Case Resources (SCRs), flexible large loads, manual voltage reduction, 30-minute reserve, voluntary load curtailment, public appeals, remote controlled voltage reduction, emergency assistance from external areas, and part of 10-minute reserve to zero.

For the 2022 RNA, the NYISO implemented a change that maintained (*i.e.,* no longer deplete) 350 MW of the 1,310 MW 10-min operating reserves as part of the MARS EOPs.[12] For the 2024 RNA, the NYISO continued this practice but updated value, as discussed with the ICS, so that 400 MW of 10-minute operating reserves were maintained.[13] In addition to the update for the 10-minute operating reserves, the 2024 RNA implemented changes to the SCR model (a demand response program).[14] Additional details can be found in Appendix E of the 2024 RNA.

MARS Topology

The NYISO models the amount of power that could be transferred during emergency conditions across the system in GE-MARS using interface transfer limits applied to the connections among the

[12] Details were presented at the May 5, 2022 ESPWG/TPAS and available at: https://www.nyiso.com/documents/20142/30451285/08_Reliability_Practices_TPAS-ESPWG_2022-05-05.pdf.

[13] Maintaining Operating Reserves during Load Shedding – *2024-2025 IRM* presented at the May 5, 2023 NYSRC ICS available at: https://www.nysrc.org/wp-content/uploads/2024/10/6.1_WithholdingOperatingReserveAssumptionReview_2023.05.03_Revised-1.pdf.

NYCA 11 Areas (“bubble-and-pipe” model) and with the four neighboring systems (Ontario, Quebec, New England, and PJM). No generation pockets within Zone J and Zone K are modeled in detail in MARS.

The internal transfer limits modeled are the summer emergency ratings derived from the RNA power flow cases discussed above.

The emergency transfer criteria limits used for the MARS topology model are developed from an assessment of analysis of 2023 and 2024 power flow base cases and review of analysis performed for other planning and operations studies.

Key changes/observations, as comparing with the 2023-2033 CRP base cases, are as follows:

- The NYISO modeled a decrease in the thermal transfer limit for Dysinger East of 100 MW starting with the study year 2 (2026). This is mainly due to the Western New York large loads forecasted in the 2024 Gold Book.
- Limits changes (increases) around Long Island (Zone K) due to the inclusion of the transmission project selected by the NYISO’s Board of Directors in 2023 to address the Long Island Offshore Wind Export Public Policy Transmission Public Policy, which is assumed to in service in 2030. Specifically, starting from year 2030:
  - Zone I to Zone K forward limit is increased by about 1,400 MW and the reverse limit increased by about 1,600 MW;
  - Zone J to Zone K forward limit is increased by about 500 MW and the reverse limit is increased by about 650 MW;
  - Con Edison-LIPA forward limit is increased by about 1,650 MW and the reverse limit is increased by about 1,700 MW;
  - Zone I to Zones J and K limit is increased by about 1,400 MW; and
  - LI West limit is increased by about 1,100 MW.

Proposed Resources Additions and Retirements

The assumed proposed generation and transmission projects in the 2024 RNA Base Case pursuant to the NYISO's reliability inclusion rules are listed below. Additional details can be found in the Appendix D of the 2024 RNA.

The key generation additions and removals, net imports, and large loads assumptions are in the table below. More detailed discussion of generation additions and removals is below.

Year (1)	Additions (2)	Removals (3)	Summer Peak			Winter Peak		
			Net Imports	Summer Baseline Coincident Peak	Large Loads Demand (4)	Net Imports	Winter Baseline Coincident Peak	Large Loads Demand (4)
2024	200	171	1,844	31,541	368	735	23,800	372
2025	825	760	1,844	31,650	630	735	24,210	783
2026	1,829	760	3,094	31,900	1,091	735	24,730	1,201
2027	2,645	760	3,094	32,110	1,409	735	25,270	1,409
2028	2,645	760	3,094	32,130	1,529	735	25,760	1,529
2029	2,645	760	3,094	32,340	1,683	735	26,350	1,683
2030	2,645	760	3,094	32,580	1,894	735	27,020	1,894
2031	2,645	1,216	3,094	32,880	2,009	735	27,900	2,009
2032	2,645	1,216	3,094	33,320	2,124	735	28,850	2,124
2033	2,645	1,216	3,094	33,830	2,239	735	29,950	2,239
2034	2,645	1,216	3,094	34,210	2,268	735	31,480	2,268

Notes:

1. For Winter Peak, represents the winter beginning with the listed year (e.g. Winter 2034 is Winter 2034-35).
2. Represents running total of MW based on the Nameplate Rating for the first summer peak period following the addition.
3. Represents running total of MW based on the Summer Capability (DMNC) for the first summer peak period following removal.
4. Large loads are included in the Baseline Coincident Peak load forecasts.

Transmission

The NYCA has several major transmission projects that have been placed in service or are currently under development. Such major transmission projects are largely related to achieving public policy objectives. For instance, the 2024 RNA included the AC Transmission projects—both of which entered service in 2024. Other transmission projects included in the RNA Base case that are currently under development or construction, but not yet complete, include:

- **NYPA/National Grid's Northern New York Priority Transmission Project**. This project is expected to increase the capacity of transmission lines in northern New York, where significant wind and hydro capacity exists and constraints on existing lines contribute to curtailment of these resources. The planned in-service date is December 2025.
- **Champlain Hudson Power Express (CHPE)**. 1,250 MW HVDC project from Quebec to Astoria Annex 345 kV in New York City (Zone J). This project was awarded under

NYSERDA's Tier 4 REC program, and the facility is expected to provide capacity in the summer but not in the winter. The planned in-service date is spring 2026.

- **Propel Alternate Solution 5.** This project was selected by NYISO's Board of Directors to meet the Long Island Offshore Wind Export Public Policy Transmission Need. The project adds three new AC tie lines between Long Island and the rest of the state and a 345 kV backbone across western/central Long Island. The planned in-service date is May 2030.

As part of the NYISO's Local Transmission Planning Process, the New York Transmission Owners prepared their Local Transmission Owner Plans (LTPs), which were presented to the NYISO and stakeholders during ESPWG and TPAS meetings. The transmission assumptions, needs, and projects detailed in the LTPs and the projects reported as "firm" by the respective transmission owners in the *2024 Gold Book* are included in the 2024 RNA Base Case, with consideration for their in-service dates. A summary of these projects is reported in Appendix D of the 2024 RNA report.

Generation Additions and Removals

The figures below summarize the 2024 RNA Base Case generator addition and removals.

Figure 1: Large Generation Additions

Proposed Project Inclusion: Large Generation					
Queue	**Project Name**	**MW**	**Type**	**Zone**	**Proposed Date**
619	East Point Solar	50	Solar	F	Feb-24
618	High River Solar	90	Solar	F	Jun-24
717	Morris Ridge Solar Energy Center	177	Solar	C	Sep-24
637	Flint Mine Solar	100	Solar	G	Oct-24
766/987	Sunrise Wind II	924	Offshore Wind	K	Mar-26
737	Empire Wind 1	816	Offshore Wind	J	Dec-26

Figure 2:Small Generation Additions

Proposed Project Inclusion: Small Generation					
	Name	MW	Type	Zone	Proposed Date
572	Greene County 1	20	Solar	G	Jan-23
573	Greene County 2	10	Solar	G	Mar-23
545	Sky High Solar	20	Solar	C	Jun-23
744	Magruder BESS	20	Energy Storage	G	Sep-23
581	Hills Solar	20	Solar	E	Feb-24
586	Watkins Rd Solar	20	Solar	E	Feb-24
584	Dog Corners Solar	20	Solar	C	Apr-24
833	Dolan Solar	20	Solar	F	Apr-24
565	Tayandenega Solar	20	Solar	F	Jun-24
1003	Clear View Solar	20	Solar	C	Jun-24
564	Rock District Solar	20	Solar	F	Jul-24
807	Hilltop Solar	20	Solar	F	Jul-24
670	SunEast Skyline Solar LLC	20	Solar	E	Aug-24
734	Ticonderoga Solar	20	Solar	F	Aug-24
832	CS Hawthorn Solar	20	Solar	F	Aug-24
804	KCE NY 10*	20	Energy Storage	A	Nov-24
828	Valley Solar	20	Solar	C	Nov-24
590	Scipio Solar	18	Solar	C	Dec-24
591	Highview Solar	20	Solar	C	Dec-24
575	Little Pond Solar	20	Solar	G	Jan-25
848	Fairway Solar	20	Solar	E	Mar-25
592	Niagara Solar	20	Solar	B	Jun-25
855	NY13 Solar	20	Solar	F	Jun-25
865	Flat Hill Solar	20	Solar	E	Dec-25
885	Grassy Knoll Solar	20	Solar	E	Dec-25

Notes:

*Project does not have CRIS.

