New York ISO
Independent System Operator

2022 Reliability Needs Assessment (RNA)

A Report from the New York Independent System Operator

Draft Report

October 26, 2022, Management Committee

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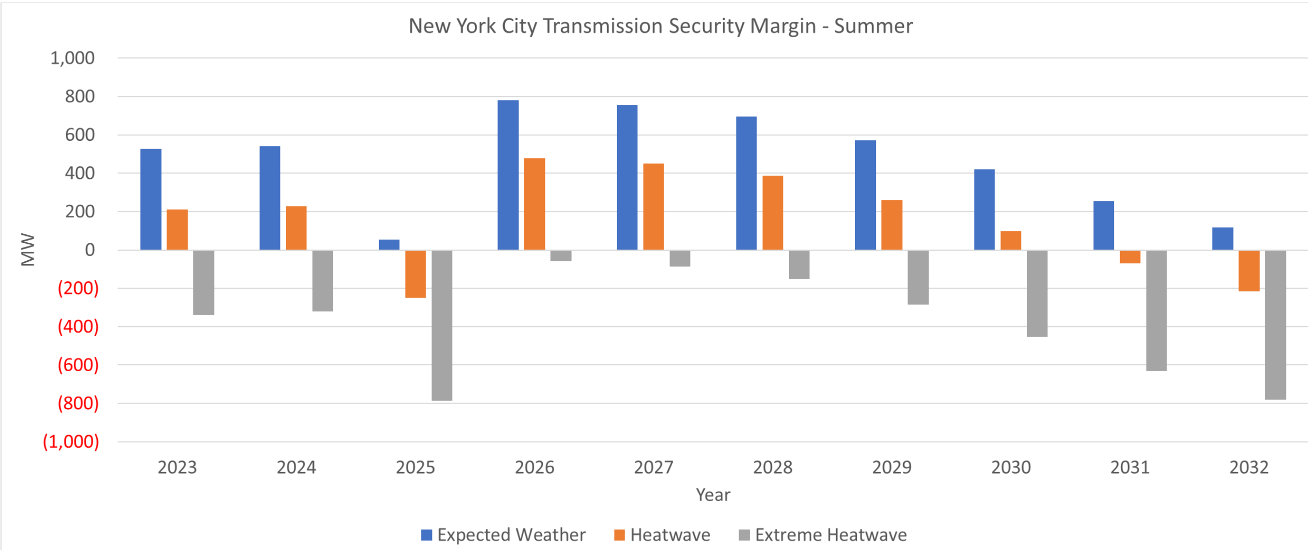
Executive Summary

This *2022 Reliability Needs Assessment* (RNA) evaluates the reliability of the New York bulk electric grid from 2026 through 2032, considering forecasts of peak power demand, planned upgrades to the transmission system, and changes to the generation mix over the next ten years. For this RNA, enhancements to the application of reliability rules were introduced to better represent expected system operations and conditions. The RNA assesses an actionable "base case" set of assumptions, as well as various scenarios that are provided for information. The RNA base case includes projected impacts driven by limitations on generator emissions, while the scenarios include an in-depth look at certain policy goals from the 2019 Climate Leadership and Community Protection Act (CLCPA). This RNA also discusses the reliability risks associated with stressed gas supply conditions as winter peak electric demand increases through time.

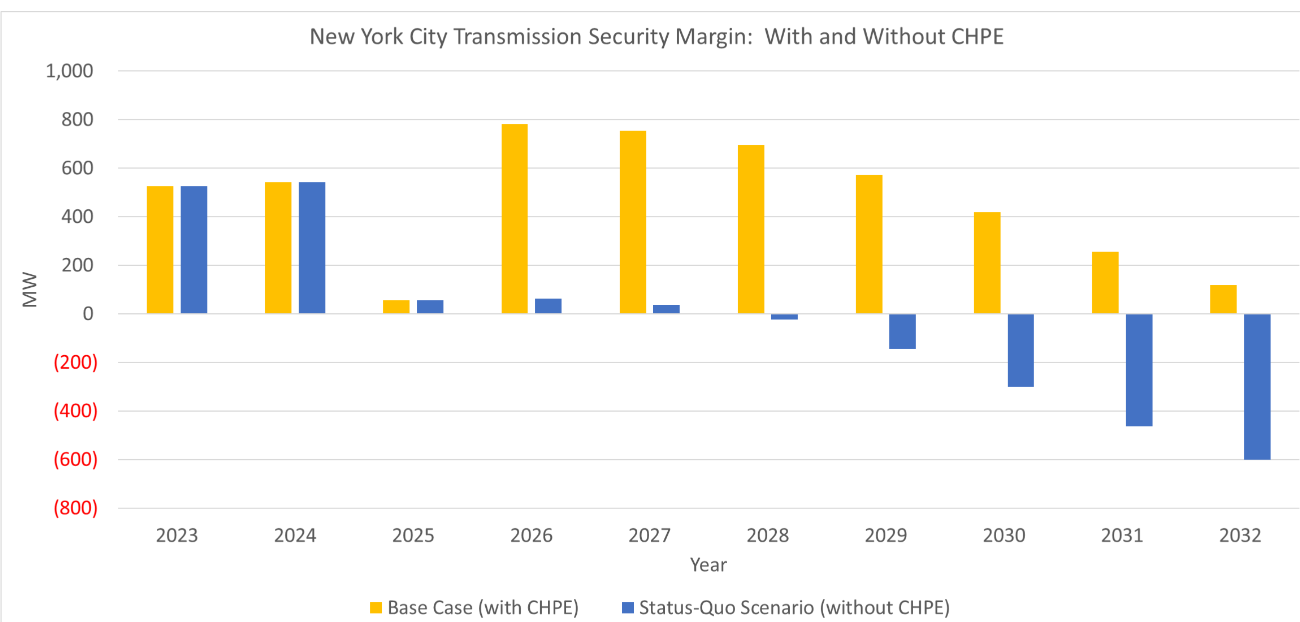
Narrowing Reliability Margins

The margin to maintain reliability over the next ten years could be eliminated based upon likely changes in planned system conditions. However, this RNA finds no long-term actionable reliability needs for the New York State Bulk Power Transmission Facilities as planned from 2026 through 2032 for the assumed future system demand and with the assumed planned projects meeting their proposed in-service dates. This finding is based on the Reliability Planning Process assumptions, which are set in accordance with applicable reliability design criteria and NYISO's procedures. Risk factors include increased system demand, delayed implementation of planned projects, additional generator deactivations, unplanned outages, and extreme weather.

Reliability margins decrease across the state through time, but the reliability of the New York City area faces the greatest risk due to limited generation and transmission to serve forecasted demand. For the assumed expected summer weather, the New York City grid as planned has limited transmission security margin in 2025 and approaches zero in ten years. The narrowing transmission security margins in the near term are primarily due to the planned unavailability of simple cycle combustion turbines to comply with the DEC's Peaker Rule in 2025. The summer margin improves in 2026 with the scheduled addition of the Champlain Hudson Power Express (CHPE) connection from Hydro Quebec to New York City but reduces through time as demand grows within New York City due to electrification of heating and transportation. However, demand forecast uncertainty or potential heatwaves of various degrees pose risks throughout the next ten years, especially in 2025. Some generation affected by the DEC Peaker Rule may need to remain in service until CHPE or other permanent solutions are completed to maintain a reliable grid and meet system demand.



The reliability margins within New York City may not be sufficient even for expected weather if (i) forecasted demand in New York City increases by as little as 60 MW in 2025, (ii) the CHPE project experiences a significant delay, or (iii) there are additional generator deactivations beyond what is already planned. In fact, the long-term demand forecast to be updated in early 2023 is expected to increase substantially due to strong commercial and residential growth along with increased electrification of transportation and home appliances. Additionally, until the CHPE project or other permanent solution is in-service, the reliability margins will continue to be less than 100 MW for the assumed system demand, indicating that current plans significantly rely on a single project for the future reliability of the New York City grid.



Resource adequacy analysis also demonstrates a continued statewide reliance on neighboring regions to the point that New York would not have adequate resources throughout the next ten years if not for emergency assistance. Such emergency assistance assumes availability of resources from neighboring systems to send power to New York in an event that New York resources are inadequate. The NYISO will maintain interregional collaboration with neighboring systems to monitor the availability of emergency assistance as the resource mix transitions throughout the entire Eastern Interconnection.

The wholesale electricity markets administered by the NYISO are an important tool to help mitigate the risks identified in this RNA. These markets are designed, and continue to evolve and adapt, to send appropriate price signals for new market entry and retention of resources that assist in maintaining reliability. The potential risks and resource needs identified in the analyses may be resolved by new capacity resources coming into service, construction of additional transmission facilities, and/or increased energy efficiency and integration of demand-side resources. The NYISO is tracking the progression of many projects that may contribute to grid reliability, including numerous offshore wind facilities that are not yet included in the RNA base case. The NYISO will continue to monitor these market-based resources and other developments to determine whether changing system resources and conditions could impact the reliability of the New York bulk electric grid.

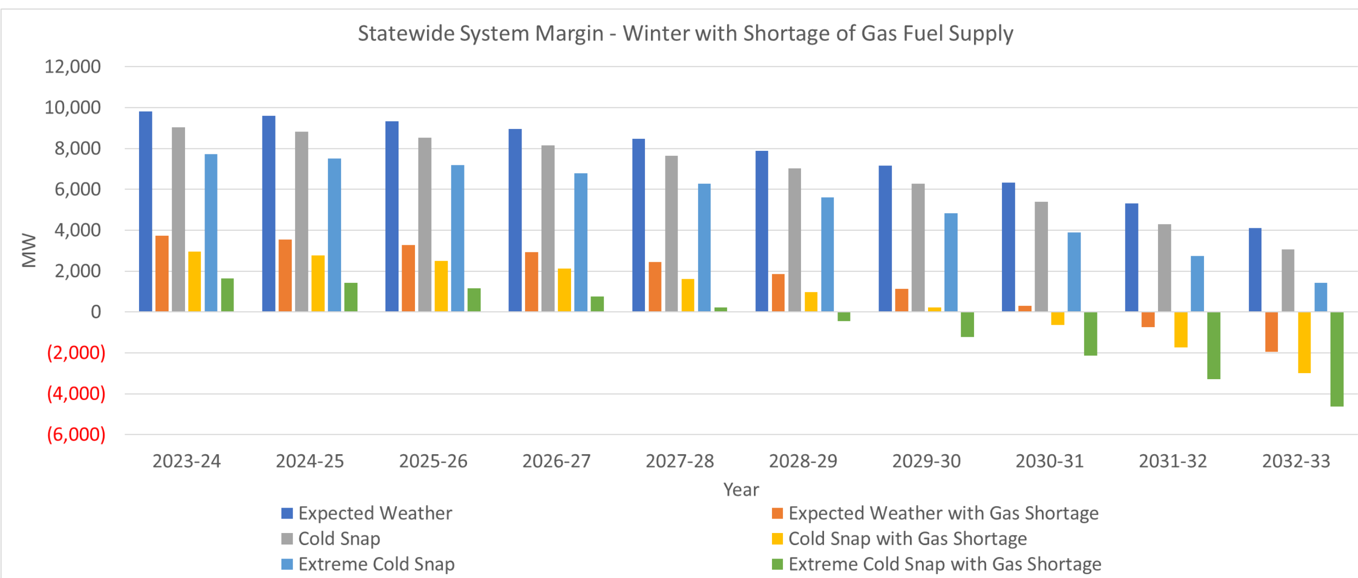
Reliability Risks Increasing in Winter

Clean energy production is a key underlying element of electrification policies driving the New York statewide system to become winter peaking in future decades primarily via heat pumps and electric vehicles. The *2022 Load & Capacity Data Report* (Gold Book) baseline forecast estimates a transition from a summer peaking system to a winter peaking system in 2034 primarily driven by electrification. Additionally, while the New York statewide system is forecast to be summer peaking throughout the RNA study period, many upstate zones are already winter peaking or will become winter peaking before the state as a whole.

Typically, NYISO reliability studies focus on summer peak as the most stressed system condition. However, with the forecasted increase in winter demand due to projected electrification and decrease in spring (light load) demand due to distributed energy resources (DER), reliability evaluations must continue to evolve toward a seasonal or even sub-seasonal focus to assess potential needs that could occur throughout all critical system states. In addition, some resources may have different contributions between summer and winter. For example, while CHPE will contribute to reliability in the summer, the facility is modeled as not having any capacity obligation in the winter.

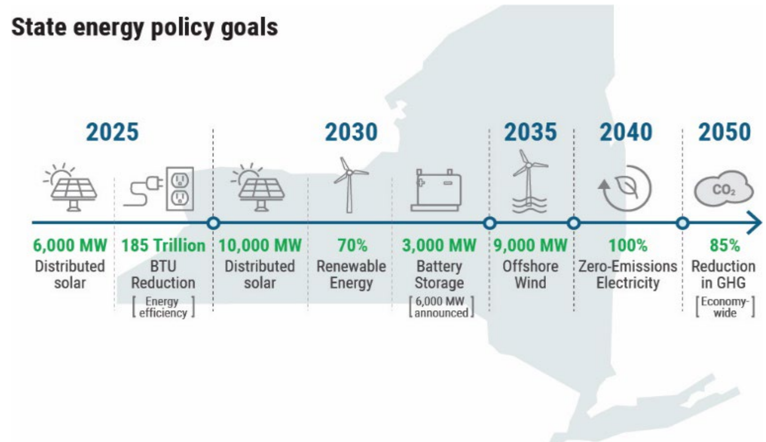
For this RNA, the NYISO assessed winter reliability for cold snap and gas supply shortage conditions. With input from NYISO's ongoing fuel & energy security initiatives, approximately 6,300 MW of existing gas-fueled generation was identified as potentially at-risk under gas shortage conditions. Using a conservative assumption that all such generation is unavailable throughout December, January, and February of 2031-2032, the analysis demonstrates that system reliability would be diminished but still be maintained within the resource adequacy criterion. However, such gas shortage conditions would result in a statewide deficiency based on deterministic design criteria.

The following chart shows that there are sufficient margins for winter throughout the study period when there is adequate gas supply, but shortfalls could occur as early as 2028 for gas shortage conditions. Planning for the more extreme system conditions of heatwaves, cold snaps, and fuel availability is currently beyond established design criteria. However, the New York State Reliability Council (NYSRC) has established goals to identify the needed actions to preserve New York reliability for extreme weather events and other extreme system conditions. The NYISO supports refining the reliability rules and models to better represent fuel shortage conditions.

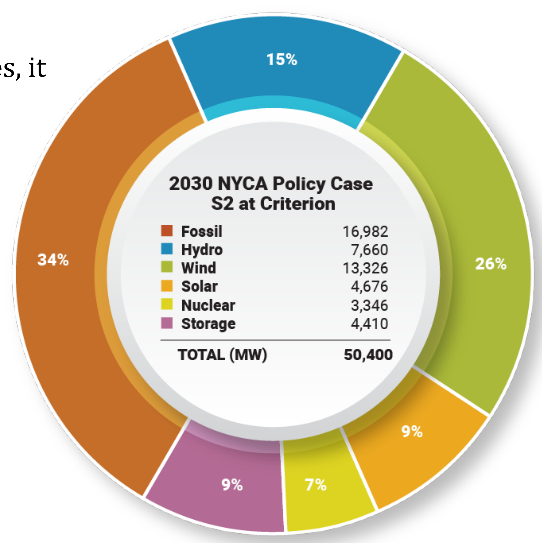


Road to 2040 – Reliability and Resiliency Challenges

Significant shifts are expected in both the demand and supply sides of the electric grid due to New York State clean energy polices and goals, and these changes will affect how the power system is currently planned and operated. For instance, the CLCPA targets include: 6,000 MW of distributed solar by 2025 (10,000 MW by 2030); 3,000 MW of battery storage by 2030; 70% renewable energy by 2030; 100% zero-emissions electricity by 2040; 9,000 MW of offshore wind by 2035; 85% reduction in greenhouse gas emissions by 2050. As part of the *2021-2040 System & Resource Outlook* (the Outlook), the NYISO assessed several policy-driven futures to identify potential resource mixes and examine resulting system constraints and operational limitations. This RNA builds upon the findings of the Outlook and its Policy Case with an analysis of the postulated 2030 system conditions.



In an electric grid with excess wind, solar, and storage resources, it is reasonable to expect that less efficient generation will retire. A resource adequacy analysis of the Policy Case 2030 representation demonstrates that a minimum of 17,000 MW of the existing fossil fleet will need to be retained to reliably serve a net peak demand of 26,700 MW postulated by this scenario. The necessary amount of fossil generation will be greater if the net peak demand approaches the NYISO's forecast of 31,700 MW. Additional fossil generation may also be needed to provide other reliability services such as black start, voltage support, governor response, etc.



With high penetration of renewable intermittent resources and the prospect of fossil fleet retirements beyond 2030, dispatchable emission-free resources (DEFRs) are needed to balance intermittent supply with demand. These types of resources must be significant in capacity and have attributes such as the ability to come on-line quickly, stay on-line for as long as needed, maintain the system's balance and stability, and adapt to meet rapid, steep ramping needs.