Figure 3: Generation Additions by Year

Running Total of MW Additions by Type (2)			
Year (1)	Solar	Off-shore Wind	Energy Storage
2024	180	0	20
2025	785	0	40
2026	865	924	40
2027	865	1740	40
2028	865	1740	40
2029	865	1740	40
2030	865	1740	40
2031	865	1740	40
2032	865	1740	40
2033	865	1740	40
2034	865	1740	40

Notes:

1. First summer peak period following the addtion.
2. MW based on the Nameplate Rating.

Figure 4: Generation Removals by Year

MW Removals			
Generator Name	Zone	MW Removals (1)	Year (2)
Coxsackie GT	G	19.7	2024
South Cairo	G	14.6	2024
Glenwood GT 03	K	52	2024
Shoreham 1	K	42	2024
Shoreham 2	K	17.4	2024
Arthur Kill Cogen	J	11.1	2024
Astoria GT 01	J	13.8	2025
59 St. GT 1	J	13.9	2025
Arthur Kill GT 1	J	12.3	2025
Gowanus 2-1 - 2-8	J	140.9	2025
Gowanus 3-1 - 3-8	J	138.5	2025
Narrows 1-1 - 1-8	J	140	2025
Narrows 2-1 - 2-8	J	144.3	2025
Gowanus 5	J	40	2031
Gowanus 6	J	39.9	2031
Kent	J	46	2031
Pouch	J	45.4	2031
Hellgate 1	J	39.9	2031
Hellgate 2	J	39.6	2031
Harlem River 1	J	39.9	2031
Harlem River 2	J	39.6	2031
Vernon Blvd 2	J	40	2031
Vernon Blvd 3	J	39.9	2031
Brentwood	K	45	2031
Total Removed before Summer 2025		760.5	
Total Removed before Summer 2031		1215.7	

Notes:

1. MW based on the Summer Capability (DMNC.)
2. First summer peak period following removal.

Additionally, the NYISO's interconnection queue has seen an unprecedented increase in the number of projects seeking interconnection service. The projects that are at a more advanced stage in the interconnection process are listed in Table IV from the 2024 Gold Book. Many of these projects did not satisfy the inclusion rules and, therefore, are not in the 2024 RNA Base Case. However, the NYISO performed scenario analysis in the 2024 RNA to understand changes on the system for information purposes only. Figure 5 below shows proposed projects that were included in a scenario performed in the 2024 RNA for information. The projects that are included in the 2024 RNA Base Cases are highlighted in green.

Figure 5: Additional Proposed Generation Projects from the 2024 Gold Book

2024 RNA Status	Queue #	OWNER / OPERATOR	STATION UNIT	ZONE	Proposed Date[6] (M-YY)	Nameplate Rating (MW)	Min (CRIS,DMNC)	Requested CRIS (MW)	CRIS (MW)	SUMMER (MW)	WINTER (MW)	Unit Type	Class Year Facilities Study
			Completed Class Year Facilities Study										
Scenario	596	Alle-Catt Wind Energy LLC	Alle Catt II Wind	A	Feb-25	339.1	339.1	339.1	339.1	339.1	339.1	Wind Turbines	2019
Scenario	704	Bear Ridge Solar, LLC	Bear Ridge Solar	A	Oct-24	100.0	100.0	100.0	100.0	100.0	100.0	Solar	2019
Scenario	783	ConnectGen Chautauqua County LLC	South Ripley Solar and BESS	A	Jun-24	270.0	270.0	270.0	270.0	270.0	270.0	Solar+Energy Storage	2021
Scenario	787	Levy Grid, LLC	Levy Grid, LLC	A	Aug-25	150.0	150.0	150.0	150.0	150.0	150.0	Energy Storage	2021
Scenario	571	Heritage Wind, LLC	Heritage Wind	B	Sep-26	200.1	200.1	200.1	200.1	200.1	200.1	Wind Turbines	2021
Scenario	710	Horseshoe Solar Energy LLC	Horseshoe Solar	B	Oct-25	180.0	180.0	180.0	180.0	180.0	180.0	Solar	2021
Scenario	721	Excelsior Energy Center, LLC	Excelsior Energy Center	B	Feb-25	280.0	280.0	280.0	280.0	280.0	280.0	Solar	2019
Scenario	811	Hecate Energy Cider Solar LLC	Cider Solar	B	Nov-24	500.0	500.0	500.0	500.0	500.0	500.0	Solar	2021
Scenario	883	Garnet Energy Center, LLC	Garnet Energy Center	B	Nov-25	200.0	200.0	200.0	200.0	200.0	200.0	Solar	2021
Scenario	276	Homer Solar Energy Center LLC	Homer Solar Energy Center	C	Apr-26	90.0	90.0	90.0	90.0	90.0	90.0	Solar	2019
Scenario	396	Baron Winds, LLC	Baron Winds	C	Dec-24	238.8	117.0	300.0	300.0	117.0	117.0	Wind Turbines	2017
Scenario	519	Canisteo Wind Energy LLC	Canisteo Wind	C	Feb-25	289.8	289.8	290.7	290.7	289.8	289.8	Wind Turbines	2019
Scenario	617	Watkins Glen Solar Energy Center, LLC	Watkins Glen Solar	C	Nov-24	54.0	50.0	50.0	50.0	50.0	50.0	Solar	2019
Base Case	717	Morri Ridge Solar Energy Center, LLC	Morris Ridge Solar Energy Center	C	Sep-24	177.0	177.0	177.0	177.0	177.0	177.0	Solar	2021
Scenario	720	Trelina Solar Energy Center, LLC	Trelina Solar Energy Center	C	Dec-24	86.8	79.8	80.0	80.0	79.8	79.8	Solar	2019
Scenario	801	Prattsburgh Wind, LLC	Prattsburgh Wind Farm	C	Dec-25	147.0	147.0	147.0	147.0	147.0	147.0	Wind Turbines	2021
Scenario	805	Osbow Hill Solar, LLC	Owbox Hill Solar	C	Dec-24	140.0	140.0	140.0	140.0	140.0	140.0	Solar	2021
Scenario	521	Bull Run Energy LLC	Bull Run II Wind	D	Dec-26	449.0	449.0	449.0	449.0	449.0	449.0	Wind Turbines	2021
Scenario	620	North Side Energy Center, LLC	North Side Solar	D	Dec-24	180.0	180.0	180.0	180.0	180.0	180.0	Solar	2019
Scenario	706	High Bridge Wind, LLC	High Bridge Wind	E	Dec-24	100.8	100.8	100.8	100.8	100.8	100.8	Wind Turbines	2019
Scenario	864	Greens Corners Solar LLC	NY38 Solar	E	Dec-24	120.0	120.0	120.0	120.0	120.0	120.0	Solar	2021
Scenario	495	Mohawk Solar LLC	Mohawk Solar	F	Nov-24	90.5	90.5	90.5	90.5	90.5	90.5	Solar	2019
Base Case	618	High River Energy Center, LLC	High River Solar	F	Jun-24	90.0	90.0	90.0	90.0	90.0	90.0	Solar	2019
Base Case	619	East Point Energy Center, LLC	East Point Solar	F	Feb-24	50.0	50.0	50.0	50.0	50.0	50.0	Solar	2019
Scenario	644	Hecate Energy Columbia County 1, LLC	Columbia County 1	F	Dec-24	60.0	60.0	60.0	60.0	60.0	60.0	Solar	2019
Base Case	637	Flint Mine Solar LLC	Flint Mine Solar	G	Oct-24	100.0	100.0	100.0	100.0	100.0	100.0	Solar	2019
Scenario	683	KCE NY 2, LLC	KCE NY 2	G	Dec-24	200.0	200.0	200.0	200.0	200.0	200.0	Energy Storage	2019
Base Case	737	Empire Offshore Wind LLC	Empire Wind 1	J	Dec-26	816.0	816.0	816.0	816.0	816.0	816.0	Wind Turbines	2019
Scenario	815	Bayonne Energy Center	Bayonne Energy Center III	J	Oct-25	49.8	49.8	49.8	49.8	49.8	49.8	Energy Storage	2021
Scenario	835	Astoria Generating Company, LP	Luyster Creek Energy Storage 1	J	May-26	59.1	56.3	56.3	56.3	56.3	57.3	Energy Storage	2021
Scenario	840	Hecate Grid Swiftsure LLC	Swiftsure Energy Storage	J	Nov-26	650.0	121.0	650.0	121.0	650.0	650.0	Energy Storage	2021
Scenario	907	Harlem River ESS, LLC	Harlem River Yard	J	Dec-26	100.0	100.0	100.0	100.0	100.0	100.0	Energy Storage	2021
Scenario	931	East River ESS, LLC	Astoria Energy Storage	J	Dec-24	106.7	100.0	100.0	100.0	100.0	100.0	Energy Storage	2021
Scenario	535	Riverhead Solar 2, LLC	Riverhead Solar 2	K	Feb-25	36.0	36.0	36.0	36.0	36.0	36.0	Solar	2019
Base Case	612	South Fork Wind, LLC	South Fork Wind Farm	K	Feb-24	96.0	96.0	96.0	96.0	96.0	96.0	Wind Turbines	2019
Base Case	695	South Fork Wind, LLC	South Fork Wind Farm II	K	Feb-24	40.0	40.0	40.0	40.0	40.0	40.0	Wind Turbines	2019
Base Case	766	Sunrise Wind LLC	Sunrise Wind	K	Mar-26	1,085.7	880.0	880.0	880.0	880.0	880.0	Wind Turbines	2021
Scenario	956	Holtsville Energy Storage, LLC	Holtsville 138kV Energy Storage	K	Oct-26	300.9	110.0	110.0	110.0	110.0	110.0	Energy Storage	2021
Scenario	965	Yaphank Energy Storage, LLC	Yaphank Energy Storage	K	Sep-26	79.6	76.8	76.8	76.8	76.8	77.6	Energy Storage	2021
Base Case	987	Sunrise Wind LLC	Sunrise Wind II	K	Mar-26	1,085.7	44.0	44.0	44.0	44.0	44.0	Wind Turbines	2021
			Non Class Year Generators (Small Generators) Interconnection Agreement Complete										
Base Case	545	Sky High Solar LLC	Sky High Solar	C	Jun-23	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	564	Rock District Solar, LLC	Rock District Solar	F	Jul-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	565	Tayandenega Solar, LLC	Tayandenega Solar	F	Jun-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	572	Hecate Energy Greene 1 LLC	Greene County 1	G	Jan-23	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	573	Hecate Energy Greene 2 LLC	Greene County 2	G	Mar-23	10.0	10.0	10.0	10.0	10.0	10.0	Solar	
Base Case	581	SunEast Hills Solar LLC	Hills Solar	E	Feb-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	584	SunEast Dog Corners Solar LLC	Dog Corners Solar	C	Apr-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	586	SunEast Watkins Road Solar LLC	Watkins Rd Solar	E	Feb-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	590	SunEast Scipio Solar LLC.	Scipio Solar	C	Dec-24	18.0	18.0	18.0	18.0	18.0	18.0	Solar	
Base Case	591	SunEast Highview Solar LLC	Highview Solar	C	Dec-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	2019
Base Case	592	SunEast Niagara Solar LLC	Niagara Solar	B	Jun-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	670	SunEast Skyline Solar LLC	SunEast Skyline Solar LLC	E	Aug-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	734	ELP Ticonderoga Solar, LLC	Ticonderoga Solar	F	Aug-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	744	Mitchell Energy Facility, LLC	Magruder BESS	G	Jan-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	807	SunEast Hilltop Solar LLC	Hilltop Solar	F	Jul-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	828	SunEast Valley Solar LLC	Valley Solar	C	Nov-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	832	Granada Solar, LLC	CS Hawthorn Solar	F	Aug-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	833	Dolan Solar, LLC	Dolan Solar	F	Apr-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	848	SunEast Fairway Solar LLC	Fairway Solar	E	Mar-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	855	Bald Mountain Solar LLC	NY 13 Solar	F	Jun-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	865	SunEast Flat Hill Solar LLC	Flat Hill Solar	E	Dec-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	885	SunEast Grassy Knoll Solar LLC	Grassy Knoll Solar	E	Dec-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	1003	Clear View LLC	Clear View Solar	C	Jun-24	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	575	Little Pond Solar, LLC	Little Pond Solar	G	Jan-25	20.0	20.0	20.0	20.0	20.0	20.0	Solar	
Base Case	804	KCE NY 10, LLC	KCE NY 10	A	Nov-24	20.0	20.0	20.0	20.0	20.0	20.0	Energy Storage	

Resource Adequacy Results

The Base Case as well as the scenarios results are described below.

Base Case Results

The 2024 RNA Base Case resource adequacy studies show that the annual NYCA LOLE is below the 0.1 event-days/year criterion throughout the Study Period, except study year 10 (2034). As reflected in the summer and winter LOLE results, the annual NYCA LOLE increases through the study period are more driven by the winter events.

The planning models reflected several changes to account for winter uncertainties:

- On the demand side, a load forecast growing (through study years) uncertainty was modeled for winter to account for electrification and large loads; and
- On the resources side, risk of gas unavailability mainly related with gas-only plants was implemented.

Over 2,000 MW of proposed large loads, such as industrial loads and data centers, were included in the baseline load forecast used for the 2024 RNA Base Case. A total of about 1,200 MW was assumed flexible. This assumption was modeled in MARS as an EOP step before the SCR step. The Base Case results show the LOLE for both with and without flexibility of certain large loads.

The NYCA LOLE results are presented in Figure 6 and Figure 7 below. The 2024 RNA Study Years are year 4 (2028) through year 10 (2034), and year 1 through year 3 are for information.

The resource adequacy studies show that the annual NYCA LOLE would be below the 0.1 event-days/year criterion for each study year. There is a sharp increase in LOLE in the outer years with the LOLE just below criterion for 2034. For information, the LOLE results are also shown without large load flexibility, which would result in an LOLE above the criterion in 2034. The increase in LOLE is mainly due to the winter risks reflected in the Base Case, such as the non-firm gas unavailability and growth in winter demand forecast.

Figure 6: NYCA Resource Adequacy LOLE Results

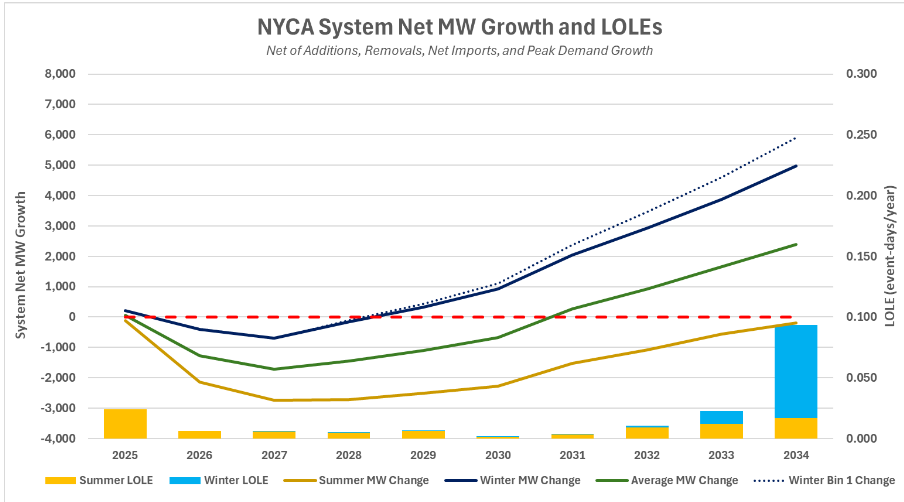
	NYCA Annual LOLE (event-days/year)	
Study Year	Base Case without Large Loads Flexibility	Base Case with Large Loads Flexibility
2025	0.031	**0.024**
2026	0.010	**0.006**
2027	0.009	**0.006**
2028	0.007	**0.005**
2029	0.009	**0.006**
2030	0.004	**0.001**
2031	0.011	**0.004**
2032	0.030	**0.010**
2033	0.080	**0.022**
2034	0.289	**0.094**