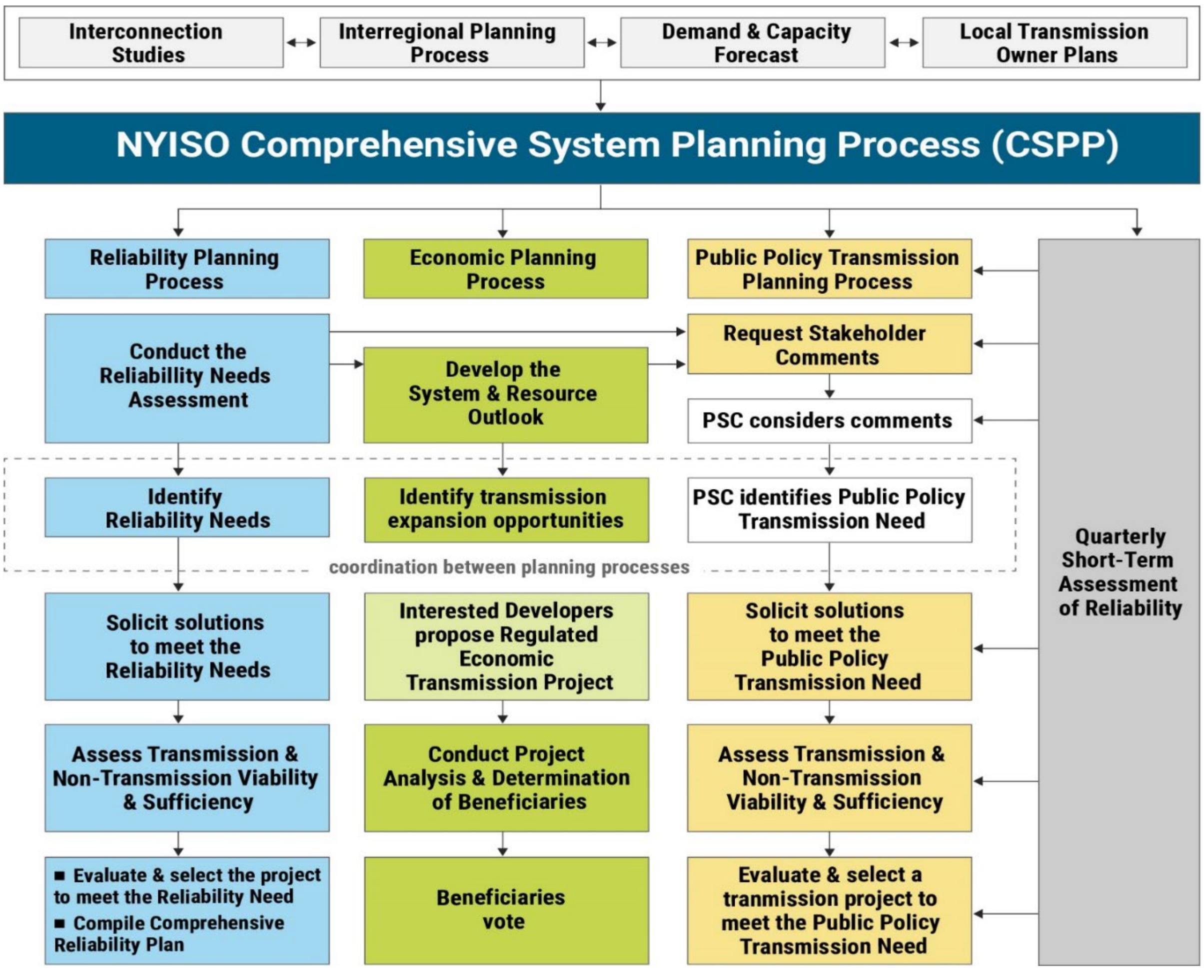
RNA Key Takeaways

- The margin to maintain reliability over the next ten years could be eliminated based upon likely changes in planned system conditions. However, this RNA finds no long-term actionable reliability needs for the New York State Bulk Power Transmission Facilities as planned from 2026 through 2032 for assumed system demand and with the assumed planned projects meeting their proposed in-service dates.
- New York City reliability margins are very tight decreasing to approximately 50 MW by 2025 primarily due to the planned unavailability of simple cycle combustion turbines to comply with the DEC's Peaker Rule. The reliability of the grid is heavily reliant on the timely completion of planned transmission projects, chiefly Champlain Hudson Power Express (CHPE). Increased demand, significant delays in projects, or additional generator deactivations could all cause deficiencies in New York City. Some generation affected by the DEC Peaker Rule may need to remain in service until CHPE or other permanent solutions are completed to maintain a reliable grid.
- Demand forecast uncertainty or potential heatwaves of various degrees pose risks throughout the next ten years, especially in 2025. In fact, the long-term demand forecast for New York City, to be updated in early 2023, is expected to increase due to strong commercial and residential growth along with increased electrification of transportation and home appliances.
- New York's current reliance on neighboring systems is expected to continue through the next ten years. Without emergency assistance from neighboring regions, New York would not have adequate resources throughout the next ten years.
- Extreme events, such as heatwaves or storms, could result in deficiencies to serve demand statewide, especially in New York City, considering the plans included in this RNA. This outlook could improve as more resources and transmission are added to New York City.
- The New York statewide grid is projected to become a winter-peaking system in the mid-2030s, primarily driven by electrification of space heating and transportation. The New York statewide grid is reliable in the winter for the next ten years but will be stressed under gas supply shortage conditions that can occur during cold snaps.
- Planning for the more extreme system conditions of heatwaves, cold snaps, and fuel availability is currently beyond established design criteria. However, several reliability organizations are investigating whether these events should become design conditions.
- With increased renewable intermittent generation for achievement of the CLCPA goal of 70% renewable energy by 2030, at least 17,000 MW of existing fossil must be retained to continue to reliably serve forecasted demand. Beyond 2030, dispatchable emissions-free resources (DEFRs) will be needed to balance intermittent supply with demand.
- Since this RNA did not identify any Reliability Needs at this time, the NYISO will proceed to the *2023-2032 Comprehensive Reliability Plan* (CRP), to be completed in 2023. Through the Short-Term Reliability Process, the NYISO will conduct quarterly Short-Term Assessments of Reliability (STARs) to assess reliability needs within a five-year horizon. If necessary, the NYISO will seek solutions to address any reliability needs identified through that process.

Introduction

This report sets forth the NYISO's 2022 RNA and scenario findings for the study period of years 4 through 10 (*i.e.*, years 2026 through 2032). The RNA is the first of two main components of the Reliability Planning Process, which is one of the three processes that comprise the NYISO's Comprehensive System Planning Process (*see* Figure 1). The RNA is performed to evaluate electric system reliability according to resource adequacy and transmission security criteria over the study period.

Figure 1: The NYISO's Comprehensive System Planning Process (CSPP)



The RNA is developed by the NYISO in conjunction with stakeholders and interested parties as the first step in the Reliability Planning Process. The RNA assesses the reliability of the New York Bulk Power Transmission Facilities (BPTFs) as the foundation study used in the development of the Comprehensive Reliability Plan (CRP). Two major study types — resource adequacy and transmission security — are performed over the RNA study period (*i.e.,* year 4 through year 10, 2026-2032). If the RNA identifies any violation of reliability criteria[1] for BPTFs, the NYISO will report a Reliability Need quantified by an amount of compensatory megawatts (MW) in a location that would resolve that need. After the NYISO's Board approval of the RNA and if any Reliability Needs are left after the post-RNA Base Case updates process, the NYISO will solicit market-based solutions, designate one or more Responsible Transmission Owners (TOs) to develop regulated backstop solutions to address each identified Reliability Need, and solicit alternative regulated solutions from Other Developers, as defined by the NYISO tariff.

The CRP details the NYISO's plan for continued reliability of the BPTFs during the study period and identifies additional resources, or combinations of resources, that resolve any identified criteria violations in the RNA. New or proposed resources included in the CRP may be provided by market-based solutions developed in response to market forces, and by the request for solutions. If the market does not adequately respond, reliability will be maintained by either regulated backstop solutions developed by the Responsible TOs, which are obligated to provide reliable service to their customers, or alternative regulated solutions being developed by Other Developers. To maintain the long-term reliability of the BPTFs, these additional resources must be readily available or in development at the appropriate time to address the identified need.

Proposed solutions that are submitted in response to an identified Reliability Need are evaluated in the development of the CRP and must satisfy reliability criteria. However, the solutions submitted to the NYISO for evaluation in the CRP do not have to be in the same amounts of MW or locations as the compensatory MW reported in the RNA. There are various combinations of resources and transmission upgrades that could meet the needs identified in the RNA. The reconfiguration of transmission facilities and/or modifications to operating protocols identified in the solution phase could result in changes and/or modifications of the needs identified in the RNA.

This report begins by highlighting the changes to the Reliability Planning Process recently implemented in the NYISO's tariffs and procedures. Next, this report summarizes the prior Reliability Planning Process findings and reliability plans. The report continues with a summary of the load and resource forecast for the RNA study period, the RNA Base Case assumptions and methodology, and the RNA findings. Detailed analyses, data and results, and the underlying modeling assumptions are contained in the appendices.

Along with addressing reliability, the Reliability Planning Process is also designed to provide information that is both informative and of value to the New York wholesale electricity marketplace and federal and state policymakers. For informational purposes, this RNA report reviews activities related to

[1] A condition identified by the NYISO in the RNA as a violation or potential violation of Reliability Criteria as defined by the OATT.

environmental regulatory programs and other relevant developments. The RNA report also provides the latest historical information for the past five years of congestion, and related data is posted on the NYISO's website.

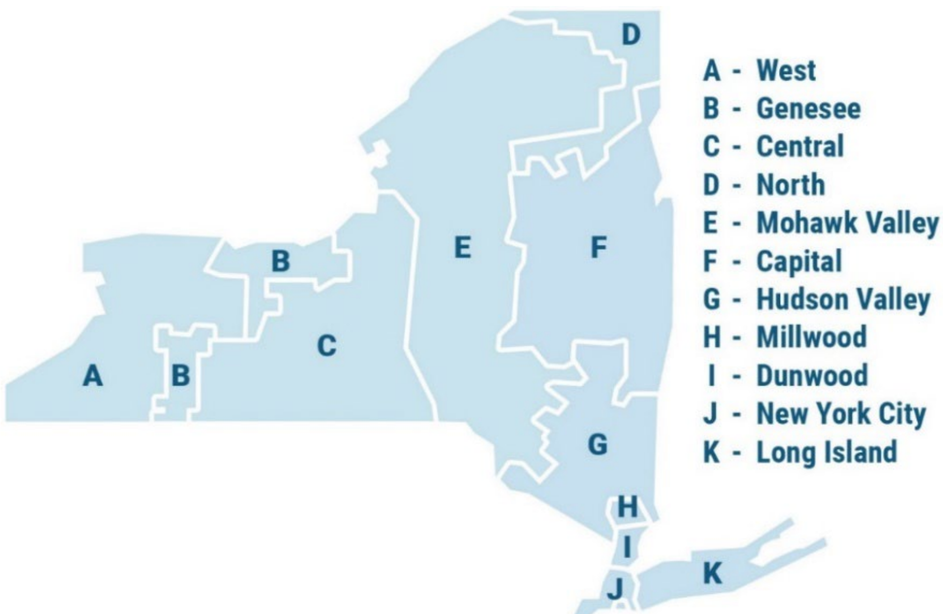
An overview of the Reliability Planning Process is illustrated in Figure 2 in **Appendix B** and is described in the Reliability Planning Process Manual.

State of the Grid

New York's power grid is dramatically changing how it serves consumers and the bulk power system is evolving to meet the state's clean energy objectives. The NYISO offers two annual publications—the *Load & Capacity Data Report*[2] (Gold Book) and *Power Trends*[3]—that provide independent sources of information and analysis on New York's electric system.

The New York Control Area (NYCA) is comprised of 11 geographical zones from western New York (Zone A) through Long Island (Zone K). These zones are referred to throughout this report to provide locational details regarding system demand, projected resource mixes, and anticipated transmission constraints. A map of the NYISO zones is shown in Figure 2.

Figure 2: NYISO Load Zone Map



The detailed data and analysis of the generation in New York can be found in the *Power Trends* Report. A summary of the current system resources is provided below to facilitate understanding of the findings in this report. **Figure 3** depicts the projected mix of resource capacity expected to be available for the 2022 summer capability period. **Figure 4** provides the energy production by fuel sources in 2021. In 2021, zero-emission resources made up 91% of upstate production, while fossil units downstate made up 89% of the production from that region.

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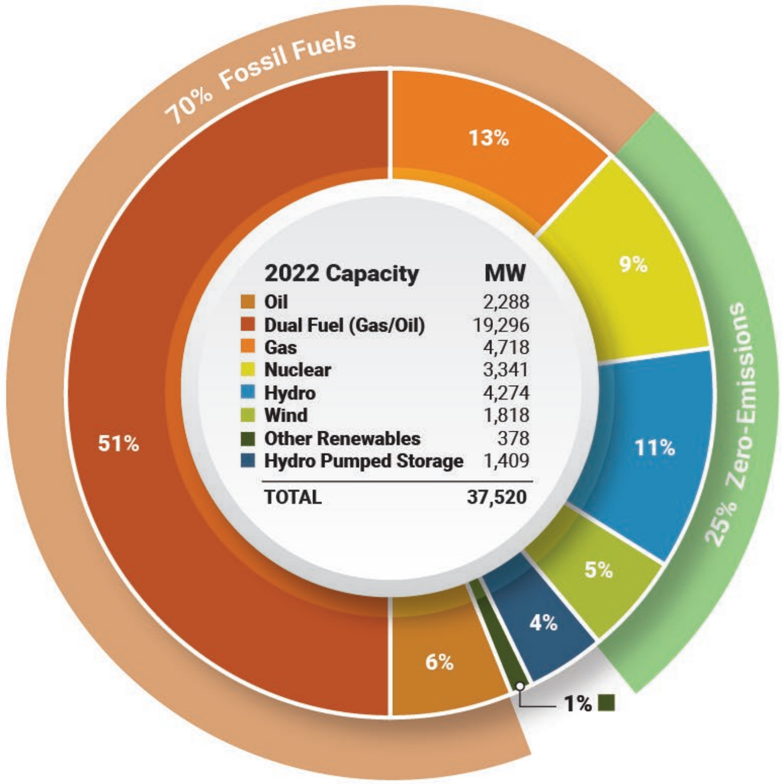
[2] 2022 Load & Capacity Data Report (Gold Book)

[3] 2022 Power Trends

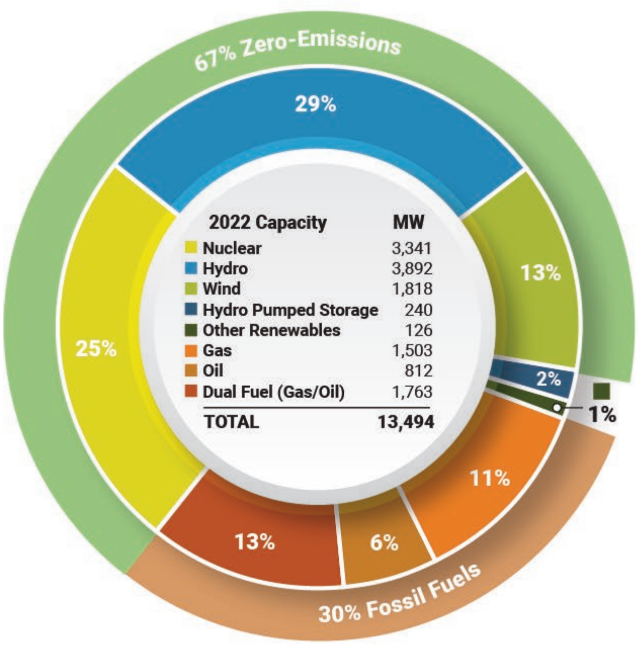
Figure 3: Summer Installed Capacity (MW) by Fuel Source – Statewide, Upstate, & Downstate New York: 2022

NYCA Summer Installed Capacity



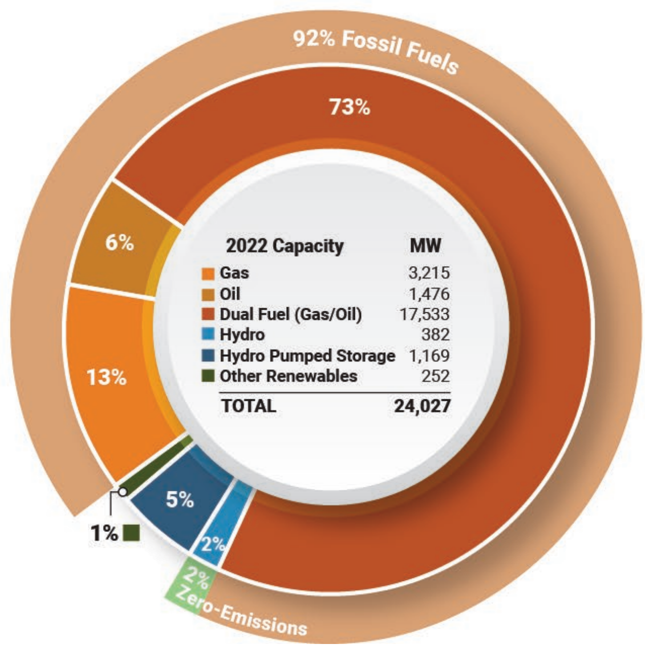
2022 Capacity	MW
Oil	2,288
Dual Fuel (Gas/Oil)	19,296
Gas	4,718
Nuclear	3,341
Hydro	4,274
Wind	1,818
Other Renewables	378
Hydro Pumped Storage	1,409
TOTAL	37,520

Upstate
Summer Installed Capacity
(Zones A-E)



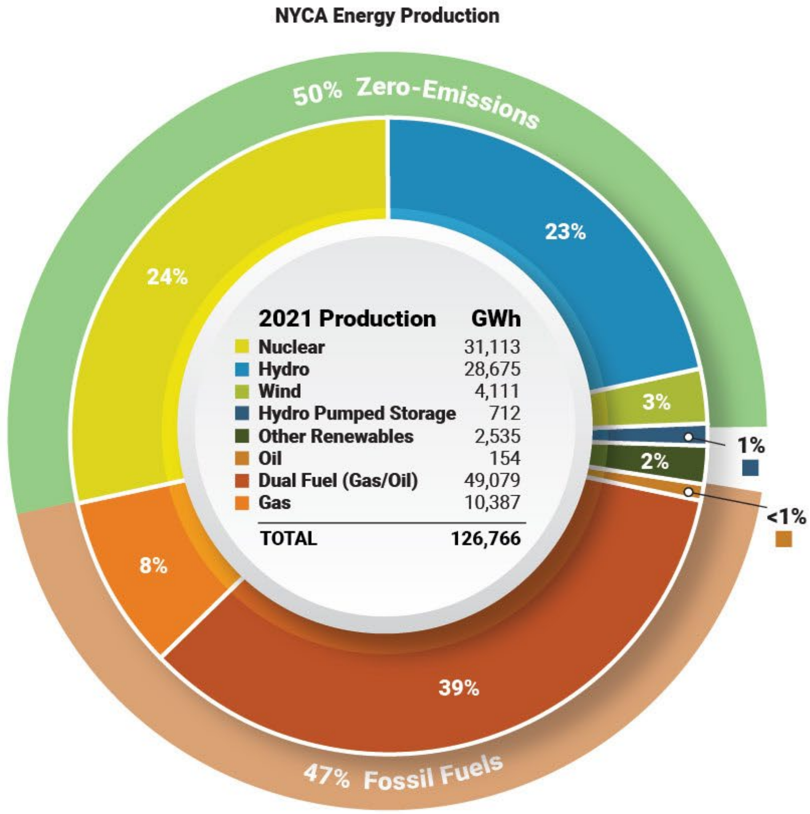
2022 Capacity	MW
Nuclear	3,341
Hydro	3,892
Wind	1,818
Hydro Pumped Storage	240
Other Renewables	126
Gas	1,503
Oil	812
Dual Fuel (Gas/Oil)	1,763
TOTAL	13,494

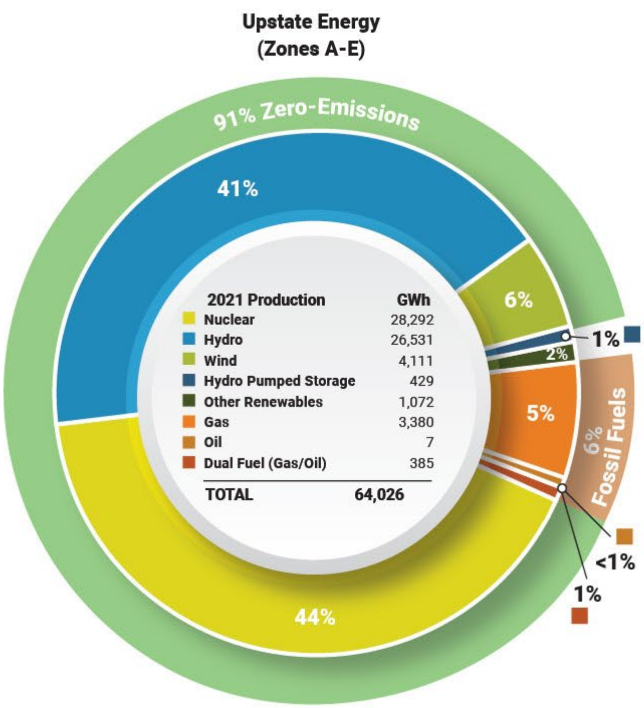
Downstate
Summer Installed Capacity
(Zones F-K)

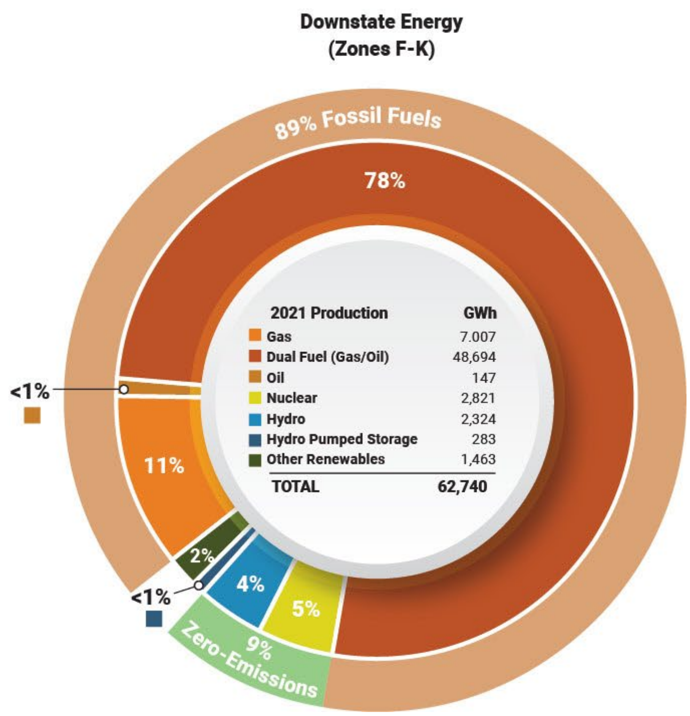


2022 Capacity	MW
Gas	3,215
Oil	1,476
Dual Fuel (Gas/Oil)	17,533
Hydro	382
Hydro Pumped Storage	1,169
Other Renewables	252
TOTAL	24,027

Figure 4: Energy Production by Fuel Source (GWh) – Statewide, Upstate, & Downstate New York: 2021



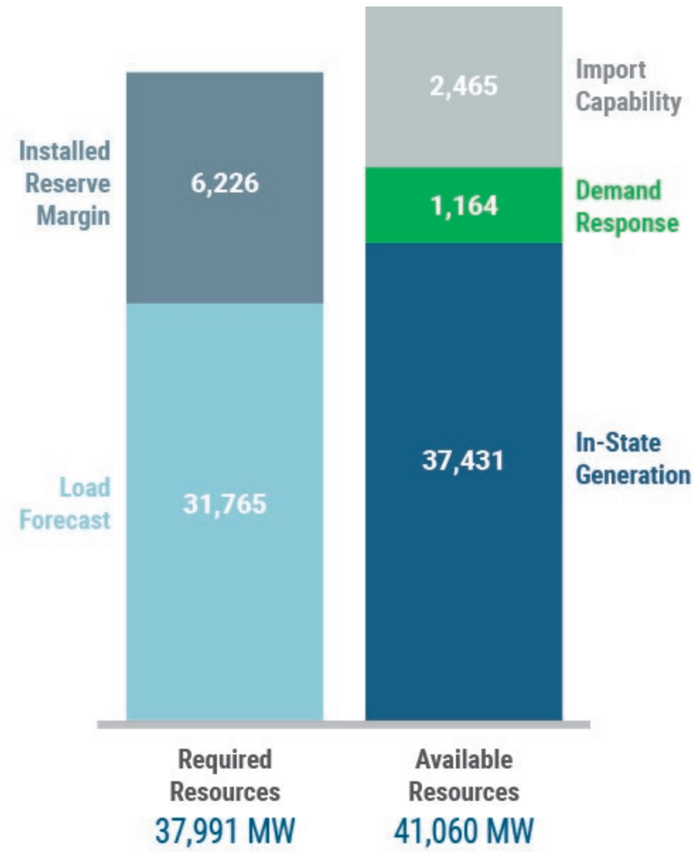




Total generation resource capability in New York for the summer of 2022 is projected to be 41,060 MW, which includes 37,431 MW of generating capability, 1,164 MW of Special Case Resources (SCR) and/or demand response, and 2,465 MW of net long-term purchases and sales with neighboring control areas.