Figure 7: NYCA Resource Adequacy LOLE, LOLH, EUE Results

Study Year	LOLE (event-days/year)	LOLH (event-hrs/year)	EUE *(MWh/year)*
2025	**0.024**	0.064	21.9
2026	**0.006**	0.017	3.5
2027	**0.006**	0.017	3.3
2028	**0.005**	0.012	1.7
2029	**0.006**	0.016	2.6
2030	**0.001**	0.002	0.5
2031	**0.004**	0.007	2.3
2032	**0.010**	0.025	9.4
2033	**0.022**	0.053	22.8
2034	**0.094**	0.251	148.1

Figure 8 shows how the **net** resource balance in the NYCA trends similarly to the LOLE. For each forecast year, summer and winter peak demand growth is calculated relative to 2024, as drivers for increasing LOLE. Resource removals also contribute to the increases in the LOLE. Resource additions and the change in net imports relative to 2024 are subtracted, as this additional supply acts to reduce LOLE. The solid yellow and blue lines represent the baseline net demand minus supply growth for summer and winter, respectively. The green line shows the average of the summer and winter lines. Finally, the dotted winter blue line adds the impacts of the dynamic winter LFU fanning on the Bin 1 MW balance.

Figure 8: NYCA Net MW Resources Growth



Noteworthy, the MARS simulations do not take into consideration potential reliability impacts due to unit commitment and dispatch, ramp rate constraints, other production cost modeling techniques, or impacts due to sub-zonal constraints on the transmission system.

Impact of Emergency Operating Procedures

The LOLE results after each EOP step are shown in Figure 9. GE-MARS evaluates the need for using EOP MW by calculating after each EOP step the expected number of days per year that the system is at a positive (surplus) and a negative (deficiency) MW margin. Each EOP's MW is used as needed and in sequential order.

The EOP step 8 shows the impact of emergency assistance from external areas. As an example, study year 10 (2034) results show that after EOP steps 1 through 7 have been applied and before the emergency assistance is available, the NYCA LOLE is 3.16 event-days/year, which is significantly above the 0.1 event-days/year criterion. After the external area emergency assistance from EOP step 8 becomes available, the LOLE decreases to 0.67 event-days/year. While still above the criterion, the decrease in LOLE is significant. This signifies that without emergency assistance from neighboring regions, there would not be sufficient resources to serve demand within New York for each of the study years evaluated.

Figure 9: LOLE Results by Emergency Operating Procedure Step for Study Year 10 (2034)

	NYCA LOLE (days/year) by EOP Step											
	Step	EOP	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
	1	Removing Operating Reserve (1965 MW)	3.47	2.09	2.23	2.14	2.98	1.63	2.61	3.72	5.89	7.64
	2	Flexible Large Loads (407-976 MW)	2.95	1.53	1.46	1.45	2.22	0.82	1.53	2.37	4.02	5.45
	3	Require SCRs (Load and Generator)	2.16	1.10	1.08	1.09	1.71	0.46	0.92	1.58	2.87	4.18
	4	5% Manual Voltage Reduction	2.11	1.08	1.05	1.07	1.68	0.43	0.88	1.51	2.77	4.08
	5	655 MW 30-Minute Reserve to Zero	0.95	0.46	0.46	0.41	0.66	0.20	0.45	0.92	1.88	3.03
	6	Voluntary Load Curtailment	0.76	0.37	0.37	0.33	0.53	0.16	0.35	0.76	1.61	2.72
	7	Public Appeals	0.69	0.34	0.34	0.29	0.47	0.14	0.33	0.72	1.55	2.63
	8	5% Remote Controlled Voltage Reduction	0.51	0.25	0.25	0.21	0.37	0.09	0.22	0.53	1.22	2.19
	9	Emergency Assistance	0.09	0.03	0.02	0.02	0.02	0.01	0.03	0.06	0.11	0.30
NYCA LOLE	10	Part of 10-Minute Reserve (910 of 1310 MW) to Zero	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.09

Notes:

- The results at **step 9** in grey highlight represent the NYCA LOLE and are compared against the 0.1 event-days/year criterion. Blue font value indicates number is above 0.1 days/year, however the criterion does not apply until step 10.

To avoid overly relying on external areas, the NYISO uses several modeling methods to limit New York's reliance on external areas in its analysis. For instance, the NYISO applies a 3,500 MW statewide limitation on emergency assistance, as well as aligning New York's five peak days with external areas, and setting the LOLE for external areas between 0.1 and 0.15 event-days/year. This assumes that the external areas are self-sufficient before providing assistance to New York.

The 2024 RNA Base Case resource adequacy results show:

- The New York Control Area (NYCA) loss of load expectation through the study period is below the NYSRC's and NPCC's criterion of one day in 10 years (or 0.1 event-days per year) when certain large loads are assumed flexible.
- The increase in LOLE through the study years, culminating in the highest LOLE in year 10, is mainly due to the winter risks reflected in the 2024 RNA Base Case, such as the winter non-firm gas unavailability, the winter demand forecast uncertainties modeled in the 2024 RNA Base Case, and growth in demand forecast.
- The MARS events are distributed in both winter and summer months (December, January, February, July, and August) and in the late afternoon hours (as shown in the event analysis graphs above).
- In addition to internal EOPs, New York relies on support from external areas during emergency conditions.
- There are positive reliability impacts (*i.e.*, NYCA LOLE decrease) as result of including the following proposed projects in the RNA Base Case:
    a. CHPE, which imports 1,250 MW HVDC (summer only) from Hydro Quebec to Astoria Annex 345 kV in Zone J,
    b. The NYPA/National Grid Northern New York Priority Transmission Project

starting 2026, which increases the Moses South interface limits, and

c. The Propel NY Alternate Solution 5 project, which increases the MARS topology limits (both imports and exports) starting 2030.

d. Two additional offshore wind projects: Sunrise Wind (starting in 2026) and Empire 1 (starting in 2027), which inject additional MW in Zone J and K.

- The assumption that approximately 450 MW of NYPA's simple cycle GTs will be out of service starting January 2031, based on state legislation, led to an increase in the reliability indices (system less reliable) starting 2031. Most of the affected generators are located in New York City Zone J and one generator located in Long Island Zone K.

Resource Adequacy Scenarios

The NYISO developed reliability scenarios in the 2024 RNA. Scenarios are variations on the RNA Base Case to assess the impact of possible changes in key study assumptions which, if they occurred, could change the timing, location, or degree of violations of reliability criteria on the NYCA system during the study period. RNA scenarios are provided for information only and do not lead to the identification of Reliability Needs. The following resource adequacy scenarios were performed as part of the 2024 RNA, with an identification of the type of assessment performed:

1. **Zonal Resource Adequacy Margins (ZRAM) Scenario**
   - Identification of the maximum level of zonal MW capacity that can be removed without either causing a NYCA LOLE violation or exceeding the zonal capacity.
2. **Free-Flow Scenario**
   - This analysis removes the limit on various transmission interfaces in resource adequacy models—either one at the time or in various combinations (*i.e.,* "free flow").
3. **High Demand Forecast Scenario**
   - The 2024 Gold Book High Demand forecast was used for the resource adequacy analysis.
4. **CHPE Delayed Scenario**
   - Removal of the proposed 1,250 MW HVDC transmission line from Quebec to New York City.

5. **Additional Proposed Projects Scenarios.** Two scenarios were performed, one at a time, on the RNA Base Case:

    a) One scenario added approximately 5,000 MW of resource projects that are in an advanced stage of development but has not yet met the reliability planning inclusion rules to be included in the 2024 RNA Base Case. This amounted to approximately 2,500 MW solar, 1,500 MW land-based wind, and 1,000 MW battery storage.

    b) One scenario added approximately 7,000 of additional proposed offshore wind (5,000 MW in Zone J and 2,000 MW in Zone K) for a total of about 9,000 MW interconnected to the NYCA.

Zonal Resource Adequacy Margins (ZRAM)

Resource adequacy simulations were performed on the 2024 RNA Base Case to determine the amount of "perfect capacity" in each zone (one zone at the time) that could be removed before the NYCA LOLE reaches 0.1 event-days/year (one-event-day-in-ten-years). These simulations offer another relative measure of how close the system is from not having adequate resources to reliably serve load.

In performing this analysis, and if the LOLE is below criterion, resource capacity is reduced one zone at a time to determine when a violation occurs. This analysis is performed in the same manner as the compensatory "perfect MW" (compensatory MW) are added to mitigate resource adequacy violations but with the opposite impact.

"Perfect capacity" is capacity that is not derated (*e.g.,* due to ambient temperature or unit unavailability), not subject to energy durations limitations (*i.e.*, available at maximum capacity every hour of the study year), and not tested for transmission security or interface impacts. A map of NYISO zones is shown in Figure 10, and the zonal resource margin analysis (ZRAM) is summarized in Figure 11.

Figure 10: NYISO Load Zone Map

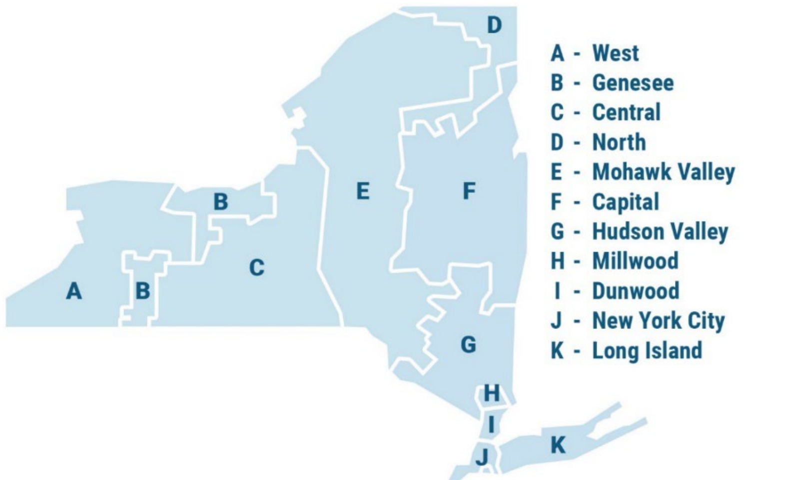


Figure 11: Zonal Resource Adequacy Margins/Compensatory MW

Study Year	Base Case LOLE (event-days/year)	Zone A MW	Zone B MW	Zone C MW	Zone D MW	Zone E MW	Zone F MW	Zone G MW	Zone H MW	Zone I MW	Zone J MW	Zone K MW
2025	0.024	1500	1500	2200	1500	2200	2200	2200	1600	1600	1300	500
2026	0.006	1600	1600	3400	1600	3400	3400	3400	2700	2700	2200	700
2027	0.006	1700	1700	3600	1900	3600	3600	3600	2900	2900	2400	700
2028	0.005	1600	1700	3700	1900	3700	3700	3700	2900	2900	2500	700
2029	0.006	1700	1700	3200	2000	3200	3200	3200	2800	2800	2300	600
2030	0.001	1800	1800	3600	1900	3600	3600	3600	3100	3100	2900	1300
2031	0.004	1700	1700	2800	1900	2800	2800	2800	2500	2500	2400	1200
2032	0.010	1600	1600	2000	1700	2000	2000	2000	1800	1800	1800	1000
2033	0.022	1000	1000	1100	1000	1100	1100	1100	1000	1000	1100	800
2034	0.094	50	50	50	50	50	50	50	50	50	50	50

The ZRAM/Compensatory MW assessment identifies a maximum level of "perfect capacity" that can be removed/added from/to each zone without causing a violation of the NYCA LOLE criterion. However, the impacts of removing (or adding) capacity on the reliability of the transmission system and on transfer capability are highly dependent on location. Thus, removal of lower amounts of capacity are likely to result in reliability issues at specific transmission locations. These simulations did not attempt to assess a comprehensive set of potential scenarios that might arise from specific unit retirements. Therefore, actual proposed capacity removals from any of these zones will need to be further studied in light of the specific capacity locations in the transmission network to determine whether any additional violations of reliability criteria would result. Additional transmission security analysis, such as N-1-1 steady-state analysis, transient stability, and short circuit, will be necessary under the applicable process for any contemplated plant retirement in any zone.

Free-Flow Scenario

To determine whether a specific transmission interface impacts system resource adequacy, the NYISO performed "free-flow" simulations. This analysis removes the limit on various transmission interfaces in the resource adequacy models—either one at the time or in various combinations (*i.e.,* "free flow"). A decrease in the NYCA LOLE resulting from removal of an interface limit is an indication that the flow of power across the interface is "binding" due to transmission constraints.

The results of removing all the internal New York topology limits are shown in Figure 12. The results show that increasing transmission system limits does not decrease the LOLE significantly.

Figure 12: Free Flow LOLE Results (event-days/year)

Year	Base Case	Free flow	*Delta*
2025	**0.024**	0.017	*-0.007*
2026	**0.006**	0.003	*-0.004*
2027	**0.006**	0.001	*-0.005*
2028	**0.005**	0.001	*-0.004*
2029	**0.006**	0.001	*-0.005*
2030	**0.001**	0.001	*0.000*
2031	**0.004**	0.003	*0.000*
2032	**0.010**	0.009	*-0.001*
2033	**0.022**	0.020	*-0.002*
2034	**0.094**	0.093	*-0.001*

High Demand Scenario

The 2024 RNA Base Case uses the baseline forecasts developed for the 2024 Gold Book. The 2024 Gold Book also contains other demand forecasts—one of which is a higher demand scenario. The high demand forecast represents a higher bound on forecast growth, including faster economic growth and electrification sufficient to meet state policy targets, and includes additional large load growth not included in the baseline forecast.

Figure 13 below shows a comparison between the baseline forecast and the higher demand forecast.

Figure 13: Baseline Demand Forecasts vs the High Demand Forecasts (MW)

Summer				Winter			
Year	Baseline	High Demand	*Delta*	Year	Baseline	High Demand	*Delta*
2025	31,650	32,200	*550*	2024-25	23,800	24,050	*250*
2026	31,900	32,910	*1,010*	2025-26	24,210	24,960	*750*
2027	32,110	33,450	*1,340*	2026-27	24,730	25,790	*1,060*
2028	32,130	33,940	*1,810*	2027-28	25,270	26,690	*1,420*
2029	32,340	34,400	*2,060*	2028-29	25,760	27,610	*1,850*
2030	32,580	34,910	*2,330*	2029-30	26,350	28,560	*2,210*
2031	32,880	35,480	*2,600*	2030-31	27,020	29,650	*2,630*
2032	33,320	36,130	*2,810*	2031-32	27,900	30,960	*3,060*
2033	33,830	36,810	*2,980*	2032-33	28,850	32,540	*3,690*
2034	34,210	37,480	*3,270*	2033-34	29,950	34,350	*4,400*

The NYCA LOLE results are in the figure below and show that the higher demand would result in an LOLE violation by 2032.

Figure 14: High Demand Scenario NYCA LOLE Results

Sudy Year	Base Case	High Demand Scenario
2025	0.024	0.036
2026	0.006	0.013
2027	0.006	0.015
2028	0.005	0.016
2029	0.006	0.028
2030	0.001	0.026
2031	0.004	0.081
2032	0.010	0.298
2033	0.022	1.328
2034	0.094	2.744

CHPE Delayed Scenario

The proposed 1,250 MW CHPE project was included in the 2024 RNA Base Case starting summer 2026. The CHPE project is assumed to inject 1,250 MW into New York City from Hydro Quebec in the summer and zero MW in the winter. This scenario removes the CHPE project to gauge the impacts of potential delays in the project's development. The results are in Figure 15 below.

The scenario shows that the impact of CHPE's delay or failure to enter service on NYCA LOLE is significant.