For the 2022-23 capability year beginning May 1, 2022, the approved Installed Reserve Margin (IRM) is 19.6%. Based on a projected summer 2022 peak demand of 31,765 MW, the total installed capacity requirement for the upcoming summer capability period is 37,991 MW.

Figure 5: Statewide Resource Availability: Summer 2022



Summary of 2021-2030 Comprehensive Reliability Plan

The *2021-2030 Comprehensive Reliability Plan* (CRP) completed the NYISO's 2020-2021 cycle of the Reliability Planning Process. The *2020 Reliability Needs Assessment* (RNA), approved by the NYISO Board of Directors in November 2020, was the first step of the NYISO's 2020-2021 Reliability Planning Process.[4] The CRP followed the 2020 RNA and post-RNA updates and incorporated findings and solutions from the quarterly Short-Term Reliability Process.

The 2020 RNA identified reliability criteria violations and system deficiencies constituting actionable reliability needs primarily driven by a combination of forecasted peak demand and the assumed unavailability of 1,500 MW of generation in New York City affected by the New York State Department of Environmental Conservation (DEC) "Peaker Rule." The Peaker Rule limits nitrogen oxides (NOx) emissions from simple-cycle combustion turbines in a phased implementation from 2023 to 2025. After the RNA was published and before pursuing a solicitation for solutions, the NYISO considered subsequent updates to system plans. These updates included a reduced demand forecast to account for economic and societal effects from the COVID-19 pandemic and new local transmission plans and operating procedures by Con Edison for the New York City service territory.

- NYISO's load forecast update to account for the expected impact of COVID-19 and the associated economic and societal effects, as presented at the November 19, 2020 ESPWG/TPAS/LFTF meeting [link]
- Local Transmission Owner Plans (LTPs) updates to address local reliability deficiencies as presented by Con Edison at the January 25, 2021, ESPWG/TPAS [link]:
  - A new (2nd) 345/138 kV PAR controlled 138 kV Rainey – Corona feeder in 2023
  - A new (3rd) 345/138 kV PAR controlled 138 kV Gowanus – Greenwood feeder in 2025
  - A new 345/138 kV PAR controlled 138 kV Goethals – Fox Hills feeder in 2025
- Short-Term Reliability Process solution for addressing the 2023 short-term need identified in the 2020 Quarter 3 STAR [link]. The solution changed the planned operating status of existing series reactors, starting summer 2023 through 2030:
  - In-service: series reactors on the following 345 kV cables: 71, 72, M51, M52
  - Bypass: series reactors on the following 345 kV cables:[5] 41, 42, Y49

With these updates, there were no remaining violations of reliability design criteria at the end of the 2020-2021 Reliability Planning Process (RPP) cycle. This conclusion was captured in the 2021-2030 CRP.

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[4] Reliability planning study reports are available at: https://www.nyiso.com/library.

[5] Additional LTPs were subsequently presented by the Transmission Owners, such as further changing the status of the series reactors on Con Edison's cables #41 and #42 from assumed bypassed in this CRP (starting 2023) to in-service, starting summer 2025 – details in the July 23, 2021 ESPWG Con Edison's presentation [link]. This change is reflected in the 2021 Q3 STAR [link].

Regulatory Policy Activities

New York's climate goals continue to impact the electric system in profound ways. State and local requirements have created what are arguably the most aggressive energy and environmental policies in the nation. The question of how to maintain system reliability on the road to meeting the State's decarbonization goals has become a central issue.

This past year alone featured several announcements and developments that are reshaping the grid. In late 2021, the Climate Action Council (CAC), created under the CLCPA, released a *Draft Scoping Plan* to guide the state in reaching the CLCPA's requirements. In addition to addressing the clean energy objectives of the CLCPA, the *Draft Scoping Plan* calls for eliminating the use of fossil-fuels in any new home construction by 2025 and for multi-family or commercial buildings by 2030. In addition, the PSC approved the results of the state's competitive Tier 4 Clean Energy Standard solicitations, which sought proposals to deliver additional renewable energy into New York City. Two proposed transmission projects have since been awarded Tier 4 Renewable Energy Credit (REC) contracts.

Figure 6 summarizes key environmental regulations and energy policies affecting New York.

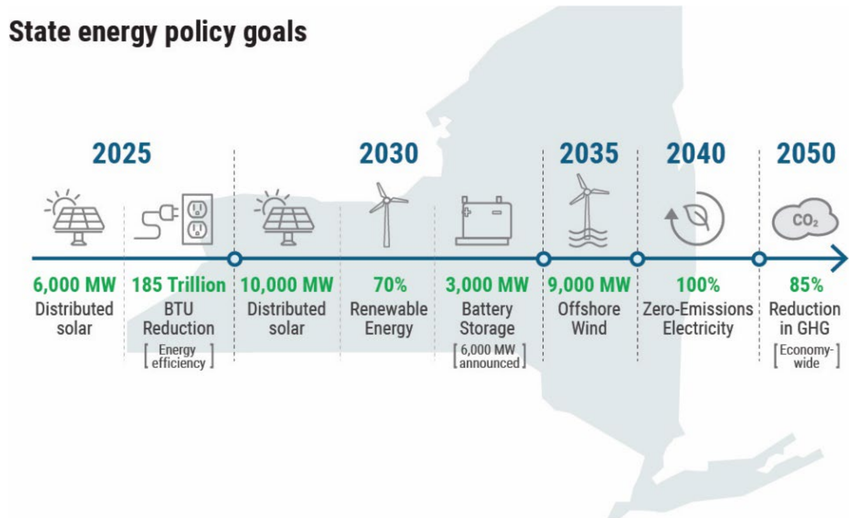
Figure 6: Summary Table of Key Environmental Regulations and Energy Policies

PUBLIC POLICY INITIATIVE	POLICYMAKING ENTITIES	PUBLIC POLICY GOALS	PUBLIC POLICY IMPLICATIONS
Climate Leadership and Community Protection Act (CLCPA)	NY PSC, New York State Energy Research and Development Authority (NYSERDA), DEC, CAC	**10,000 MW** of distributed solar installed by 2030: **185 trillion** BTU reduction in total energy consumption, including electrification to reduce fossil fuel use in buildings by 2025; **3,000 MW** of storage installed by 2030, with an-announced goal of 6,000 MW by 2030; 70% of load supplied by renewable resources by 2030; **9,000 MW** of offshore wind installed by 2035; and 100% of load supplied by zero-emissions resources by 2040. Reduce New York's greenhouse gas emissions by 85% of 1990 levels by 2050.	Transformation of the power grid, necessitating examination of market structures, planning processes, flexible load, and investment in bulk power system infrastructure.
"Peaker Rule" Ozone Season Oxides of Nitrogen (NOx) Emissions Limits for Simple Cycle and Regenerative Combustion Turbines	DEC	Reduce ozone-contributing pollutants associated with New York State-based peaking unit generation. Compliance obligations phased in between **2023** and **2025.**	DEC rule impacts approximately **3,300 MW** of peaking unit capacity in New York State. The NYISO analyzes compliance plans through its Reliability Planning Process (RPP) to determine whether the plans trigger reliability needs that must be addressed with solutions to maintain system reliability.
NYS Accelerated Renewable Energy Growth and Community Benefit Act	Office of Renewable Energy Siting (ORES) within the NYS Department of State, NY PSC, NYSERDA	Provides for an accelerated path for the permitting and construction of renewable energy projects other than the Article 10 power plant siting law, calls for a comprehensive study to identify cost-effective distribution, local and bulk electric system upgrades to support the state's climate goals, and to file the study with the New York State Public Service Commission. Calls for use of the NYISO's competitive Public Policy Process to meet transmission needs to meet CLCPA goals.	Intended to help accelerate siting of **eligible renewable resources** in support of state policy goals. Intended to establish new transmission investment priorities to facilitate the achievement of state policies.
New York City Residual Oil Elimination	City of New York	Eliminate combustion of fuel oil numbers 6 and 4 in New York City by **2020** and **2025,** respectively.	**2,946 MW** of installed capacity affected
New York City Local Law 97	New York City	Requires reduced building greenhouse gas emissions by 40% by **2030**, with compliance starting in **2024,** and 80% by **2050.**	Mandate applies to any building in NYC 25,000 square feet or larger; the law was updated in 2020 to include buildings in which up to 35% of units are rent regulated, starting in 2026. Officials estimate the law would **apply to roughly 50,000** of the city's more than one million buildings.

Discussion of Key Environmental Regulations and Energy Policies

Climate Leadership and Community Protection Act (CLCPA)

The Climate Action Council, created under the CLCPA, established six advisory panels, including a Power Generation Advisory Panel that included NYISO representation. The CAC also approved the formation of a Just Transition Working Group and a Climate Justice Working Group.



The CAC is expected to issue a final Scoping Plan by the end of 2022 outlining recommendations for the state to achieve the emissions reductions called for by the CLCPA.

Starting 2020, the NYISO has been performing CLCPA scenarios in both its reliability and economic planning processes.

Peaker Rule: Ozone Season Oxides of Nitrogen (NOx) Emission Limits for Simple Cycle and Regenerative Combustion Turbines

In December 2019, the DEC issued requirements to reduce emissions of nitrogen oxides, which are smog-forming pollutants, from peaking generation units.

The Peaker Rule, which phases in compliance obligations between 2023 and 2025, will affect approximately 3,300 MW of simple-cycle turbines located mainly in the lower Hudson Valley, New York City, and Long Island. While some of these units will be capable of complying with the rule's stricter emissions limits, approximately 1,600 MW of capability will be unavailable during the summer of 2025 based on filed compliance plans. Approximately 950 MW of that capability becomes unavailable starting May 2023. Importantly, the Peaker Rule allows the NYISO to designate resources that are needed to sustain reliability and continue operation on a temporary basis beyond 2023 and 2025.

The NYISO is actively assessing the implications of these compliance plans in its Reliability Planning Process, particularly via this RNA and ongoing quarterly Short-Term Assessment of Reliability reports.

NYS Accelerated Renewable Energy Growth and Community Benefit Act

The Accelerated Renewable Energy Growth and Community Benefit Act (the "Act") seeks to accelerate siting and construction of large-scale clean energy projects by establishing the Office of Renewable Energy Siting (ORES) within the New York State Department of State to oversee permitting approval for renewable generators larger than 25 MW. Under regulations issued by ORES, it must act on applications in the siting process within one year, or six months if the applicant is seeking to locate on certain former commercial or industrial sites.

The Act also authorized the New York Power Authority (NYPA) to undertake the development of transmission investments needed to achieve CLCPA targets. The NYPSC utilized this authority to authorize NYPA to pursue construction of its "Smart Path Connect" transmission expansion project in northern New York. NYPA, in partnership with National Grid, submitted its application to the NYPSC's Article VII transmission permitting process, which entails public participation prior to a final determination from the NYPSC before construction can begin. The 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 Act also directed the New York State Department of Public Service (DPS), in consultation with the New York State Energy Research and Development Authority (NYSERDA), NYPA, the Long Island Power Authority (LIPA), the investor-owned utilities, and the NYISO to conduct a comprehensive study to identify cost-effective distribution and local and bulk power system upgrades to support the state's climate and clean energy policies.

The initial *Power Grid Study*, delivered by the DPS and NYSERDA in January 2021, concluded that the public policy transmission projects already approved by the NYISO and the NYPSC, together with the NYPA priority projects, position the state to achieve the 70% by 2030 renewable energy requirement of the CLCPA. The report indicated that additional transmission would be needed to move toward the goal of a zero-emission electric system by 2040. Finally, the report indicated that transmission upgrades would be needed to facilitate delivery of land-based renewable resources and 9,000 MW of offshore wind capacity called for in the CLCPA.

As projects advance in their development process, they will be included in the reliability studies base cases.

New York City Residual Oil Elimination

New York City passed legislation in December 2017 prohibiting the combustion of fuel oil number 6 beginning in 2020 and fuel oil number 4 beginning in 2025. After 2025, only fuel oil number 2 may be combusted within New York City based generation. The rule is expected to impact 2,946 MW of generation in New York City, which previously used fuel oil number 6 or continue to use fuel oil number 4. Many generators in New York City that are connected to the local gas distribution network are required to maintain alternative fuel combustion capabilities.

Generators have taken steps to convert their facilities to comply with the law. While oil accounts for a relatively small percentage of the total electricity production in New York State, it is often called upon to fuel generation during critical periods, such as when severe cold weather limits access to natural gas. Dual-fuel capability serves as both an important tool in meeting reliability and an effective economic hedge against high natural gas prices during periods of high demand for natural gas.

In addition, the NYSRC has a minimum oil-burn requirement rule that is intended to maintain electric system reliability in the event of gas supply interruptions.

New York City Local Law 97

The New York City Council passed Local Law 97 in 2019, which mandates that any building 25,000 square feet or larger reduce its greenhouse gas emissions by 40% by 2030 and 80% by 2050, with compliance starting in 2024. One expected approach to compliance is the electrification of building systems currently reliant on fossil fuels, which is expected to significantly increase the demand for electricity. Officials estimate the local law applies to roughly 50,000 of New York City's more than one million buildings.

Base Case Assumptions

The NYISO has established procedures and a schedule for the collection and submission of data and for the preparation of the models used in the RNA. The Reliability Planning Process procedures are designed to allow planning activities to be performed in an open and transparent manner. The Reliability Planning Process is conducted under a defined set of rules that are aligned and coordinated with the related planning activities of the North American Electric Reliability Council (NERC), the Northeast Power Coordinating Council (NPCC), and the New York State Reliability Council (NYSRC). The assumptions underlying the RNA were reviewed at the ESPWG and TPAS and are shown in **Appendix D** of this report.

The RNA Base Cases were developed in accordance with NYISO procedures using projections for the installation and deactivation of generation resources and transmission facilities that were developed in conjunction with Market Participants and Transmission Owners:

- For the transmission security evaluations, the power flow RNA Base Case uses the NYISO 2022 FERC 715 filing as a starting point, adding and removing resources consistent with the base case inclusion screening process provided in Section 3 of the Reliability Planning Process Manual. Representations of neighboring systems are derived from interregional transmission planning coordination conducted under the Northeast Power Coordinating Council (NPCC) and the Eastern Interconnection Reliability Assessment Group (ERAG) Multiregional Modeling Working Group (MMWG) processes, and pursuant to the Northeast ISO/RTO Planning Coordination Protocol.
- For the resource adequacy evaluations, the models are developed starting with prior resource adequacy models and are updated with information from the *2022 Gold Book* and historical data, with the application of the inclusion rules. Information on modeling of neighboring systems is based on the input received from the NPCC CP-8 working group.

This section highlights the key assumptions and modeling data updates for the RNA. These include the load forecast model, the forecasted level of special case resources, the change in generation resource status, LTPs, and bulk power transmission projects. As described above, the RNA study period is from 2026 (year 4) through 2032 (year 10).

Load Forecast

The RNA Base Cases use a peak demand and energy forecast originating from the baseline forecast reported in the *2022 Gold Book*. The baseline forecast from the 2022 Gold Book is derived from energy and peak models that are built based on projections of end-use intensities and economic variables. End-use intensities modeled include those for lighting, refrigeration, cooking, heating, cooling, and other plug loads. The baseline forecast includes the projected impacts of energy efficiency programs, building codes and standards, distributed energy resources, behind-the-meter energy storage, behind-the-meter solar photovoltaic power, electric vehicle usage, and electrification of heating and other end uses. Economic variables considered include gross state product (GSP), households, population, and commercial and industrial employment. For the resource adequacy study, the baseline load forecast was modified by adding back the projected behind-the-meter solar impacts and explicitly modeling the solar generation. The factors considered in developing the 2022 RNA Base Case forecast are included in **Appendix C** of this report.

The demand-side management impacts include or account for in the 2022 Base Case forecast derive from actual and projected spending levels and realization rates for state-sponsored programs such as the CLCPA, Clean Energy Standard (CES), the Clean Energy Fund (CEF), the NY-SUN initiative, the energy storage initiative, and earlier programs developed as part of the Reforming the Energy Vision (REV) proceedings.

The baseline energy forecast for the 2022 RNA is generally higher than the 2020 RNA baseline forecast,[6] with a 2.2% increase in 2030. The baseline peak forecast for the 2022 RNA is generally lower than the 2020 RNA baseline forecast, including a 1.0% decline in 2030. The higher energy forecasts are primarily attributed to increasing impacts of electric vehicle charging and heating electrification. The lower peak forecasts are largely driven by the peak-reducing impacts of energy efficiency and growth in behind-the-meter solar capacity.

Figure 7 summarizes the baseline forecasts, Figure 8 summarizes the high load scenario, and Figure 9 shows a comparison of the between the 2020 RNA and 2022 RNA baseline forecasts and energy efficiency program impacts. Figure 10 and Figure 11 present actual, weather-normalized, and forecast values of annual energy and summer peak demand for the 2022 RNA. Figure 12 and Figure 13 present the NYISO's projections of annual energy and summer peak demand in the 2022 RNA for energy efficiency, distributed generation, and behind-the-meter (BtM) solar PV.

The long-term demand forecast will be updated in early 2023, and peak demand in New York City is expected to increase substantially due to strong commercial and residential growth along with increased electrification of transportation and home appliances.

[6] The 2021-2030 Comprehensive Reliability Plan utilized an updated forecast (relative to the 2020 Gold Book and RNA). The forecast values are included on slides 22, 23, and 34 in the November 19, 2020 Long Term Forecast Update presentation, which is available here.