Figure 15: Scenario with CHPE Removed NYCA LOLE Results (event-days/year)

Study Year	Base Case	Without CHPE Scenario
2025	**0.024**	0.024
2026	**0.006**	0.014
2027	**0.006**	0.010
2028	**0.005**	0.008
2029	**0.006**	0.010
2030	**0.001**	0.005
2031	**0.004**	0.014
2032	**0.010**	0.029
2033	**0.022**	0.044
2034	**0.094**	0.119

Addition of Other Proposed Projects Scenarios

The 2024 RNA Base Case included certain proposed projects that met the reliability inclusion rules and are in advanced development stages. These projects only represent a fraction of the proposed projects that have interconnection requests undergoing study in the NYISO's interconnection processes.

The 2024 RNA performed two scenarios, one at a time, on the RNA Base Case:

- One scenario added approximately 5,000 MW of resource projects that are in an advanced stage of development but has not yet met the reliability planning inclusion rules to be included in the 2024 RNA Base Case. This amounted to approximately 2,500 MW solar, 1,500 MW land-based wind, and 1,000 MW battery storage.
- One scenario added approximately 7,000 MW of additional proposed offshore wind (5,000 MW in Zone J and 2,000 MW in Zone K) for a total of about 9,000 MW interconnected to the NYCA.

The results of these scenarios are below and show that LOLE falls well below criterion for each of the scenarios for study year 10 (2034).

Figure 16: Additional Proposed Projects Scenarios NYCA LOLE Results

	Base Case	Scenario	Scenario
Stduy Year	**With Large Load Flexibility**	**Additional Proposed Projects *(5,000 MW)***	**Additional Offshore Wind *(7,000 MW)***
2034	0.094	0.030	0.031

Next Steps

As with any planning study, there is a level of uncertainty in the key assumptions used in the 2024 RNA given the 10-year planning horizon. Through the Reliability Planning Process and Short-Term Reliability Process, the NYISO will monitor system developments and update assumptions as new information becomes available. Additional actions include:

- Monitoring the impact of projects that did not satisfy the reliability planning inclusion rules but have completed an interconnection facilities study, including projects in Class Year 2023, and projects selected in the upcoming NYSERDA large-scale renewable, offshore wind, and storage procurement efforts;
- Considering market rules and behaviors of various existing and future markets programs, such as demand response, DER, capacity accreditation, and winter fuel risks in planning assumptions; and
- Continuing to monitor the development of the existing and proposed large loads.

Appendix A – 2024 RNA Resource Adequacy Assumptions

2024 RNA MARS Assumptions Matrix

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
Key Assumptions and Reports			
1	**Links to Key Assumptions Presentations and Final Reports**	Nov 15, 2022: NYISO Board approval and final 2022 RNA posting. 2022 RNA Report link 2022 RNA Appendix link	**March 1 ESPWG/TPAS**: Draft Schedule [link] **April 18 ESPWG/TPAS/LFTF [link]**: Schedule, Scenarios, Assumptions Matrices for resource adequacy and transmission security **April 30 ESPWG/TPAS** [link]: Winter Gas Derates **July 25 ESPWG/TPAS** [link]: preliminary RNA results presentation **September 3, 2024 ESPWG/TPAS** [link]: Updated results **September 27, 2024 ESPWG/TPAS** [link]: Updated results October 17, 2024 OC: Vote on Draft Report October 31, 2024 MC: Vote on Draft Report, and MMU's review November 2024: NYISO's Board of Directors approval
Load Parameters			
1	**Peak** Load Forecast	Adjusted 2022 Gold Book NYCA baseline peak load forecast. It includes large loads from the NYISO interconnection queue, with forecasted impacts. Baseline load represents coincident summer peak demand and includes the reductions due to projected energy efficiency programs, building codes and standards, BtM storage impacts at peak, distributed energy resources and BtM solar photovoltaic resources; it also reflects expected impacts (increases) from projected electric vehicle usage and electrification. The GB 2022 baseline peak load forecast includes the impact (reduction) of behind-the-meter (BtM) solar at the time of NYCA peak. For the BtM Solar adjustment, gross load forecasts that include the impact of the BtM generation will be used for the 2022 RNA, as provided by the Demand Forecasting Team which then allows for a discrete modeling of the BtM solar resources using 5 years of inverter data.	Adjusted 2024 Gold Book NYCA baseline peak load forecast. It includes large loads from the NYISO interconnection queue, with forecasted impacts. Baseline load represents coincident summer peak demand and includes the reductions due to projected energy efficiency programs, building codes and standards, BtM storage impacts at peak, distributed energy resources and BtM solar photovoltaic resources; it also reflects expected impacts (increases) from projected electric vehicle usage and electrification. The GB 2024 baseline peak load forecast includes the impact (reduction) of behind-the-meter (BtM) solar at the time of NYCA peak. For the BtM Solar adjustment, gross load forecasts that include the impact of the BtM generation will be used for the 2024 RNA, as provided by the Demand Forecasting Team which then allows for a discrete modeling of the BtM solar resources using 5 years of inverter data.
2	Load **Shapes** (Multiple Load Shapes)	**New Load Shapes** *(see March 24, 2022 LFTF/ESPWG):* Used Multiple Load Shape MARS Feature 8,760-hour historical gross load shapes were used as base shapes for LFU bins: Load Bins 1 and 2: 2013 Load Bins 3 and 4: 2018	Used Multiple Load Shape MARS Feature *(see March 24, 2022LFTF/ESPWG).* 8,760-hour historical gross load shapes were used as base shapes for LFU bins: Load Bins 1 and 2: 2013 Load Bins 3 and 4: 2018 Load Bins 5 to 7: 2017

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
		Load Bins 5 to 7: 2017 Historical load shapes are adjusted to meet zonal (as well as G-J) coincident and non-coincident peak forecasts (summer and winter), while maintaining the energy targets. For the BtM Solar discrete modeling, gross load forecasts that include the impact of the BtM generation are used (additional details under the BtM Solar category below).	Historical load shapes are adjusted to meet zonal (as well as G-J) coincident and non-coincident peak forecasts (summer and winter), while maintaining the energy targets. For the BtM Solar discrete modeling, gross load forecasts that include the impact of the BtM generation are used (additional details under the BtM Solar category below).
3	Load Forecast Uncertainty (LFU) The LFU model captures the impacts of weather conditions on future loads.	2022 LFU Updated via Load Forecast Task Force (LFTF) process. Updated LFU values *(as presented at the April 21, 2022 LFTF [link])*	2024 LFU Updated via Load Forecast Task Force process. Same summer LFU values as the ones presented in 2023 *(as presented at the May 26, 2023 LFTF [link] and also presented at the April 18, 2024 LFTF [link])* New Method for Winter: **Winter Dynamic Load Forecast Uncertainty (LFU):** In order to reflect uncertainty stemming from electrification, electric vehicles (EVs), and large loads, the 2024 RNA will use a winter LFU multipliers model. Over the study period year 2 through year 10, dynamic winter LFU multipliers were calculated, reflecting the increasing share and load behavior of EV charging load, heating electrification, and large load projects. The dynamic winter LFU multipliers increase over the study horizon, reflecting the increasing winter weather sensitivity due to additional EV charging and electric heating load. Note: the first winter of the study period (winter 2024-25) match those calculated using recent winter load and weather data. Additional details are available in the April 18 TPAS/ESPWG/LFTF presentation [link]
Generation Parameters			
1	**Existing** Generating Unit Capacities (*e.g., thermal units, large hydro)*	2022 Gold Book values: Summer is min of (DMNC, CRIS). Winter is min of (DMNC, CRIS). Adjusted for RNA Base Case inclusion rules application.	2024 Gold Book values: Summer is min of (DMNC, CRIS). Winter is min of (DMNC, CRIS). Adjusted for RNA Base Case inclusion rules application
2	**Proposed New Units Inclusion** Determination	2022 Gold Book with RNA Base Case inclusion rules applied *See April 26, 2022 TPAS/ESPWG*	2024 Gold Book with RNA Base Case inclusion rules applied *See April 18, 2024 TPAS/ESPWG*
3	Retirement, Mothballed Units, IIFO	2022 Gold Book with RNA Base Case inclusion rules applied *See April 26, 2022 TPAS/ESPWG*	2024 Gold Book with RNA Base Case inclusion rules applied *See April 18, 2024 TPAS/ESPWG*

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
4	Forced and Partial Outage Rates (*e.g., thermal units)*	Five-year (2017-2021) GADS data for each unit represented. Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period. For new units or units that are in service for less than three years, NERC 5-year class average EFORd data are used.	Five-year (2019-2023) GADS data for each unit represented. Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period. For new units or units that are in service for less than three years, NERC 5-year class average EFORd data are used.
5	Modeling of Non-firm Gas Unavailability During Winter Peak Conditions	N/A	New: In order to simulate anticipated risks from cold snaps on the gas availability, gas plants available MWs in NYCA are further derated, *i.e.,* all gas-only units with non-firm gas within the NYCA are assumed unavailable. Also, certain dual-fuel units with duct-burn capability are derated. The forecasted winter coincident peak is used to determine when the gas derates are applied in the RNA Base Cases and for each load bin and Study Year.
6	Daily Maintenance	Fixed maintenance based on schedules received by the NYISO.	Based on schedules received by the NYISO.
7	Weekly Planned Maintenance	MARS is automatically scheduling maintenance based on NYCA capacity and demand. Data: 5y (2017-2021) of historical scheduled maintenance data from Operations and GADS system to determine the number of weeks on maintenance for each thermal unit.	MARS is automatically scheduling maintenance based on NYCA capacity and demand. Data: 5y (2019-2023) of historical scheduled maintenance data from Operations and GADS system to determine the number of weeks on maintenance for each thermal unit.
8	Summer Maintenance	None	None
9	Combustion Turbine Derates	Derate based on temperature correction curves. Thermal derates are based on a ratio of peak load before LFU is applied and LFU applied load. For new units: used data for a unit of same type in same zone, or neighboring zone data.	Derate based on temperature correction curves. Thermal derates are based on a ratio of peak load before LFU is applied and LFU applied load. For new units: used data for a unit of same type in same zone, or neighboring zone data.
10	Existing Landfill Gas (LFG) Plants	Actual hourly plant output over the last 5 years. Program randomly selects an LFG shape of hourly production over the last 5 years for each model replication. Probabilistic model is incorporated based on five years of input shapes, with one shape per replication randomly selected in the Monte Carlo process.	Actual hourly plant output over the last 5 years. Program randomly selects an LFG shape of hourly production over the last 5 years for each model replication. Probabilistic model is incorporated based on five years of input shapes, with one shape per replication randomly selected in the Monte Carlo process.

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
11	Existing and Proposed **Wind** Units	Actual hourly plant output over the last 5 years (2017-2021). Probabilistic model is incorporated based on five years of input shapes with one shape per replication being randomly selected in Monte Carlo process.	New data source: Model-based hourly data over the available past 5 years (2017-2021 developed by DNV-GL). For any unit that was included in the DNV data the data "as is" was used. For any unit not included a weighted zonal average was modeled. Probabilistic model is incorporated based on five years of input shapes with one shape per replication being randomly selected in Monte Carlo process.
12	Proposed **Offshore Wind** Units	RNA Base Case inclusion rules Applied to determine the generator status. Power curves based on 2008-2012 NREL from 3 different sites: NY Harbor, LI Shore, LI East, and GE updates of the NREL curves reflecting derates.	RNA Base Case inclusion rules Applied to determine the generator status. New data source: 5 years of hourly model-based data as developed by DNV-GL (2017-2021)
13	Existing and Proposed **Utility-scale Solar Resources**	Probabilistic model chooses from the production data output shapes covering the last 5 years. One shape per replication is randomly selected in Monte Carlo process.	New data source: Probabilistic model chooses from the model-based data shapes covering past available 5 years (2017-2021), as developed by DNV-GL. One shape per replication is randomly selected in Monte Carlo process.
14	**BtM Solar Resources**	**Supply side:** Five years (2017-20217) of 8,760 hourly MW profiles based on sampled inverter data. The MARS random shape mechanism randomly picks ne 8,760 hourly shape (of five) for each replication year; similar with the past planning modeling and aligns with the method used for wind, utility solar, landfill gas, and run-of-river facilities. **Load side:** Gross load forecasts for the 2022 RNA, as developed by the NYISO forecasting team.	**Supply side:** Five years (2017-2021) of 8,760 hourly MW profiles based on sampled inverter data. The MARS random shape mechanism randomly picks one 8,760 hourly shape (of five) for each replication year; similar with the past planning modeling and aligns with the method used for wind, utility solar, landfill gas, and run-of-river facilities. **Load side:** Gross load forecasts for the 2024 RNA, as developed by the NYISO forecasting team.
15	Existing **BTM-NG Program**	These units are former load modifiers that sell capacity into the ICAP market. Modeled as cogen type 1 (or type 2 as applicable) unit in MARS. Unit capacity set to CRIS value, load modeled with weekly pattern that can change monthly.	These units are former load modifiers that sell capacity into the ICAP market. Modeled as cogen type 1 (or type 2 as applicable) unit in MARS. Unit capacity set to CRIS value, load modeled with weekly pattern that can change monthly.
16	Existing **Small Hydro** Resources (*e.g.,* run of river)	Actual hourly plant output over the past 5 years period. Program randomly selects a hydro shape of hourly production over the 5-year window for each model replication. The randomly selected shape is multiplied by their current nameplate rating.	Actual hourly plant output over the past 5 years period. Program randomly selects a hydro shape of hourly production over the 5-year window for each model replication. The randomly selected shape is multiplied by their current nameplate rating.

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
17	Existing **Large Hydro**	Probabilistic Model based on 5 years of GADS data. Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period. Methodology consistent with thermal unit transition rates.	Probabilistic Model based on most recent 5 years of GADS data (2019-2023). Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period. Methodology consistent with thermal unit transition rates.
18	Proposed front-of-meter **Battery Storage**	GE MARS 'ES' model is used. Units are given a maximum capacity, maximum stored energy, and a dispatch window.	GE MARS 'ES' model is used. Units are given a maximum capacity, maximum stored energy, and a dispatch window. Limited to one charge/discharge cycle per day.
19	Existing Energy Limited Resources (**ELRs)**	**New method:** GE developed MARS functionality to be used for ELRs. Resource output is aligned with the NYISO's peak load window when most loss-of-load events are expected to occur.	GE developed MARS functionality to be used for ELRs. Resource output is aligned with the NYISO's peak load window when most loss-of-load events are expected to occur. Limited to one charge/discharge cycle per day.
Transaction – Imports/ Exports			
1	Capacity Purchases	Grandfathered Rights and other awarded long-term rights Modeled using MARS explicit contracts feature.	Grandfathered Rights and other awarded long-term rights Modeled using MARS explicit contracts feature.
2	Capacity Sales	These are long-term contracts filed with FERC. Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount	These are long-term contracts filed with FERC. Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount
3	FCM Sales	Model sales for known years Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount	Model sales for known years Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount
4	UDRs	Updated with most recent elections/awards information (VFT, HTP, Neptune, CSC) Added CHPE HTP (from Hydro Quebec into Zone J) at 1250 MW (summer only) starting 2026	Updated with most recent elections/awards information (VFT, HTP, Neptune, CSC) Added CHPE HVDC (from Hydro Quebec into Zone J) at 1250 MW (summer only) starting 2026.
5	External Deliverability Rights (EDRs)	**Cedars Uprate 80 MW**. Increased the HQ to D by 80 MW. Note: The Cedar bubble has been removed and its corresponding MW was reflected in HQ to D limit.	**Cedars Uprate 80 MW**. Modeled reflecting External CRIS rights.