Figure 7: 2022 RNA Load and Energy Forecast: Baseline Forecast, and Baseline with BtM Solar PV Forecasts Added Back

Baseline and Adjusted Baseline Energy Forecasts

Annual GWh	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2022 Econometric Energy Forecast	159,065	162,750	164,563	165,064	166,282	167,490	168,320	169,296	170,130	171,242	171,863
-- Energy Efficiency and Codes & Standards	2,616	5,458	8,557	11,862	15,218	18,466	21,545	24,447	27,186	29,735	31,883
-- BTM Solar PV	4,635	5,605	6,616	7,559	8,532	9,462	10,298	11,016	11,538	11,853	12,108
-- BTM Non-Solar Distributed Generation	1,656	1,739	1,840	1,900	1,964	2,019	2,068	2,118	2,171	2,224	2,263
+ Storage Net Energy Consumption	47	70	117	184	275	383	510	645	786	891	980
+ Electric Vehicle Energy	567	868	1,263	1,795	2,523	3,503	4,762	6,313	8,151	10,240	12,518
+ Building Electrification	488	1,234	2,110	3,038	4,184	5,541	7,109	8,867	10,848	13,029	15,413
2022 Gold Book Baseline Forecast	151,260	152,120	151,040	148,760	147,550	146,970	146,790	147,540	149,020	151,590	154,520
+ BTM Solar PV	4,635	5,605	6,616	7,559	8,532	9,462	10,298	11,016	11,538	11,853	12,108
2022 RNA Base Case Forecast[1]	155,895	157,725	157,656	156,319	156,082	156,432	157,088	158,556	160,558	163,443	166,628

Baseline and Adjusted Baseline Summer Peak Forecasts

Peak MW	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2022 Econometric Peak Demand Forecast	33,461	34,295	34,669	34,946	35,308	35,715	36,115	36,577	36,997	37,377	37,691
-- Energy Efficiency and Codes & Standards	365	769	1,213	1,696	2,197	2,687	3,160	3,610	4,044	4,451	4,786
-- BTM Solar PV (Net Peak Hour)	985	1,113	1,216	1,314	1,386	1,421	1,423	1,416	1,379	1,315	1,261
-- BTM Non-Solar Distributed Generation	288	304	319	330	342	352	359	369	376	386	394
-- BTM Storage Peak Reductions	148	244	365	416	469	528	583	640	697	755	812
+ Electric Vehicle Peak Demand	58	96	139	193	269	359	471	610	801	1,025	1,246
+ Building Electrification	32	57	83	122	156	206	256	316	382	451	530
2022 Gold Book Baseline Forecast[2]	31,765	32,018	31,778	31,505	31,339	31,292	31,317	31,468	31,684	31,946	32,214
+ BTM Solar PV	985	1,113	1,216	1,314	1,386	1,421	1,423	1,416	1,379	1,315	1,261
2022 RNA Base Case Forecast[1]	32,750	33,131	32,994	32,819	32,725	32,713	32,740	32,884	33,063	33,261	33,475

[1] For the resource adequacy study, the Gold Book baseline load forecast was modified by adding back BtM solar PV impacts in order to model solar PV explicitly as a generation resource to account for the intermittent nature of its availability.

[2] The transmission security power flow RNA base cases use this Gold Book baseline forecast.

Figure 8: 2022 RNA Load and Energy for High Load Scenario: High Load Scenario Forecast, and High Load Scenario Forecast with BtM Solar PV Added Back

High Load Scenario and Adjusted High Load Scenario Energy Forecasts

Annual GWh	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2022 High Load Econometric Energy Forecast	160,378	164,754	166,463	167,637	168,937	170,221	171,100	172,158	173,090	174,306	175,075
-- Energy Efficiency and Codes & Standards	1,829	3,816	5,979	8,285	10,625	12,892	15,043	17,069	18,984	20,766	22,266
-- BTM Solar PV	4,441	5,154	5,879	6,616	7,462	8,352	9,239	10,028	10,689	11,183	11,552
-- BTM Non-Solar Distributed Generation	1,656	1,739	1,840	1,900	1,964	2,019	2,068	2,118	2,171	2,224	2,263
+ Storage Net Energy Consumption	42	58	92	141	201	273	351	427	502	573	635
+ Electric Vehicle Energy	569	884	1,326	1,978	2,931	4,275	6,042	8,199	10,717	13,538	16,548
+ Building Electrification	597	1,433	2,387	3,475	4,762	6,274	8,007	9,931	12,105	14,526	17,233
2022 Gold Book High Load Scenario	153,660	156,420	156,570	156,430	156,780	157,780	159,150	161,500	164,570	168,770	173,410
+ BTM Solar PV	4,441	5,154	5,879	6,616	7,462	8,352	9,239	10,028	10,689	11,183	11,552
2022 RNA High Load Scenario[3]	158,101	161,574	162,449	163,046	164,242	166,132	168,389	171,528	175,259	179,953	184,962

High Load Scenario and Adjusted High Load Scenario Summer Peak Forecasts

Peak MW	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2022 High Load Scenario Econometric Peak Demand	33,689	34,666	35,126	35,454	35,839	36,235	36,688	37,119	37,535	37,920	38,258
-- Energy Efficiency and Codes & Standards	257	538	847	1,185	1,535	1,877	2,210	2,523	2,827	3,111	3,347
-- BTM Solar PV	944	1,023	1,082	1,151	1,212	1,254	1,277	1,288	1,278	1,240	1,202
-- BTM Non-Solar Distributed Generation	288	304	319	330	342	352	359	369	376	386	394
-- BTM Storage Peak Reductions	125	198	289	318	346	377	400	423	445	485	527
+ Electric Vehicle Peak Demand	68	114	168	253	371	536	743	1,056	1,453	1,890	2,330
+ Building Electrification	36	63	92	131	171	222	279	343	413	492	580
2022 Gold Book High Load Scenario	32,179	32,780	32,849	32,854	32,946	33,133	33,464	33,915	34,475	35,080	35,698
+ BTM Solar PV	944	1,023	1,082	1,151	1,212	1,254	1,277	1,288	1,278	1,240	1,202
2022 RNA High Load Scenario[3]	33,123	33,803	33,931	34,005	34,158	34,387	34,741	35,203	35,753	36,320	36,900

[3] The high load scenario forecast will be used for the high load resource adequacy scenario.

Figure 9: Comparison of 2020 RNA & 2022 Base Case Forecasts

Comparison of Base Case Energy Forecasts - 2020 & 2022 RNA (GWh)

Annual GWh	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2020 RNA Base Case Forecast	156,013	155,107	155,097	154,905	154,932	155,139	155,676	156,313	157,063		
2022 RNA Base Case Forecast	155,895	157,725	157,656	156,319	156,082	156,432	157,088	158,556	160,558	163,443	166,628
Change from 2020 RNA	-118	2,618	2,559	1,414	1,150	1,293	1,412	2,243	3,495	NA	NA

Comparison of Base Case Summer Peak Forecasts - 2020 & 2022 RNA (MW)

Peak MW	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2020 RNA Base Case Forecast	32,969	32,904	32,940	32,915	32,957	33,024	33,148	33,276	33,403		
2022 RNA Base Case Forecast	32,750	33,131	32,994	32,819	32,725	32,713	32,740	32,884	33,063	33,261	33,475
Change from 2020 RNA	-219	227	54	-96	-232	-311	-408	-392	-340	NA	NA

Comparison of Energy Efficiency and Codes & Standards and BTM Non-Solar Distributed Generation Energy Impacts - 2020 & 2022 RNA (GWh)

Annual GWh	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2020 RNA Base Case Impacts	3,300	5,580	7,940	10,475	12,855	14,998	16,893	18,560	20,030		
2022 RNA Base Case Impacts	4,272	7,197	10,397	13,762	17,182	20,485	23,613	26,565	29,357	31,959	34,146
Change from 2020 RNA	972	1,617	2,457	3,287	4,327	5,487	6,720	8,005	9,327	NA	NA

Comparison of Energy Efficiency and Codes & Standards and BTM Non-Solar Distributed Generation Summer Peak Impacts - 2020 & 2022 RNA (MW)

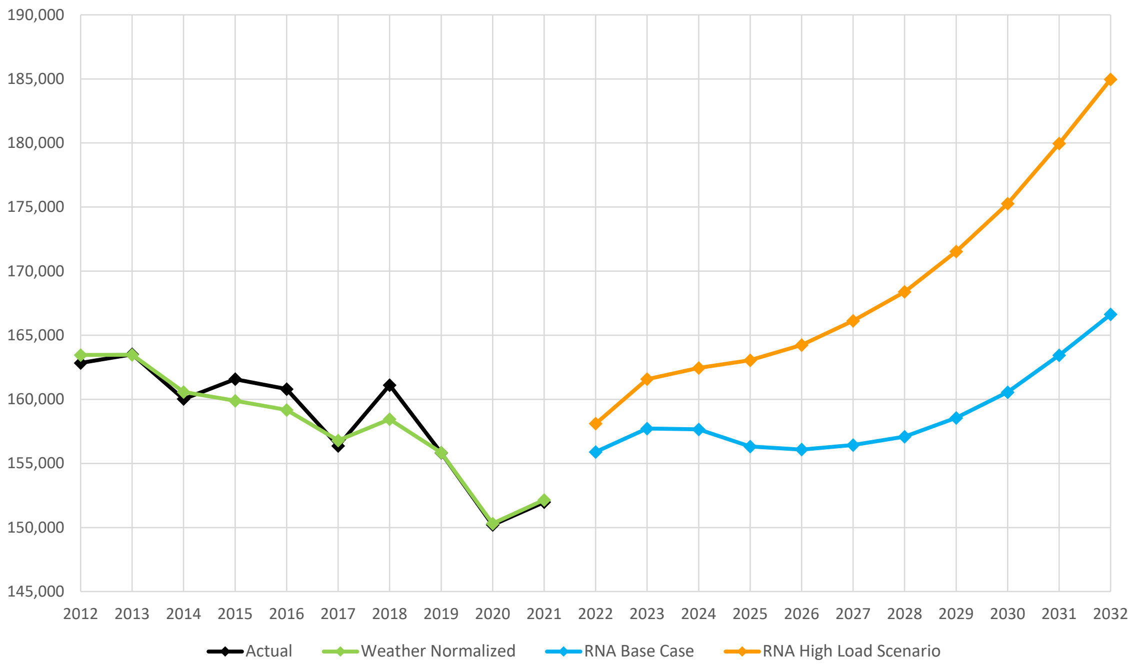
Peak MW	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2020 RNA Base Case Impacts	541	900	1,266	1,671	2,055	2,398	2,695	2,943	3,165		
2022 RNA Base Case Impacts	653	1,073	1,532	2,026	2,539	3,039	3,519	3,979	4,420	4,837	5,180
Change from 2020 RNA	112	173	266	355	484	641	824	1,036	1,255	NA	NA

[1] For the resource adequacy study, the Gold Book baseline load forecast was modified by adding back BtM solar PV impacts in order to model solar PV explicitly as a generation resource to account for the intermittent nature of its availability.

[2] 2020 Gold Book values have been adjusted to include only those impacts from 2022 forward, so as to compare directly to the 2022 Gold Book values.

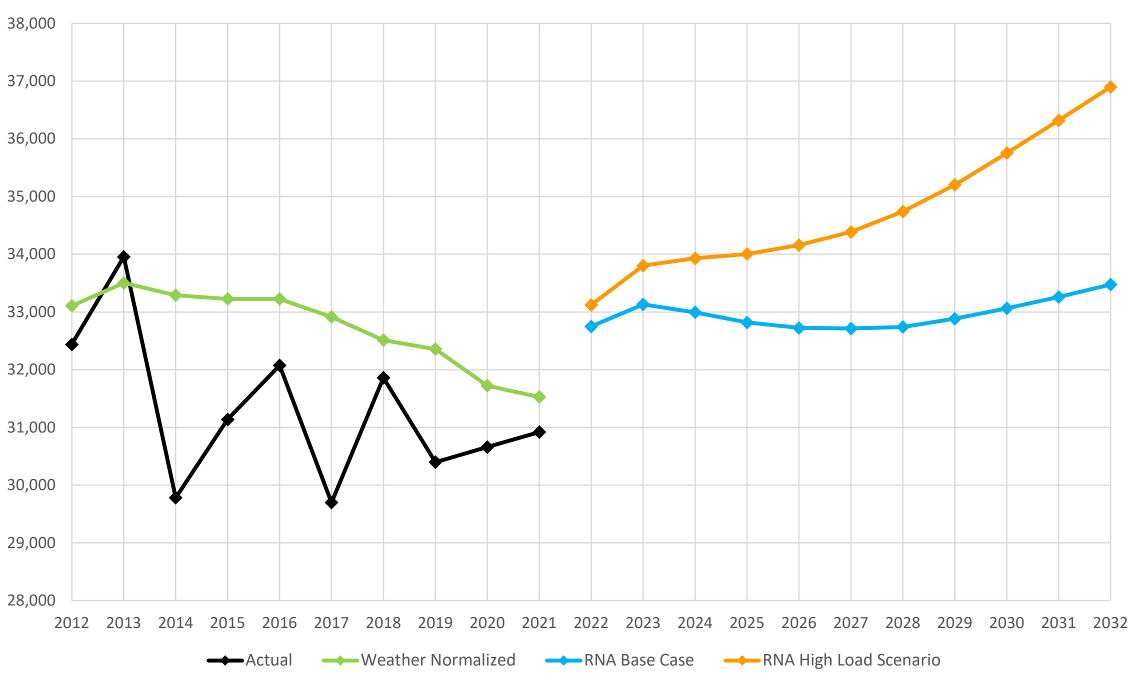
Note: The 2021-2030 Comprehensive Reliability Plan utilized an updated forecast (relative to the 2020 Gold Book and RNA), included in this presentation (forecast values shown on slides 22, 23, and 34).

Figure 10: 2022 Baseline and High Load Scenario Energy Forecasts with Solar PV Added Back



Note: Historical actual and weather normalized values reflect loads as found, with no add back of BtM solar generation. RNA forecast values include projected BtM solar generation added back.

Figure 11: 2022 Baseline and High Load Energy Scenario Summer Peak Demand Forecasts with Solar PV Added Back



Note: Historical actual and weather normalized values reflect loads as found, with no add back of BtM solar generation. RNA forecast values include projected BtM solar generation added back.

Figure 12: 2022 Baseline Annual Energy Forecast Impacts - GWh

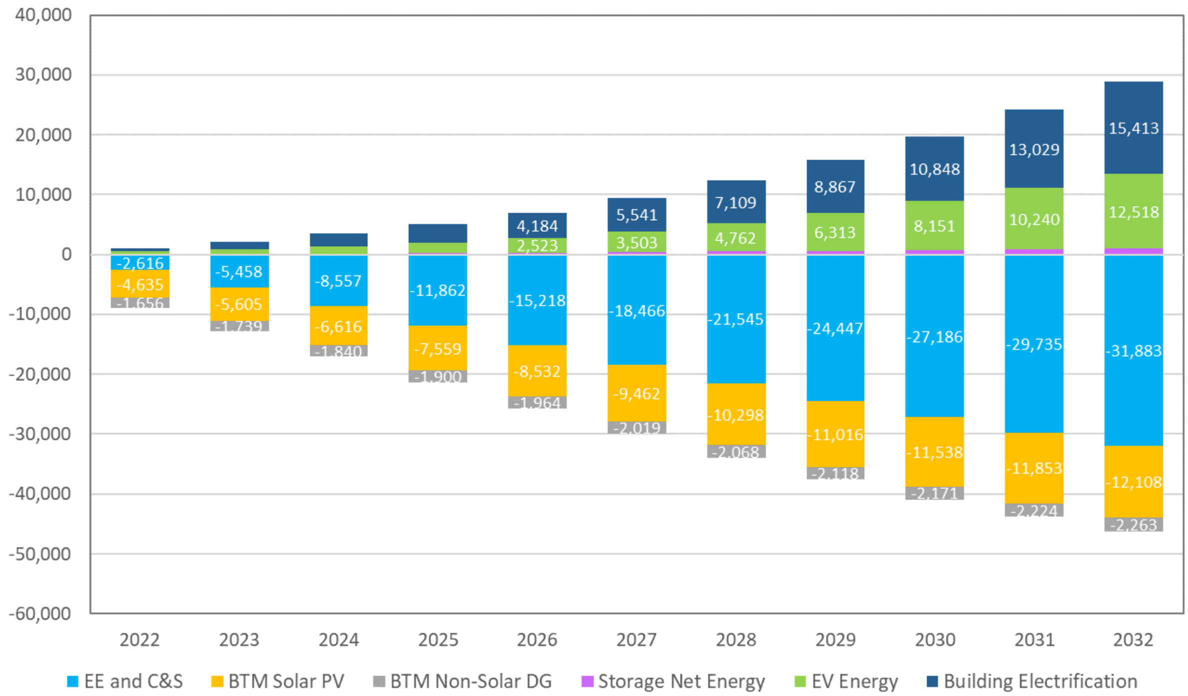
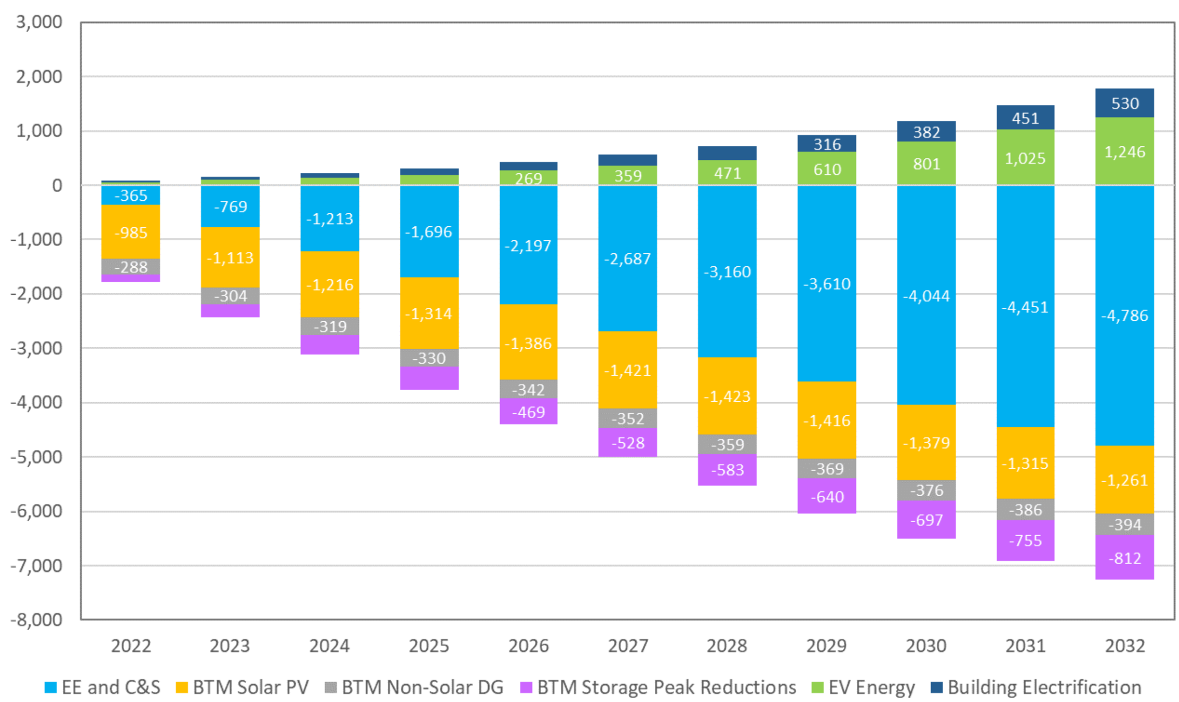


Figure 13: 2022 Baseline Summer Peak Demand Forecast Impacts



The NYISO uses BtM solar PV production data in RNA resource adequacy assessments. For General Electric's Multi-Area Reliability Simulations (GE-MARS) modeling, the BtM solar PV component is added back in the baseline forecast in order to explicitly model the BtM solar PV as generation resources. The load shapes used in the study are adjusted from the historic shapes to a shape that meets the forecasted zonal peak, NYCA peak, Zones G through J Locality peak, and NYCA energy forecast. Discretely modeling BtM solar PV as a resource provides for flexibility to adjust the amount of resource available across the system.

For the 2022 RNA resource adequacy assessments, gross peak load forecasts were developed, representing zonal load during the maximum system-wide gross demand hour (net load plus BtM solar). With BtM solar modeled as a resource, these values represent the maximum annual load needed to be served by BtM solar and other resources. The system gross peak load hour typically occurs earlier in the afternoon relative to the system net peak hour reported in the Gold Book.

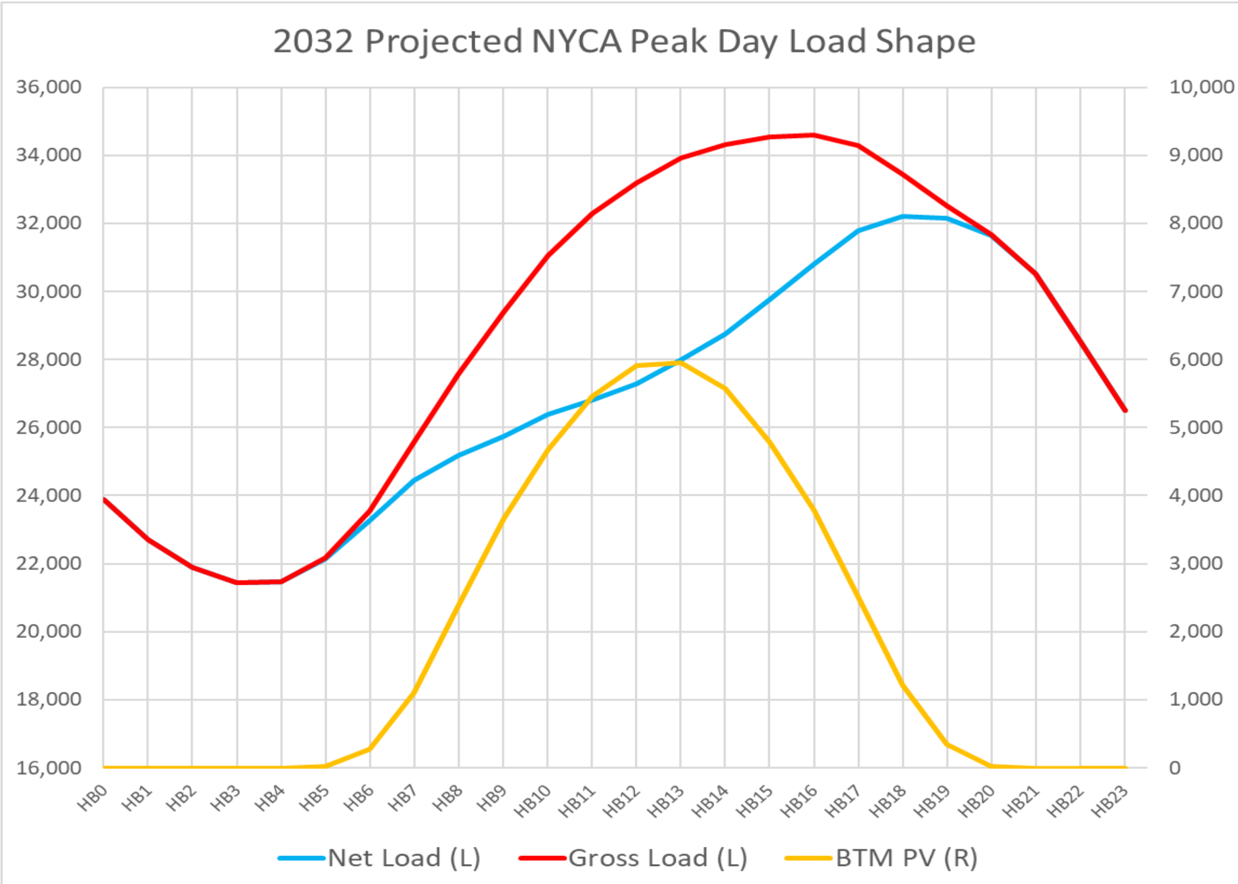
Figure 14: Base Case Gross Peak Load Hour Forecast (Net Load Plus BtM Solar) - MW

Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
2023	2,920	2,216	3,009	707	1,489	2,633	2,391	649	1,409	10,979	5,241	33,643
2024	2,959	2,231	3,013	709	1,496	2,640	2,398	648	1,406	10,972	5,174	33,646
2025	2,981	2,244	3,010	711	1,500	2,651	2,414	647	1,404	10,936	5,112	33,610
2026	2,985	2,246	2,984	710	1,489	2,643	2,413	647	1,401	10,934	5,081	33,533
2027	2,985	2,248	2,956	707	1,478	2,635	2,412	647	1,403	10,963	5,104	33,538
2028	2,980	2,249	2,929	705	1,469	2,631	2,413	650	1,409	11,031	5,144	33,610
2029	2,985	2,245	2,910	702	1,466	2,636	2,420	654	1,421	11,159	5,198	33,796
2030	2,990	2,244	2,897	701	1,464	2,645	2,431	661	1,435	11,318	5,253	34,039
2031	2,999	2,249	2,893	698	1,469	2,658	2,448	668	1,451	11,483	5,307	34,323
2032	3,014	2,257	2,899	696	1,475	2,675	2,467	674	1,465	11,622	5,362	34,606

Figure 14 shows additional detail representative of the gross peak forecast.[7] Projected net load, BtM solar generation, and gross load shapes reflecting the 2032 NYCA summer peak day are plotted. Net load is projected to peak during the 6 PM hour at 32,214 MW, reflective of the coincident peak forecast from the 2022 Gold Book. Per the Gold Book, BtM solar generation during the net peak hour is 1,202 MW, resulting in a 2032 gross load RNA Base Case forecast of 33,475 MW (as shown in Figure 7). This value reflects the gross load during the net peak hour. Due to the increasing impacts of BtM solar, the net peak hour shifts later into the afternoon and early evening. The maximum gross load of 34,606 MW (shown in Figure 15) occurs earlier in the day during the 4 PM hour.

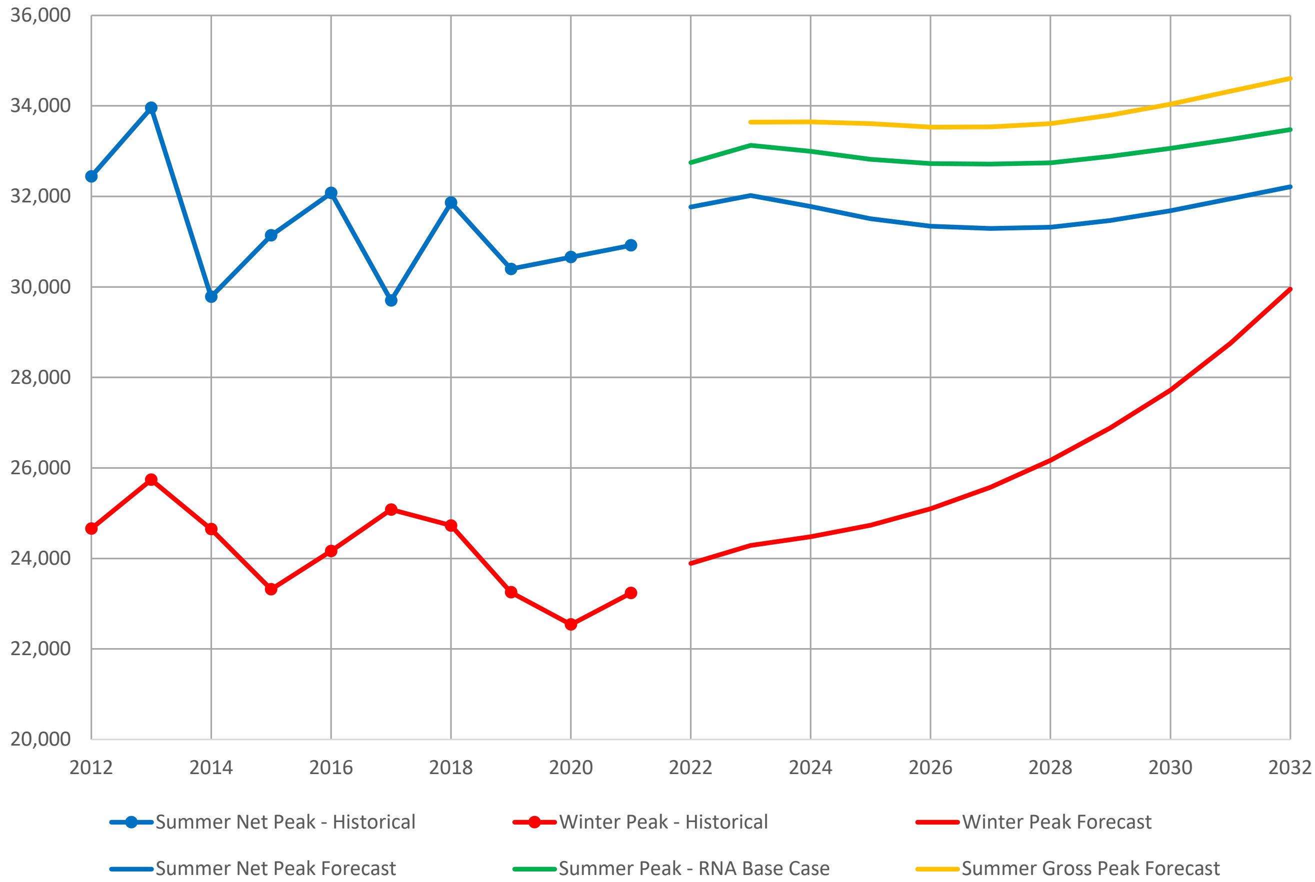
[7] Additional information on the methodology and calculation of the gross peak forecast is included in the 2022 Gross Peak Forecast presentation to the Load Forecasting Task Force, which is available here.

Figure 15: NYCA Peak Day Net, Gross, and BtM Solar Shapes



The NYCA is projected to become a winter-peaking system in the mid-2030s, primarily driven by electrification of space heating through heat pumps and other potential electric heating systems. Figure 16 compares the NYCA winter peak forecast to the various baseline summer peak forecasts through 2032. Growth in heating load is such that the winter peak forecast draws considerably closer to the summer peak forecast during the later years of the RNA horizon on a statewide basis. However, several of the upstate zones become winter peaking within the study period of this RNA. Summer peak forecasts presented include the Gold Book baseline forecast reflective of the net peak, the RNA Base Case forecast reflective of the gross load during the net peak hour, and RNA Gross Peak forecast reflective of the maximum gross load hour. There is one winter peak forecast reflective of the Gold Book forecast, as the net and gross winter peak hours are the same since gross peak demand occurs after sunset.

Figure 16: Summer and Winter Peak Forecast Comparison (MW)



Notes: Net refers to net of BtM solar. RNA Base Case forecast reflects gross load during net peak hour.

A light load forecast was developed for the 2022 RNA for use in transmission security analyses.[8] The forecast reflects a low midday net load hour with high BtM solar generation, approaching or equal to the overall NYCA annual minimum load hour. The forecast is set on a spring weekend day during the noon hour. As BtM solar capacity and generation increases over time, minimum net loads during midday hours decrease significantly in later forecast years. Figure 17 lists the NYCA-coincident midday minimum load forecast by zone. Figure 18 shows historical and forecast midday minimum load trends at the system level, including its relationship with BtM solar capacity. Figure 19 displays the evolving daily load pattern on the light load day for upstate New York (Zones A through F). In later forecast years, the relative concentration of BTM solar (relative to load) is generally greatest in the upstate zones.

[8] Additional information on the methodology and calculation of the light load forecast is included in the 2022 Light Load Forecast presentation to the Load Forecasting Task Force, which is available here.

Figure 17: NYCA Midday Light Load Forecast – Net Load (MW)

Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
2023	1,230	765	1,122	638	407	758	491	252	478	4,619	1,172	11,932
2024	1,088	717	1,016	624	311	667	440	253	477	4,644	1,122	11,359
2025	935	670	898	613	214	567	385	246	463	4,605	1,045	10,641
2026	834	632	797	598	133	476	322	242	452	4,578	963	10,027
2027	740	600	707	586	60	393	275	239	441	4,564	906	9,511
2028	649	569	625	575	-7	319	234	236	432	4,562	859	9,053
2029	577	547	560	565	-57	263	211	236	432	4,585	824	8,743
2030	523	532	516	557	-96	222	202	240	433	4,625	800	8,554
2031	499	527	498	551	-114	205	207	245	438	4,684	794	8,534
2032	489	528	489	544	-119	201	211	246	445	4,760	809	8,603

Figure 18: System Light Load Trends (MW)

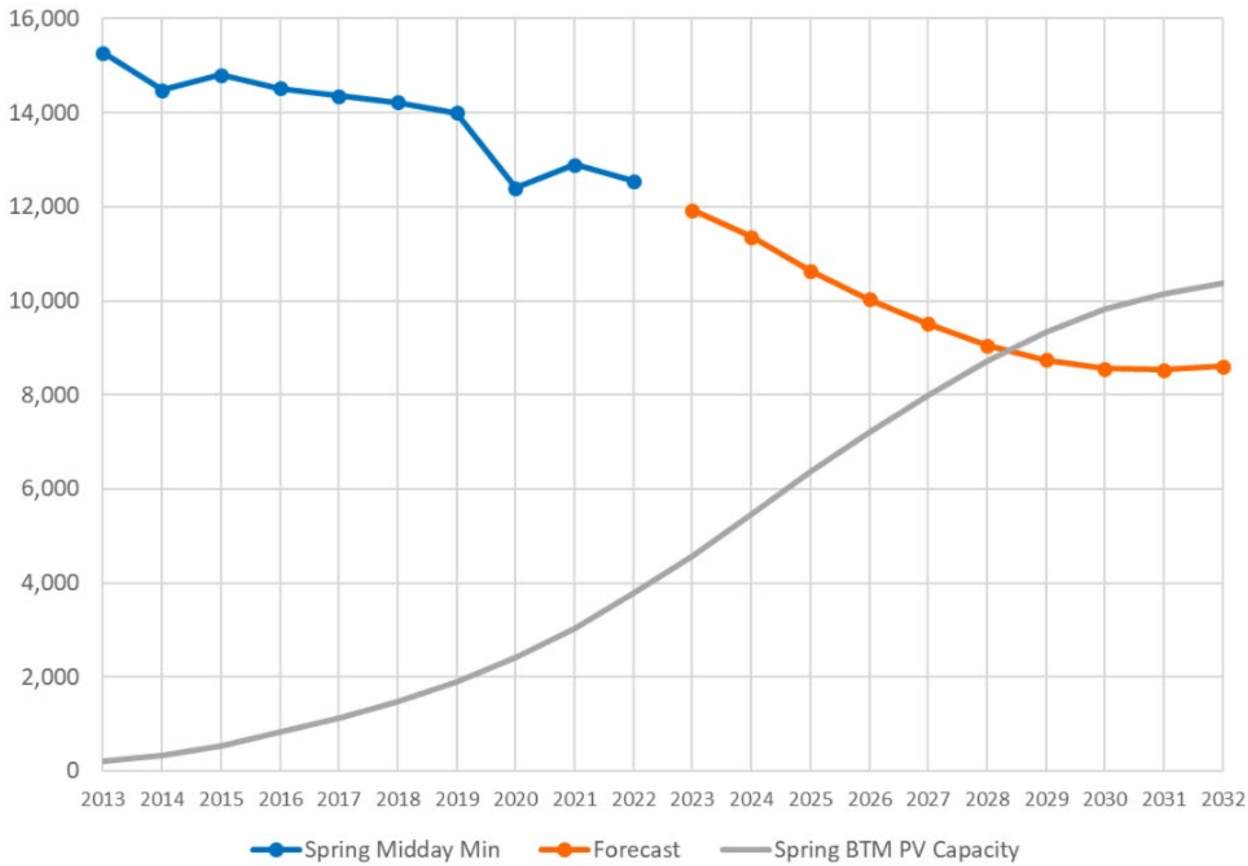
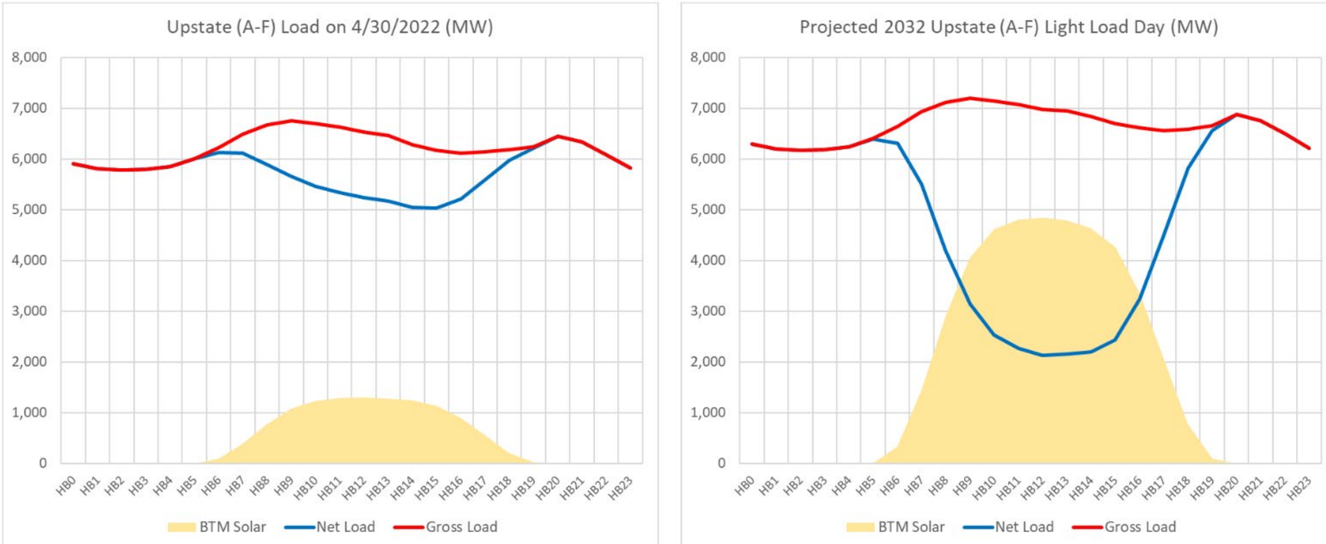


Figure 19: Upstate Light Load Day Shapes



Resource Additions and Removals

Since the 2021-2030 CRP assumptions were finalized, new resources have been added to the system, some deactivation notices have been withdrawn and the associated facilities have returned to the system, and some other resources have been removed from the 2022 RNA Base Case, as shown in Figure 20.

An additional 2,815 MW of proposed resources have been included in the 2022 RNA base case compared with the 2021-2030 CRP bringing the total proposed resources to 3,382 MW. This includes approximately 2,132 MW of proposed generation (mostly wind and solar) and 1,250 MW of HVDC from Quebec to New York City. The NYISO is tracking the progression of many other projects that may contribute to grid reliability, including numerous offshore wind facilities that are not yet included in the RNA base case. These additional tracked projects are listed in the *2022 Gold Book* and in **Appendix D**.

An additional 304 MW of generation has been removed from the 2022 RNA base case compared with the 2021-2030 CRP, bringing the total generation removed to approximately 4,870 MW (some of the units are only out of service in the May through October ozone season only). Their removal is due to being in a deactivated state (*e.g.,* retired, mothballed, or in an ICAP-Ineligible Forced Outage (IIFO), or proposed to retire or mothball), or as operationally impacted by the DEC Peaker Rule.

Figure 20: Total Summer Capability MW of Proposed Projects Included in the 2022 RNA Base Case

	Additions	Deactivations
Changes since CRP	2,815	304
Total MW	3,382	4,870

The comparison of generation status between the 2021 – 2030 CRP and 2022 RNA is detailed in Figure 21, Figure 22, and Figure 23. The MW values represent the summer capability MW values from the 2022 Gold Book.