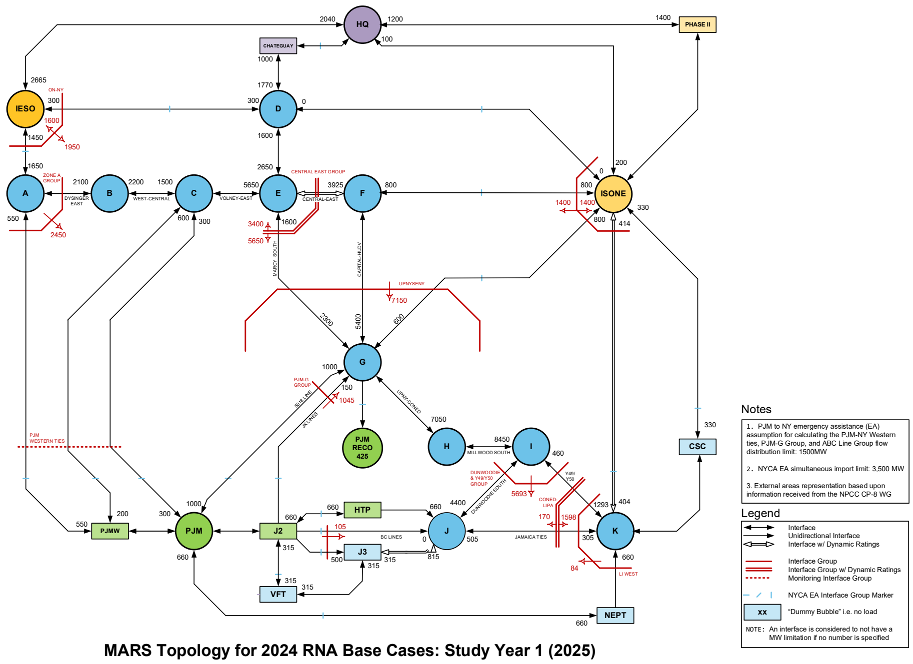
#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
6	Wheel-Through Contract	**300 MW HQ through NYISO to ISO-NE.** Modeled as firm contract; reduced the transfer limit from HQ to NYISO by 300 MW and increased the transfer limit from NYISO to ISO-NE by 300 MW.	**300 MW HQ through NYISO to ISO-NE.** Modeled as firm contract; reduced the transfer limit from HQ to NYISO by 300 MW and increased the transfer limit from NYISO to ISO-NE by 300 MW.
MARS Topology: a simplified bubble-and-pipe representation of the transmission system			
1	Interface Limits	Developed by review of previous studies and specific analysis during the RNA study process.	Developed by review of previous studies and specific analysis during the RNA study process.
2	New Transmission	Based on TO-provided firm plans (via Gold Book/LTP 2021-2020 process) and proposed merchant transmission facilities meeting the RNA Base Case inclusion rules.	Based on TO-provided firm plans (via Gold Book/LTP 2023-2024 processes) and proposed merchant transmission facilities meeting the RNA Base Case inclusion rules.
3	AC Cable Forced Outage Rates	All existing cable transition rates updated with data received from ConEd and PSEG-LIPA to reflect most recent five-year history.	All existing cable transition rates updated with data received from ConEd and PSEG-LIPA to reflect most recent five-year history.
4	UDR unavailability	Five-year history of forced outages.	Five-year history of forced outages.
Emergency Operating Procedures (EOPs)			
1	EOP Steps Order	1. Removing Operating Reserve 2. Special Case Resources (SCRs) (Load and Generator) 3. 5% Manual Voltage Reduction 4. 30-Minute Operating Reserve to Zero 5. 5% Remote Controlled Voltage Reduction 6. Voluntary Load Curtailment 7. Public Appeals 8. Emergency Assistance from External Areas 9. Part of the 10-Minute Operating Reserve to Zero (960 MW of 1310 MW) to Zero	New order: Implementing NYSRC ICS/EC November 9, 2023 decision for the new EOP order recommendation: 1. Removing Operating Reserve 2. Special Case Resources (SCRs) (Load and Generator) 3. 5% Manual Voltage Reduction 4. 30-Minute Operating Reserve to Zero 5. Voluntary Load Curtailment 6. Public Appeals 7. 5% Remote Controlled Voltage Reduction 8. Emergency Assistance from External Areas 9. Part of the 10-Minute Operating Reserve (910 MW of 1310 MW) to Zero
2	Special Case Resources (SCR)	SCRs sold for the program discounted to historic availability ("effective capacity"). Monthly variation based on historical experience. Summer values calculated from the latest available July registrations (July 2022 SCR enrollment) held constant for all years of study. Modeling 15 calls/year. Generation and load zonal MW are combined into one step.	SCRs sold for the program discounted to historic availability ("effective capacity"). Monthly variation based on historical experience. Summer values calculated from the latest available July registrations (July 2023 SCR enrollment) held constant for all years of study. New Method: SCRs are modeled as duration-limited resources. The duration limited units are constrained to be called once in a day when a loss of load event occurs, and are invoked between 5 and 7 hours (defined by zone), which is determined based on historical

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
			SCR performance in the applicable zone. Hourly response rates are used. The contribution by the SCRs vary monthly by applicable zone. These monthly values are also derived from historical performance of the SCRs. **Additional details in the January 3, 2024 ICS/ICAP presentation [link] and May 1, 2024 ICS [link].**
3	EDRP Resources	Not modeled if the values are less than 2 MW.	Not modeled if the values are less than 2 MW.
4	Operating Reserves	655 MW 30-min reserve to zero **960** MW (of 1310 MW) 10-min reserve to zero Note: the 10-min reserve modeling method is updated per NYISO's recommendation (approved at the May 4, 2022 NYSRC ICS [link]) to maintain (or no longer deplete/use) 350 MW of the 1,310 MW 10-min operating reserve at the applicable EOP step. Therefore, the 10-min operating reserve MARS EOP step will use, as needed each MARS replication: 960 MW (=1,310 MW–350 MW)	655 MW 30-min reserve to zero 910 MW (of 1310 MW) 10-min reserve to zero Note: the 10-min reserve modeling method is updated per NYISO's recommendation (approved at the May 5, 2023 NYSRC ICS [link]) to maintain (or no longer deplete/use) 400 MW of the 1,310 MW 10-min operating reserve at the applicable EOP step. Therefore, the 10-min operating reserve MARS EOP step will use, as needed each MARS replication: 910 MW (=1,310 MW–400 MW).
5	Other EOPs *(e.g., manual voltage reduction, voltage curtailments, public appeals, external assistance, as listed above)*	Based on TO information, measured data, and NYISO forecasts. Used 2022 elections, as available.	Based on TO information, measured data, and NYISO forecasts. Will use 2024 elections, as available.
External Control Areas Modeling Assumptions • External models (NE, HQ, Ontario, PJM) received via the NPCC CP-8 WG process. • The top 5 (changed from 3 starting 2024 RNA as an additional method to further limit reliance) summer and winter peak load days of an external Control Area is modeled as coincident with the NYCA top three peak load days. • Load and capacity fixed through the study years. • The renewable and energy limited shapes are removed. • EOPs are not represented for the external Control Area capacity models. • External Areas adjusted to be between 0.1 and 0.15 event-days/year LOLE by adjusting capacity pro-rata in all areas. • Implemented a statewide emergency assistance (from the neighboring systems) limit of 3500 MW. • LFU is applied to neighboring systems. • Same load historical years are used as NY.			
1	PJM	Simplified model: The 5 PJM MARS areas (bubbles) were consolidated into one starting 2020 RNA. As per RNA procedure.	Simplified model: The 5 PJM MARS areas (bubbles) were consolidated into one starting 2020 RNA. As per RNA procedure.

#	Parameter	2022 RNA (2022 Gold Book) Study Period: y4 (2026)-y10 (2032)	2024 RNA (2024 Gold Book) Study Period: y4 (2028)-y10 (2034)
2	ISONE	Simplified model: The 8 ISO-NE MARS areas (bubbles) were consolidated into one starting 2020 RNA	Simplified model: The 8 ISO-NE MARS areas (bubbles) were consolidated into one starting 2020 RNA
3	HQ	As per RNA Procedure.	Per RNA Procedure.
4	IESO	As per RNA procedure.	Per RNA procedure.
5	Reserve Sharing	All NPCC Control Areas indicate that they will share reserves **equally** among all members before sharing with PJM.	All NPCC Control Areas indicate that they will share reserves **equally** among all members before sharing with PJM.
6	NYCA Emergency Assistance Limit	Implemented a statewide limit of 3,500 MW, additional to the “pipe” limits.	Implemented a statewide limit of 3,500 MW, additional to the “pipe” limits.
Miscellaneous			
1	MARS Model Version	4.10.2035	4.14.2179

2024 RNA MARS Topology

2024 Planning Topology Year 1 (2025)



MARS Topology for 2024 RNA Base Cases: Study Year 1 (2025)

2024 Planning Topology Years 2-5 (2026 -2029)