Figure 21: Proposed Projects Included in the 2022 RNA Base Case

Queue #	Project Name/(Owner)	Zone	Point of Interconnection	Type	COD or I/S Date	Summer Peak MW	Included Starting
Proposed Transmission Additions, other than Local Transmission Owner Plans							
0545A	Empire State Line	A	Dysinger - Stolle 345kV	AC Transmission (WNYPP)	I/S July 2022	n/a	2018-2019 RPP
0543	Segment B Knickerbocker-Pleasant Valley 345 kV	F,G	Greenbush - Pleasant Valley 345kV	AC Transmission (ACPPTPP)	12/2023	n/a	2020-2021 RPP
0556	Segment A Double Circuit	E, F	Edic - New Scotland 345kV		12/2023	n/a	
0430	Cedar Rapids Transmission Upgrade	D	Dennison - Alcoa 115kV	AC Transmission	I/S	+80	
0631	NS Power Express (CHPE)	J	Hertel 735kV (Quebec)-Astoria Annex 345kV (NYC)	HVDC Transmission	12/2025	1000	2022 RNA
0887	CH Uprate					250	
1125	Northern New York Priority Transmission Project (NNYPTP)	D, E	Moses/Adirondack/Porter Path	AC Transmission	12/2025	n/a	
Proposed Large Generation Additions							
396	Baron Winds	C	Hillside - Meyer 230kV	Wind	Dec-23	238.4	2020-2021 RPP
422	Eight Point Wind Enery Center	B	Bennett 115kV	Wind	Sep-22	101.8	
495	Mohawk Solar	F	St. Johnsville - Marshville 115kV	Solar	Nov-24	90.5	2022 RNA
505	Ball Hill Wind	A	Dunkirk - Gardenville 230kV	Wind	Nov-22	100.0	2020-2021 RPP
531	Number 3 Wind Energy	E	Taylorville - Boonville 115kV	Wind	Oct-22	103.9	2021 Q3 STAR
579	Bluestone Wind	E	Afton - Stilesville 115kV	Wind	Oct-22	111.8	2022 RNA
612	South Fork Wind Farm	K	East Hampton 69kV	Offshore Wind	Aug-23	96.0	
617	Watkins Glen Solar	C	Bath - Montour Falls 115kV	Solar	Nov-23	50.0	
618	High River Solar	F	Inghams - Rotterdam 115kV	Solar	Nov-22	90.0	
619	East Point Solar	F	Cobleskill - Marshville 69kV	Solar	Nov-22	50.0	
637	Flint Mine Solar	G	LaFarge - Pleasant Valley 115kV, Feura Bush - North Catskill 115kV	Solar	Sep-23	100.0	
678	Calverton Solar Energy Center	K	Edwards Substation 138kV	Solar	Jun-22	22.9	2020-2021 RPP
695	South Fork Wind Farm II	K	East Hampton 69kV	Offshore Wind	Aug-23	40.0	2022 RNA
720	Trelina Solar Energy Center	C	Border City - Station 168 115 KV	Solar	Nov-23	80.0	
721	Excelsior Energy Center	A	N. Rochester - Niagara 345 kV	Solar	Nov-22	280.0	
758	Independence GS1 to GS4 *+9MW ERIS only*	C	Scriba 345 kV	Gas	I/S	9.0	

Queue #	Project Name/(Owner)	Zone	Point of Interconnection	Type	COD or I/S Date	Summer Peak MW	Included Starting
Proposed Small Generation Additions							
545	Sky High Solar* (Sky High Solar, LLC)	C	Tilden -Tully Center 115kV	Solar	06/2023	20	2021 Q3 STAR
565	Tayandenega Solar* (Tayandenega Solar, LLC)	F	St. Johnsville - Inghams 115kV	Solar	10/2022	20	
570	Albany County 1* (Hecate Energy Albany 1 LLC)	F	Long Lane - Lafarge 115kV	Solar	12/2022	20	
572	Greene County 1* (Hecate Energy Greene 1 LLC)	G	Coxsackie - North Catskill 69kV	Solar	01/2023	20	
573	Greene County 2* (Hecate Energy Greene 2 LLC)	G	Coxsackie Substation 13.8kV	Solar	03/2023	10	
584	Dog Corners Solar* (SED NY Holdings LLC)	C	Aurora Substation 34.5kV	Solar	05/2022	20	
586	Watkins Road Solar* (SED NY Holdings LLC)	E	Watkins Rd - Ilion 115kV	Solar	06/2023	20	
590	Scipio Solar (Duke Energy Renewables Solar, LLC)	C	Scipio 34.5kV Substation	Solar	05/2023	18	
592	Niagara Solar (Duke Energy Renewables Solar, LLC)	B	Bennington 34.5kV Substation	Solar	05/2023	20	
598	Albany County 2* (Hecate Energy Albany 2 LLC)	F	Long Lane - Lafarge 115kV	Solar	12/2022	20	
638	Pattersonville* (Pattersonville Solar Facility, LLC)	F	Rotterdam - Meco 115kV	Solar	12/2022	20	
666	Martin Solar* (Martin Solar LLC)	A	Arcade - Five Mile 115kV	Solar	10/2022	20	
667	Bakerstand Solar* (Bakerstand Solar LLC)	A	Machias - Maplehurst 34.5kV	Solar	10/2022	20	2021 Q3 STAR
682	Grissom Solar* (Grissom Solar, LLC)	F	Ephratah - Florida 115kV	Solar	06/2022	20	
730	Darby Solar* (Darby Solar, LLC)	F	Mohican - Schaghticoke 115kV	Solar	12/2022	20	
731	Branscomb Solar* (Branscomb Solar, LLC)	F	Battenkill - Eastover 115kV	Solar	I/S	20	
735	ELP Stillwater Solar (ELP Stillwater Solar LLC)	F	Luther Forest - Mohican 115kV	Solar	09/2022	20	
748	Regan Solar* (Regan Solar, LLC)	F	Market Hill - Johnstown 69kV	Solar	06/2022	20	
768	Janis Solar* (Janis Solar, LLC)	C	Willet 34.5kV	Solar	04/2022	20	
775	Puckett Solar* (Puckett Solar, LLC)	E	Chenango Forks Substation 34.5kV	Solar	04/2022	20	
564	Rock District Solar* (Rock District Solar, LLC)	F	Sharon - Cobleskill 69kV	Solar	12/2022	20	
670	Skyline Solar* (SunEast Skyline Solar LLC)	E	Campus Rd - Clinton 46kV	Solar	04/2022	20	
581	Hills Solar (SunEast Hills Solar LLC)	E	Fairfield - Inghams 115kV	Solar	08/2023	20	2022 RNA
734	Ticonderoga Solar* (ELP Ticonderoga Solar LLC)	F	ELP Ticonderoga Solar LLC	Solar	8/1/2022	20	
759	KCE NY 6* (KCE NY 6, LLC)	A	Gardenville - Bethlehem Steel Wind 115kV	Storage	04/2022	20	
769	North County Energy Storage (New York Power Authority)	D	Willis 115kV	Storage	03/2022	20	
807	Hilltop Solar (SunEast Hilltop Solar LLC)	E	Eastover - Schaghticoke 115kV	Solar	07/2023	20	
848	Fairway Solar (SunEast Fairway Solar LLC.)	E	McIntyre - Colton 115kV	Solar	10/1/2023	20	
855	NY13 Solar (Bald Mountain Solar LLC)	F	Mohican - Schaghticoke 115kV	Solar	11/1/2023	20	

Notes:

*Only these proposed small generators obtained Capacity Resource Interconnection Service (CRIS) and therefore are modeled for the resource adequacy Base Cases.

All proposed large generators obtained, or are assumed to obtain, both Energy Resource Interconnection Service (ERIS) and CRIS and are modeled in both transmission security and resource adequacy Base Cases, unless otherwise noted as “ERIS only,” in which case they are modeled only for the transmission security assessments.

Figure 22: 2022 RNA Generation Deactivations[9] Assumptions

2022 GB Table	Owner/ Operator	Plant Name	Zone	Summer Capability	2022 RNA Base Case Status	2020 RNA Base Case Status
Table IV-3: Deactivated Units with Unexpired CRIS Rights Not Listed in Existing Capacity Table III-2	International Paper Company	Ticonderoga (4)	F	9.5	out	out
	Helix Ravenswood, LLC	Ravenswood 2-4	J	30.7	out	out
	Helix Ravenswood, LLC	Ravenswood 3-1	J	31.9	out	out
	Helix Ravenswood, LLC	Ravenswood 3-2	J	29.4	out	out
	Helix Ravenswood, LLC	Ravenswood 3-4	J	31.2	out	out
	Exelon Generation Company LLC	Monroe Livingston	B	2.4	out	out
	Innovative Energy Systems, Inc	Steuben County LF	C	3.2	out	out
	Consolidated Edison Co. of NY, Inc	Hudson Ave 4	J	14	out	out
	New York State Elec& Gas Corp.	Auburn - State St	C	4.1	out	out
	Cayuga Operating Company, LLC	Cayuga 1	C	151	out	out
	Albany Energy LLC	Albany LFGE	F	5.6	out	out
	Somerset Operating Company, LLC	Somerset	A	676.4	out	out
	Entergy Nuclear Power Marketing, LLC	Indian Point 2	H	1011.5	out	out
	Astoria Generating Company L.P.	Gowanus 1-8(5)	J	16	out	out
Table IV-4: Deactivated Units Listed in Existing Capacity Table III-2	Entergy Nuclear Power Marketing, LLC	Indian Point 3	H	1036.3	out	out
	Helix Ravenswood, LLC	Ravenswood 01 (3)	J	7.7	out	out
		Ravenswood 11 (3)	J	16.1	out	out
Table IV-5: Notices of Proposed Deactivations as of March 15, 2020	National Grid	West Babylon 4	K	41.2	out	out
	Long Island Power Authority	Glenwood GT 01	K	13	out	out
	Seneca Power Partners. L.P.	Allegheny Cogen	B	62	out	in
		Sithe Batavia	B	48.7	out	in
		Sithe Sterling	B	49.2	out	in
	ENGIE Energy Marketing NA, Inc.	Nassau Energy Corporation	K	38.5	out	in
	Astoria Generating Company, L.P.	Gowanus 1-1 through 1-7	J	117.1	out	out
		Gowanus 4-1 through 4-8	J	138.8	out	out
	NRG Power Marketing LLC	Astoria GT 2-1 through 2-4	J	141.6	out	out
		Astoria GT 3-1 through 3-4	J	140.5	out	out
		Astoria GT 4-1	J	138.3	out	out
			Total	4005.9		
			Changes since CRP	198.4		

[9] The Allegany and Batavia generators subsequently withdrew their deactivations notices, and West Babylon 4 and Glenwood GT 01 initiated behind the meter operation. Updated assumptions are captured in subsequent reliability assessments such as the STARs.

Figure 23: Existing Plants Impacted by DEC's Peaker Rule

2022 GB Table	Owner/ Operator	Plant Name	Zone	Summer Capability	Status Change Date 2022 RNA Base Case	2020 RNA Base Case Status
Table IV-6: Proposed Staus Change to Comply with DEC Peaker Rule	Central Hudson Gas & Elec. Corp.	Coxsackie GT	G	19.2	05/01/2023	same
		South Cairo	G	18.9	05/01/2023	same
	Consolidated Edison Co. of NY, Inc.	74 St. GT 1 & 2	J	39.3	05/01/2023	same
		Hudson Ave 3	J	13.6	05/01/2023	same
		Hudson Ave 5	J	12.3	05/01/2023	same
		59 St. GT 1	J	15.3	05/01/2025	same
	Helix Ravenswood, LLC	Ravenswood 10	J	16.0	05/01/2023	same
	National Grid	Northport GT	K	12.0	05/01/2023	same
		Port Jefferson GT 01	K	12.6	05/01/2023	same
		Shoreham 1	K	44.7	05/01/2023	in service
		Shoreham 2	K	15.7	05/01/2023	in service
		Glenwood GT 03	K	44.7	05/01/2023	in service
	NRG Power Marketing, LLC	Arthur Kill GT 1	J	13.1	05/01/2025	same
	Astoria Generating Company, L.P.	Astoria GT 01	J	12.1	05/01/2023	same
		Gowanus 2-1 through 2-8	J	145.5	05/01/2025	same
		Gowanus 3-1 through 3-8	J	137.4	05/01/2025	same
		Narrows 1-1 through 2-8	J	291.5	05/01/2025	same
			Total	863.9		
			Changes since CRP	105.1		

Note: NYSDEC's Part 227-3 applies to all simple cycle gas turbines with nameplates equal to or greater than 15 MW. Thus, all simple cycle generators are subject to the rule and all owners of these machines were required to submit compliance plans to the NYSDEC. The compliance plans consist of statements that the generator; (i) already complies with the new NOx limits, (ii) will retire, (iii) will limit operation during the ozone season, and/or (iv) will retrofit emission control technology to meet the emission limits of the new rule. If the plant owners submitted compliance plans that state that the generator will be able to operate within the new NOx limits during the ozone season, these generators remain in-service in the RNA base case.

Bulk Transmission Projects

The notable bulk transmission projects that met the inclusion rules and continue to be modeled in the 2022 RNA Base Case are:

- **The NextEra Empire State Line Project** was selected by the NYISO Board of Directors in October 2017 to address the Western New York Public Policy Transmission Need. This project includes a new 345 kV circuit and phase angle regulator (PAR) that will alleviate constraints in the Niagara area. This project is in service as of June 2022.
- **The LS Power and New York Power Authority (NYPA) Segment A, AC Transmission joint project** was selected by the NYISO Board of Directors in April 2019. The project includes a new double-circuit 345 kV line between Edic and New Scotland substations, two new 345 kV substations at Princetown and Rotterdam, two new 345 kV lines between Princetown to Rotterdam substations, and retirement of the existing Porter to Rotterdam 230 kV lines. The planned in-service date is December 2023.
- **The New York Transco Segment B, AC Transmission project** was selected by the NYISO Board of Directors in April 2019. The project includes a new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to the existing Pleasant Valley substation, 50% series compensation on the Knickerbocker to Pleasant Valley 345 kV line, and retirement of 115 kV lines between Greenbush and Pleasant Valley substations. The planned in-service date is December 2023.
- **Champlain Hudson Power Express** (CHPE) 1,250 MW HVDC project from Quebec to Astoria Annex 345 kV in New York City (Zone J), awarded under NYSERDA's Tier 4 REC program. The facility is expected to provide capacity in the summer but not in the winter. The planned in-service date is spring 2026.
- **NYPA/National Grid's Northern New York Priority Transmission 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.

Local Transmission Plans

As part of the NYISO's Local Transmission Planning Process, the New York TOs present their Local Transmission Owner Plans (LTPs) to the NYISO and stakeholders during ESPWG and TPAS meetings. The firm transmission plans presented in the LTPs and reported as firm in the *2022 Gold Book* are included in the 2022 RNA Base Case, with consideration for their in-service dates. A summary of these projects is reported in **Appendix D** of this report.

Base Case Comparison of Peak Load to Resources

The 2022 RNA Base Case models the existing generation as adjusted for the unit deactivations listed in the *2022 Gold Book*, and along with the new resource additions that met the base case inclusion rules set forth in Section 3 of the Reliability Planning Process Manual. The total capacity, taking into account additions and deactivations is summarized in Figure 24, along with the baseline peak load, capacity net purchases and the special case resources (SCRs) from the 2022 Gold Book.

The 2022 RNA SCR[10] MW levels are based on the 2022 Gold Book value of 1,164.1 MW, adjusted for their performance for the resource adequacy evaluations. Transmission security analysis, which evaluates normal transfer criteria, does not consider SCRs.

[10] The term "Special Case Resource" is defined in Section 2.19 of Market Services Tariff and also in the Appendix A of this report (Glossary).

Figure 24: NYCA Peak Load and Resources 2026 through 2030

	Year	2026	2027	2028	2029	2030	2031	2032
Peak Load (MW) - Gold Book 2022 NYCA Baseline								
	NYCA*	31,339	31,292	31,317	31,468	31,684	31,946	32,214
	Zone J*	10,778	10,804	10,864	10,986	11,140	11,303	11,441
	Zone K*	4,746	4,768	4,806	4,857	4,907	4,956	5,007
	Zone G-J*	14,936	14,959	15,027	15,173	15,360	15,560	15,735
Resources ICAP (MW)								
NYCA	Capacity**	37,625	37,625	37,625	37,625	37,625	37,625	37,625
	Net Purchases & Sales (Transaction	3,188	3,188	3,188	3,188	3,188	3,188	3,188
	SCR	1,164	1,164	1,164	1,164	1,164	1,164	1,164
	Total Resources	41,977	41,977	41,977	41,977	41,977	41,977	41,977
	Capacity/Load Ratio	120.1%	120.2%	120.1%	119.6%	118.8%	117.8%	116.8%
	Cap+NetPurch/Load Ratio	130.2%	130.4%	130.3%	129.7%	128.8%	127.8%	126.7%
	Cap+NetPurch+SCR/Load Ratio	133.9%	134.1%	134.0%	133.4%	132.5%	131.4%	130.3%
Zone J	Capacity**	8,183	8,183	8,183	8,183	8,183	8,183	8,183
	Cap+fullUDR+SCR/Load Ratio	94.2%	94.0%	93.5%	92.4%	91.2%	89.8%	88.8%
Zone K	Capacity**	5,094	5,094	5,094	5,094	5,094	5,094	5,094
	Cap+fullUDR+SCR/Load Ratio	129.0%	128.4%	127.4%	126.0%	124.7%	123.5%	122.2%
Zone G-J	Capacity**	13,052	13,052	13,052	13,052	13,052	13,052	13,052
	Cap+fullUDR+SCR/Load Ratio	101.2%	101.0%	100.5%	99.6%	98.4%	97.1%	96.0%

	Year	2026	2027	2028	2029	2030	2031	2032
Resources (UCAP MW)								
NYCA	Capacity**	32,670	32,670	32,670	32,670	32,670	32,670	32,670
	Cap+NetPurch+SCR/Load Ratio	117.0%	117.2%	117.1%	116.5%	115.7%	114.8%	113.8%
Zone J	Capacity**	7,968	7,968	7,968	7,968	7,968	7,968	7,968
	Cap+fullUDR+SCR/Load Ratio	89.2%	89.0%	88.5%	87.5%	86.3%	85.1%	84.0%
Zone K	Capacity**	4,702	4,702	4,702	4,702	4,702	4,702	4,702
	Cap+fullUDR+SCR/Load Ratio	118.5%	117.9%	117.0%	115.8%	114.6%	113.5%	112.3%
Zone G-J	Capacity**	12,356	12,356	12,356	12,356	12,356	12,356	12,356
	Cap+fullUDR+SCR/Load Ratio	94.0%	93.8%	93.4%	92.5%	91.4%	90.2%	89.2%

Notes:

*NYCA load values represent baseline coincident summer peak demand. Zones J and K load values represent non-coincident summer peak demand. Aggregate Zones G-J values represent the G-J locality peak. 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.

**NYCA Capacity values include resources electrically internal to NYCA, additions, re-ratings, and retirements (including proposed retirements, mothballs, and peaker rule impacts). Capacity values reflect the lesser of CRIS and DMNC values. NYCA resources include the net purchases and sales as per the Gold Book. Zonal totals include the full Unforced Capacity Deliverability Rights (UDRs) for those capacity zones.

- SCR: forecasted MW ICAP value from the 2022 Gold Book.
- Wind, solar, run-of river, and landfill gas summer capacity is counted as 100% of nameplate rating.

*** For UCAP calculation, EFORd from GE-MARS output file are used for thermal units. For renewables, installed capacity intermittent resources derating factors are used.

Figure 25: Total Capacity/ Load Ratios (%) ICAP vs UCAP for 2032

Total Capacity vs Load Ratio (%) for 2032			
Zone	ICAP	UCAP	Delta
NYCA	130.3%	113.8%	16.5%
J	88.8%	84.0%	4.7%
K	122.2%	112.3%	9.9%
G-J	96.0%	89.2%	6.8%

Notes:
1. Total Capacity = Capacity* + full UDR + SCR
2. *Capacity = lesser of (CRIS, DMNC). NYCA resources include the net purchases and sales as per the Gold Book.
3. ICAP = Installed Capacity
4. UCAP = Unforced Capacity (takes into consideration generation unavailability)
5. UCAP calculation:
   - For thermal units, average capacity derating factors from the MARS output are used
   - For renewables, installed capacity intermittent resources derating factors are used

As shown in the Figure 24, the total NYCA capacity margin, which is defined as capacity above the baseline load forecast, varies between 30% and 33%. Figure 25 shows a comparison between the total ICAP and total UCAP for 2030; the difference reflects generation unavailability for the resource mix assumed in the RNA Base Case for study year 2032.

Figure 26 shows the relative increase in the capacity margin, by comparing the details of the capacity margins for year 10 between the *2020 RNA* (2030) and the *2019-2028 CRP* (2028). The analysis reveals two observations:

- Positive net margin shows improvement in the relative capability to serve load, when comparing the two studies assumptions: and
- While the baseline load is 605 MW higher compared to the *2021-2030 CRP*, the total resources are 2,190 MW higher leading to the system having 1,585 MW more overall net resources (1,585 = 2190 – 605).

Figure 26: NYCA Load and Resources Comparison with the 2021 - 2030 CRP

NYCA Study Year 10	2022 RNA Y10 (2032)	2021-2030 CRP Y10 (2030)	Net Delta =*TotalResDelta minus TotalLoadDelta*
Baseline Load[1]	32,214	31,609	605
Total Resources[2]	41,977	39,787	2,190
Net Margin: Change in (netCapacity - netLoad)			**1,585**

Notes:

1. Baseline Load represents baseline 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 impacts at peak. It also reflects expected impacts (increases) from projected electric vehicle usage and electrification.
2. NYCA total capacity include resources electrically internal to NYCA, additions, re-ratings, and deactivations (including proposed retirements, mothballs, and peaker rule impacts). Capacity values reflect the lesser of CRIS and DMNC summer MW values. NYCA resources include the net purchases and sales from the Gold Book. Net purchases and sales (transactions) include the election of Unforced Capacity Deliverability Rights (UDRs), External CRIS Rights, Existing Transmission Capacity for Native Load (ETCNL) elections, estimated First Come First Serve Rights (FCFSR), and grandfathered exports.

Base Case Reliability Assessments

Overview

This section provides the methodology and results for the resource adequacy and transmission security of the New York BPTF over the RNA study period. If any reliability criteria violations are identified, the NYISO identifies Reliability Needs. Violations of the criteria are translated into MW or MVAr amounts to provide a relative quantification of the Reliability Needs, and to support the development of solutions in the CRP. Enhancements to the application of the reliability criteria were added to the *2022 RNA* and are noted below.

Methodology for the Determination of Needs

The OATT defines Reliability Needs in terms of total deficiencies relative to reliability criteria determined from the assessments of the BPTF performed in the RNA. The BPTF include all of the facilities designated by the NYISO as a Bulk Power System (BPS) element as defined by the NYSRC and NPCC, as well as other transmission facilities that are relevant to planning the New York State Transmission System. There are two steps to analyzing the reliability of the BPTF. The first is to evaluate the security of the transmission system. The second is to evaluate the resource and transmission adequacy of the system, subject to the security constraints.

For this 2022 RNA, enhancements to the application of reliability rules were employed for both transmission security and resources adequacy:

- For transmission security, to represent that not all generation will be available at any given time, a derating factor is applied to thermal units. Additionally, intermittent, weather dependent generation is dispatched according to their expected availability coincident with the represented system condition. The enhancements also include the ability to identify BPTF reliability needs for instances where the transmission security margin for a constrained area of the system is less than zero MW.
- For resource adequacy, to ensure that some level of operating reserves is maintained, the Emergency Operating Procedure (EOP) step will retain 350 MW of operating reserves at the time of a load shedding event.

Transmission Security

Transmission security is the ability of the power system to withstand disturbances, such as electric short circuits or unanticipated loss of system elements and continue to supply and deliver electricity. The analysis for the transmission security assessment is conducted in accordance with NERC Reliability Standards, NPCC Transmission Design Criteria, and the NYSRC Reliability Rules. Transmission security is assessed deterministically with potential disturbances being applied without concern for the likelihood of the disturbance in the assessment. These disturbances (single-element and multiple-element contingencies) are categorized as the design criteria contingencies, which are explicitly defined in the reliability criteria. The impacts resulting from applying these design criteria contingencies are assessed to determine whether thermal loading, voltage, or stability violations will occur. In addition, the NYISO performs a short circuit analysis to determine if the system can clear faulted facilities reliably under short circuit conditions. The NYISO's "Guideline for Fault Current Assessment"[11] describes the methodology for that analysis.

Contingency analysis is performed on the BPTF to evaluate thermal and voltage performance under design contingency conditions using the Siemens PTI PSS®E and PowerGEM TARA programs. Generation is dispatched to match load plus system losses, while respecting transmission security. Scheduled inter-area transfers modeled in the base case between the NYCA and neighboring systems are held constant.

Transmission security analysis includes the assessment of various combinations of credible system conditions intended to stress the system. As transmission security analysis is deterministic, these various credible combinations of system conditions are evaluated throughout the study period to identify Reliability Needs. Intermittent generation is represented based on expected output during the modeled system conditions.[12]

Transmission security margins included in this assessment is to identify plausible changes in conditions or assumptions that might adversely impact the reliability of the BPTF or "tip" the system into violation of a transmission security criterion. The transmission security margin is the ability to meet load plus losses and system reserve (*i.e.,* total capacity requirement) against the NYCA generation, interchanges, and temperature-based generation derates (total resources). This assessment is performed using a deterministic approach through a spreadsheet-based method using the RNA study assumptions. For the purposes of identifying Reliability Needs on the BPTF using transmission security margin calculations, thermal generation MW capability is considered available based on NERC five-year class averages for the relevant type of units.[13] The derates for thermal generation are included due to the aging fleet without expected replacement, while the share of intermittent, weather dependent, generation is growing. Figure 27 shows the NERC five-year class-average outate rate for combined cycle, gas turbine, fossil steam turbine, and jet engine generators. Figure 28 shows the impact of the thermal derates on the total resources available statewide, as well as the Lower Hudson Valley, New York City, and Long Island localities.

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[11] Attachment I of Transmission, Expansion, and Interconnection Manual.

[12] The RNA assumptions matrix is posted under the July 1, 2022 TPAS/ESPWG meeting materials, which is available at here, and also in Appendix D.

[13] The NERC five-year class average EFORd data is available here.

Reductions in thermal derates over time are driven by the assumed generator deactivations in this assessment.

Figure 27: NERC Five-Year Class Average Outage Rate

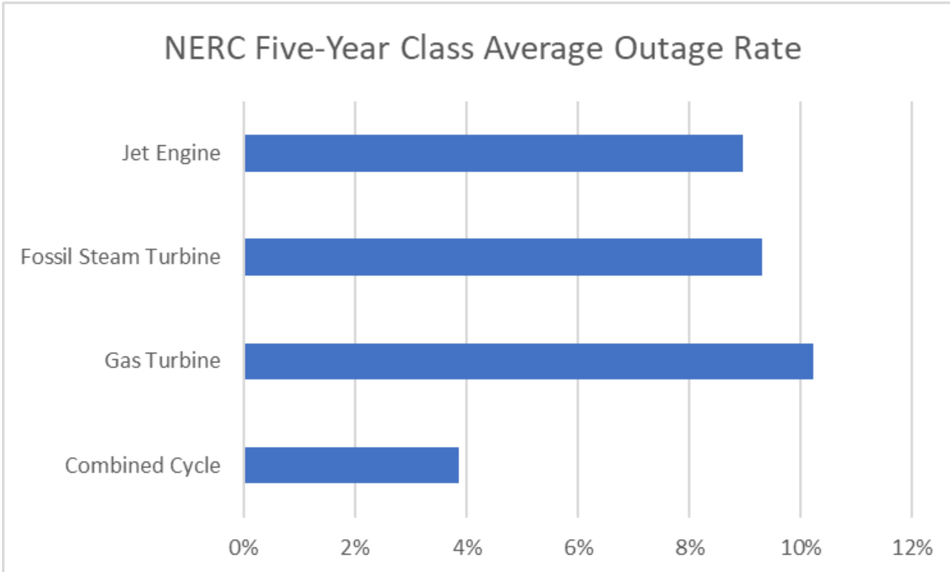
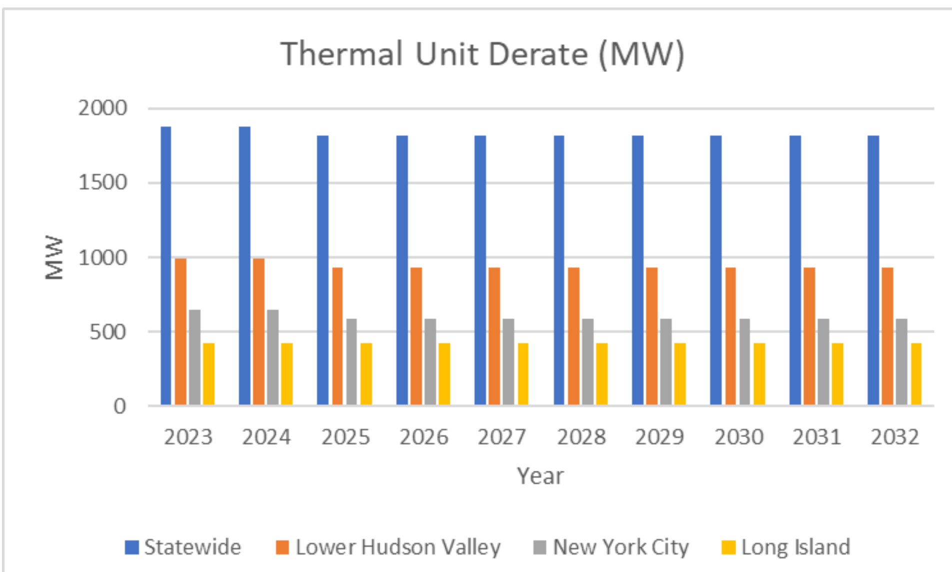


Figure 28: Thermal Unit Derate (MW) for New York



For the transmission security margin assessment, margins are evaluated for the statewide system margin, as well as Lower Hudson Valley, New York City, and Long Island localities. For this evaluation, a BPTF reliability need is identified when the margin is less than zero under baseline expected weather, normal transfer criteria conditions. Additional details regarding the impact of heatwaves, cold snaps, and other system conditions are provided in **Appendix F** for informational purposes.

Resource Adequacy

Resource adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of the firm load at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements. Resource adequacy considers the transmission systems, generation resources, and other capacity resources, such as demand response. The NYISO performs resource adequacy assessments on a probabilistic basis to capture the random nature of system element outages. If a system has sufficient transmission and generation, the probability of an unplanned disconnection of firm load is equal to or less than the system's standard, which is expressed as a loss of load expectation (LOLE). The New York State bulk power system is planned to meet a LOLE that, at any given point in time, is less than or equal to an involuntary firm load disconnection that is not more frequent than once in every 10 years, or 0.1 events per year. This requirement forms the basis of New York's Installed Reserve Margin (IRM) requirement and is analyzed on a statewide basis.

If Reliability Needs are identified, the RNA identifies various amounts and locations of compensatory MW required for the NYCA to address those needs to translate the criteria violations to understandable MW quantities. The analysis determines the compensatory MW amounts by adding generic capacity resources to NYISO zones to effectively satisfy the needs. The compensatory MW amounts and locations are based on a review of binding transmission constraints and zonal LOLE determinations in an iterative process to determine various combinations that will result in reliability criteria being met. These additions are used to estimate the amount of resources generally needed to satisfy the identified Reliability Needs. The compensatory MW additions are not intended to represent specific proposed solutions. Resource needs could potentially be met by other combinations of resources in other areas including generation, transmission, and demand response measures.

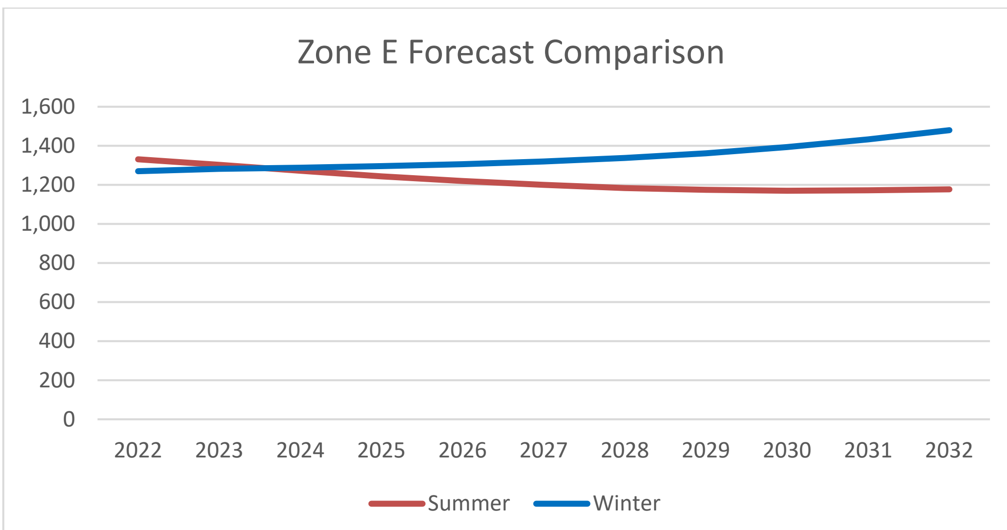
Due to the different types of supply and demand-side resources and due to transmission constraints, the amount and locations of resources necessary to match the level of identified compensatory MW needs will vary. Reliability Needs could be met in part by transmission system reconfigurations that increase transfer limits or by changes in operating protocols. Operating protocols could include such actions as using dynamic ratings for certain facilities, invoking operating exceptions, or establishing special protection systems.

The procedure to quantify compensatory MW for BPTF transmission security violations is a separate process from calculating compensatory MW for resource adequacy violations. This quantification is performed by first calculating transfer distribution factors on the overloaded facilities. The power transfer used for this calculation is created by injecting power at existing buses within the zone where the violation occurs and reducing power at an aggregate of existing generators outside of the area.

Transmission Security Base Case Assessments

To assist in the assessment, the NYISO reviewed previously completed transmission security assessments, such as the Short-Term Assessments of Reliability and other NERC, NPCC, and NYSRC compliance studies. The transmission security analysis evaluated expected summer peak, winter peak, and light load conditions under normal transfer criteria. While past RNAs have looked at various system conditions, they focused mainly on summer peak conditions, as these were the most stressful conditions that would occur over the whole year. However, with the load forecast showing that, while the total state remains summer peaking within the RNA horizon, several upstate zones will become winter peaking within the RNA 10-year horizon. As such, the transmission security analysis for this RNA also evaluated winter peak conditions. For instance, Zone E becomes winter peaking in winter 2024-25.

Figure 29: Zone E Summer and Winter Forecast Comparison



Additionally, the amount of solar DER has recently been forecasted to increase to over 10,000 MW (nameplate) by 2030. During spring daytime conditions when the load is very light and solar output could be near its maximum output capability, the amount of other generating resources needed to serve load may be significantly reduced. To capture any potential reliability issues, this transmission security case analyzed the expected load and solar generation under daytime light load conditions.

Figure 30: Expected Load and Solar Generation Under Daytime Light Load Conditions

	Final Gross Load	BTM Solar Generation	Net Load Forecast
2022	14,990	2,755	12,235
2023	15,261	3,329	11,932
2024	15,345	3,986	11,359
2025	15,297	4,656	10,641
2026	15,310	5,283	10,027
2027	15,383	5,872	9,511
2028	15,468	6,415	9,053
2029	15,621	6,878	8,743
2030	15,801	7,247	8,554
2031	16,021	7,487	8,534
2032	16,258	7,655	8,603

Potential Reliability Needs

A potential steady-state transmission security Reliability Need was identified for the study period under expected winter peak conditions. No other steady-state transmission security related needs were observed under other system conditions, including daytime light load conditions, which captured a high penetration of DER. Additionally, no stability or short-circuit needs were observed for any system conditions.

The identified transmission security Reliability Need is a low voltage violation at the Porter 115 kV bus following various contingency combinations resulting in the loss of both Edic-to-Porter 345/115 kV transformers under expected winter peak conditions. The low voltage violation at the Porter 115 kV bus is observed starting in winter 2025-26 due to the retirement of the two Porter 230/115 kV buses, which is planned to occur that winter with the Smart Path Connect Project (interconnection queue #Q1125), and the increasing load in Zone E observed in winter. The evaluation did not observe the low voltage violation at the Porter 115 kV bus under summer peak load conditions because the load forecast for Zone E is higher in winter than in summer. Since the low voltage needs observed at the Porter 115 kV bus occur due to the planned changes with Q1125, this issue will be addressed through the NYISO's interconnection process.

Transmission Security Margins (Tipping Points)

In the Lower Hudson Valley and Long Island localities, the BPTF system is designed to remain reliable in the event of two non-simultaneous outages (N-1-1). In the Con Edison service territory, the 345 kV transmission system and specific portions of the 138 kV transmission system are designed to remain reliability after the occurrence of two non-simultaneous outages and a return to normal ratings (N-1-1-0).

The transmission security margins for the Lower Hudson Valley, New York City, and Long Island localities, as well as the statewide system margin, are sufficient for all study years for the assumed system conditions. Figure 31 provides a summary of the margins under baseline expected summer weather, normal transfer criteria. While the margins are sufficient statewide (as well as in all localities), the margins within New York City are very narrow in 2025 (about 50 MW). With the planned addition of CHPE, there is an increase in the observed margins beginning summer 2026. However, the margin decreases between 2026 and 2032 due to increased load. The margin within New York City reduces to just over 100 MW by the end of the study period.

Although the New York City transmission security margins are sufficient, considering the hourly margins, which are shown in Figure 32 (year 2025) and Figure 33 (year 2032), the New York City margins are extremely narrow for several hours of the day under expected weather conditions. Under heatwaves or extreme heatwaves the margins are deficient for nearly half of the day. If the CHPE project experiences a significant delay (as shown with the status-quo scenario), the forecasted demand in New York City increases by as little as 60 MW in 2025, or there are additional generator deactivations beyond what is already planned, some generation affected by the Peaker Rule may need to remain in service until permanent solutions are completed to avoid exceeding the reliability margins.

Additional details of the transmission security margins are provided in **Appendix F**.

Figure 31: Summary of Baseline Expected Summer Weather, Normal Transfer Criteria Margins

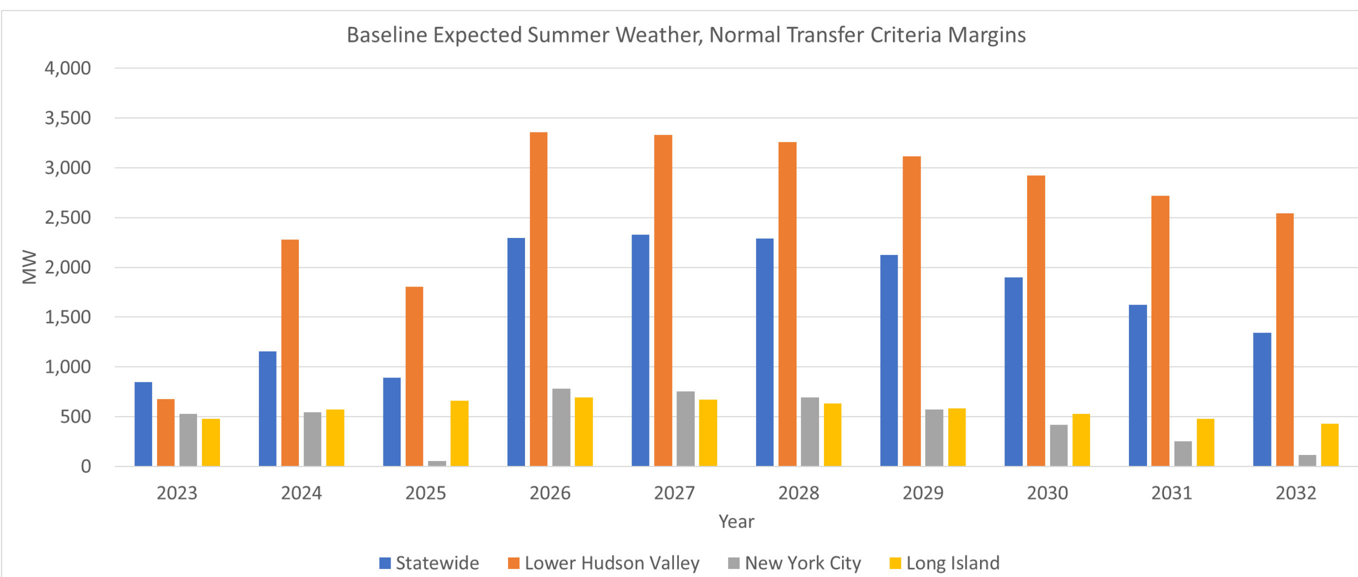


Figure 32: New York City Transmission Security Margin Hourly Curve - 2025

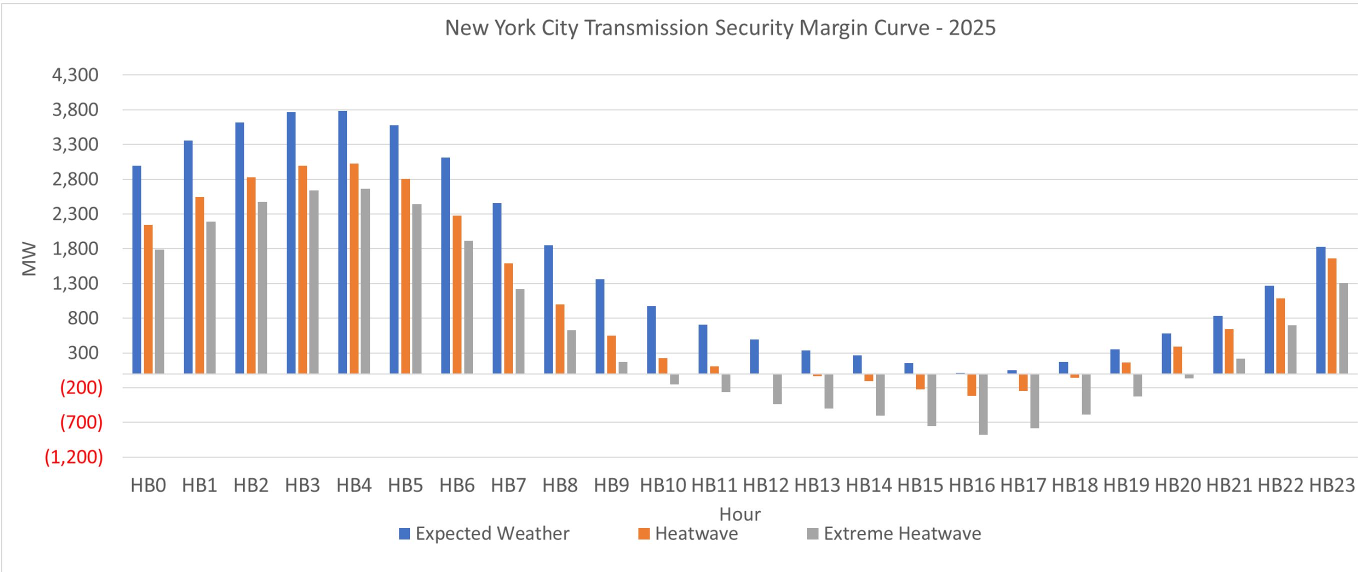
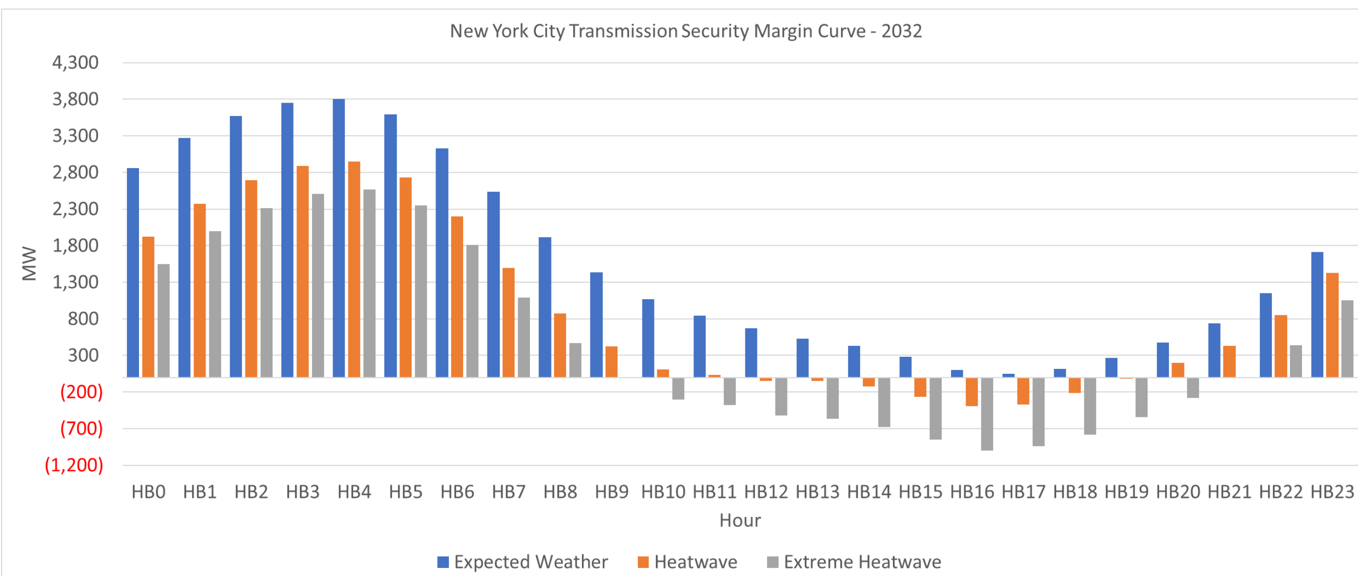


Figure 33: New York City Transmission Security Margin Hourly Curve - 2032



Resource Adequacy Base Case Assessments

The following discussion reviews the main modeling assumptions and findings of the 2022 RNA resource adequacy assessments applicable to the Base Case conditions for the study period.

Resource Adequacy Model

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 in **Appendix D**. 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.

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 units considerations include: random forced outages as determined by Generator Availability Data System (GADS) — calculated EFORd and the Monte Carlo draw, scheduled and unplanned maintenance, and thermal derates; minimum between CRIS and DMNC MW from the 2022 Gold Book is used for both summer and winter. Renewable resource units (*i.e.,* both utility and BtM 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.

Load Model

The load model in the NYISO 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 seasonal (summer and winter) basis to meet peak forecasts while maintaining the energy target. 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. The historical shapes used in the past (2002, 2006, and 2007) were replaced by the shapes for 2013, 2017, and 2018 based on the detailed analysis performed by the NYISO.[14]

External Areas Model

The NYISO models the four external Control Areas that connect to the NYCA (ISO-New England, PJM, Ontario, and Quebec). The transfer limits between the NYCA and these external Control Areas are set in collaboration with the NPCC CP-8 Working Group and are shown in the MARS Topology, Figure 34.

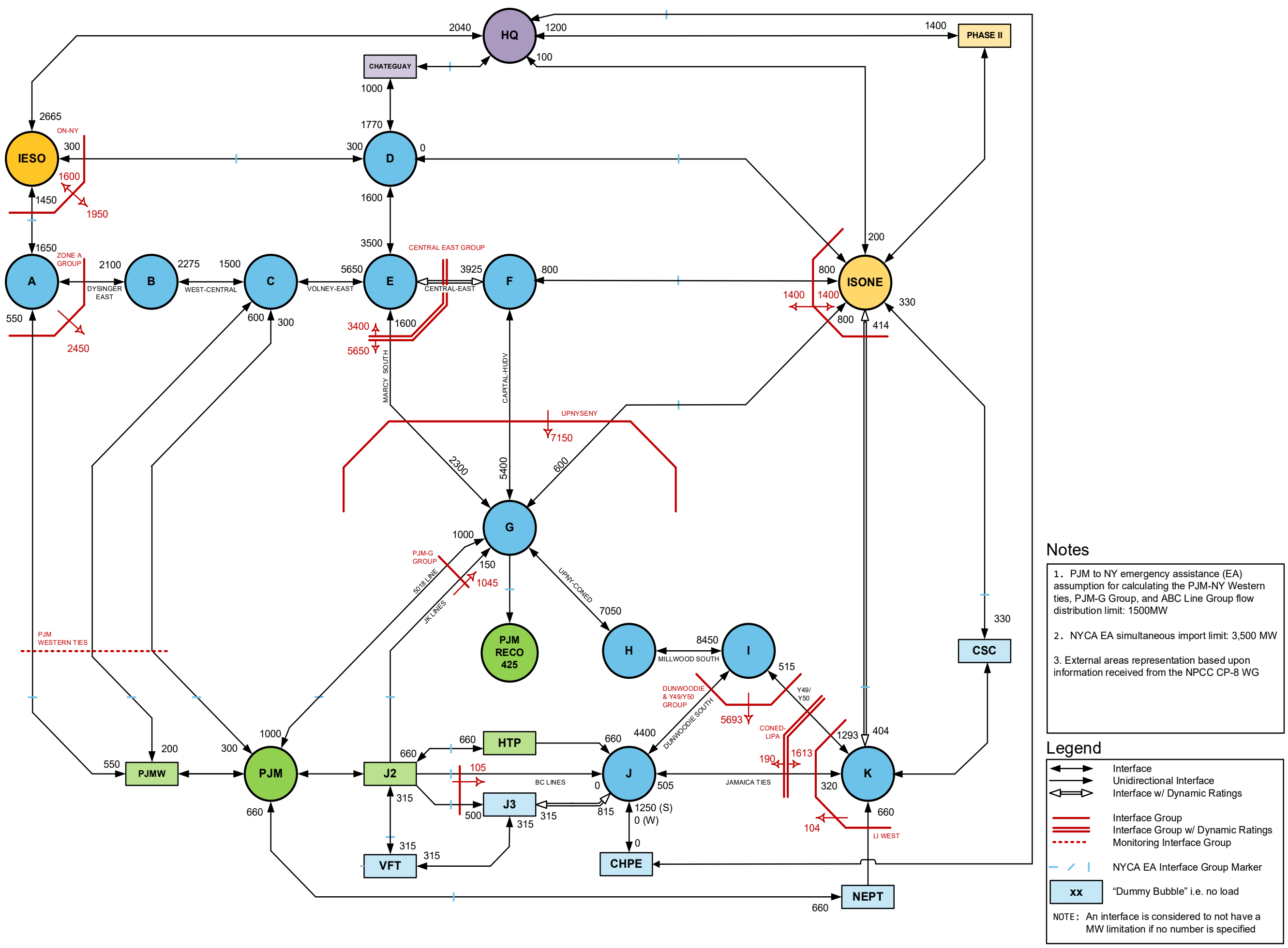
[14] The analysis was presented at the March 24, 2022 LFTF/TPAS/ESPWG, which is available at: https://www.nyiso.com/documents/20142/29418084/07%20LFU%20Phase%202_Recommendation.pdf and https://www.nyiso.com/documents/20142/29418084/08%20MARS_PlanningModel-NewLoadShapes.pdf.

Additionally, the probabilistic model used in the RNA to assess resource adequacy employs a number of methods aimed at preventing overreliance on support from these external systems. These methods include imposing a limit of 3,500 MW to the total emergency assistance from all neighbors, modeling simultaneous peak days, and modeling the long-term purchases and sales with neighboring Control Areas. Furthermore, the external Control Areas are modeled to maintain their LOLE range within 0.10 to 0.15 event-days/year.

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 between the NYCA 11 Areas ("bubble-and-pipe" model) and the four neighboring Control Areas (ISO-New England, PJM, Ontario, and Quebec). MARS does not model in detail any generation pockets in Zone J or Zone K.

Figure 34: MARS Topology – Study Years 4 through 10



Emergency Operating Procedures (EOPs)

The New York model evaluates the need to implement in sequential order several emergency operating procedures, such as operating reserves, Special Case Resources (SCRs), manual voltage reduction, public appeals, 10-minute reserve, 30-minute reserve, and emergency assistance from external areas.

A change was implemented for this RNA to maintain (*i.e.*, no longer deplete) 350 MW of the 1,310 MW 10-min operating reserves as part of the MARS EOPs. The NYISO presented and discussed this change at the May 5, 2022, ESPWG/TPAS.[15]

Resource Adequacy Base Case Results

The 2022 RNA Base Case resource adequacy studies show that the LOLE for the NYCA is below its 0.1 event-days/year criterion throughout the entire study period. Therefore, the NYISO identifies no resource adequacy Reliability Needs. The NYCA LOLE results are presented in Figure 35 below.

Figure 35: NYCA Resource Adequacy Results

Study Year	Baseline Forecast Load (MW)	RNA Base Case LOLE (days/year)
2023	32,018	0.025
2024	31,778	0.018
2025	31,505	0.024
2026	31,339	0.004
2027	31,292	0.005
2028	31,317	0.004
2029	31,468	0.005
2030	31,684	0.006
2031	31,946	0.010
2032	32,214	0.022

Notes:

- NYCA load values represent baseline coincident summer peak demand from the 2022 Gold Book.
- 2022 RNA Study Years are year 4 (2026) through year 10 (2032). Years 1 through 3 are for information.

LOLE accounts for events but does not account for the magnitude (MW) or duration (hours) of a deficit. Therefore, the NYISO conducts two additional reliability indices for informational purposes — loss of load hours (LOLH in hours/year) and expected unserved energy (EUE in MWh/year).[16]

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[15] Details of this change were presented at the May 5, 2022 ESPWG/TPAS, which presentation is available at: https://www.nyiso.com/documents/20142/30451285/08_Reliability_Practices_TPAS-ESPWG_2022-05-05.pdf.

[16] NYSRC's "Resource Adequacy Metrics and their Application" is available at: https://www.nysrc.org/PDF/Reports/Resource%20Adequacy%20Metric%20Report%20Final%204-20-2020[6431].pdf.

LOLE is generally defined as the expected (weighted average) number of days in a given period (*e.g.,* one study year) when for at least one hour from that day the hourly demand is projected to exceed the zonal resources (event day). Within a day, if the zonal demand exceeds the resources in at least one hour of that day, this will be counted as one event day. The criterion is that the LOLE shall not exceed one day in 10 years, or LOLE < 0.1 days/year.

LOLH is generally defined as the expected number of hours per period (*e.g.,* one study year) when a system's hourly demand is projected to exceed the zonal resources (event hour). If the zonal demand exceeds the resources within an hour, this will be counted as one event hour.

EUE, also referred to as loss of energy expectation (LOEE), is generally defined as the expected energy (MWh) per period (*e.g.,* one study year) when the summation of the system's hourly demand is projected to exceed the zonal resources. Within an hour, if the zonal demand exceeds the resources, this deficit will be counted toward the system's EUE.

While the resource adequacy reliability criterion of 0.1 days/year established by the NYSRC and the NPCC is compared with the loss of load expectation (LOLE in days/year) calculation, currently there is no criterion for determining a reliable system based on the LOLH and EUE reliability indices.

Figure 36: NYCA Resource Adequacy Results

Study Year	LOLE	LOLH	LOEE
	event-days/year	event-hours/year	MWh/year
2023	0.025	0.061	23.860
2024	0.018	0.035	11.538
2025	0.023	0.048	18.399
2026	0.004	0.008	1.734
2027	0.005	0.010	2.529
2028	0.004	0.008	1.626
2029	0.005	0.009	1.799
2030	0.006	0.013	3.051
2031	0.010	0.020	5.095
2032	0.022	0.045	11.382

Impact of Emergency Operating Procedures

The LOLE results after each of the emergency operating procedures (EOPs) are shown in Figure 37. 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 2032 results show that after EOP steps 1 through 7 have been applied and before the emergency assistance is available, the NYCA LOLE is 1.23 days/year, which is above the 0.1 days/year criterion. After the external area emergency assistance from EOP step 8 becomes available, the LOLE decreases to 0.09 days/year. This demonstrates that without emergency assistance from neighboring regions, there would not be sufficient resources to serve demand within New York. As a result, a sensitivity was performed to identify at what limit of emergency assistance would result in a resource deficiency in 2032. When the emergency assistance limit is reduced from 3,500 MW to 1,200 MW, the NYCA LOLE changes from 0.02 days/year to 0.1 days/year (at criterion).

Figure 37: LOLE Results by Emergency Operating Procedure Step

		NYCA LOLE (days/year) by Margin State									
Step	EOP	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1	Removing Operating Reserve	6.32	4.37	4.99	1.91	2.98	2.32	2.89	2.94	5.02	6.74
2	Require SCRs (Load and Generator)	3.30	2.72	3.16	0.94	1.46	1.38	1.54	1.72	2.73	4.12
3	5% Manual Voltage Reduction	3.12	2.59	3.01	0.88	1.34	1.32	1.47	1.64	2.60	3.94
4	30-Minute Reserve (*i.e.,* 655 MW) to Zero	2.01	1.42	1.89	0.41	0.79	0.55	0.65	0.76	1.20	2.05
5	5% Remote Controlled Voltage Reduction	1.36	1.00	1.32	0.27	0.52	0.37	0.44	0.51	0.81	1.47
6	Voluntary Load Curtailment	1.18	0.84	1.11	0.23	0.47	0.30	0.37	0.42	0.69	1.32
7	Public Appeals	1.13	0.78	1.06	0.21	0.44	0.27	0.33	0.38	0.63	1.23
8	Emergency Assistance	0.11	0.10	0.11	0.05	0.05	0.04	0.04	0.05	0.07	0.09
9	Part of 10-Minute Reserve (*i.e.* , 960 of 1310 MW) to Zero	**0.02**	**0.02**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.02**

Notes:
- **The results in bold font** represents the LOLE at the last step (9) and is the NYCA LOLE that is compared against the 0.1 days/year criterion.

There are several modeling methods currently employed to limit New York's reliance on external areas. For instance, the NYISO will apply a statewide limitation on emergency assistance and representing external areas to assure those areas are self-sufficient before providing assistance to New York.

Figure 38 shows a comparison between summer and winter zonal demand forecasts used for this 2022 RNA and the 2020 RNA resource adequacy base cases. The comparison shows that additional zones are becoming either winter peaking or dual peaking. While the LOLE is below its 0.1 days/year criterion throughout the study period, this shift is the main driver for events occurring during winter. Additional details of the events analysis can be found in **Appendix D**.

Figure 38: 2022 vs. 2020 Non-Coincident Peak Summer and Winter

2022 Gold Book Non-Coincident Peak Season - Within 5% Considered Both as Peak											
Year	A	B	C	D	E	F	G	H	I	J	K
2022	S	S	S	W	S	S	S	S	S	S	S
2023	S	S	S	W	B	S	S	S	S	S	S
2024	S	S	B	W	B	S	S	S	S	S	S
2025	S	S	B	W	B	S	S	S	S	S	S
2026	S	S	B	W	B	S	S	S	S	S	S
2027	S	S	B	W	W	S	S	S	S	S	S
2028	S	S	B	W	W	S	S	S	S	S	S
2029	S	S	W	W	W	S	S	S	S	S	S
2030	S	S	W	W	W	B	S	S	S	S	S
2031	B	S	W	W	W	B	S	S	S	S	S
2032	B	S	W	W	W	B	S	S	S	S	S

2020 Gold Book Non-Coincident Peak Season - Within 5% Considered Both as Peak											
Year	A	B	C	D	E	F	G	H	I	J	K
2022	S	S	S	W	B	S	S	S	S	S	S
2023	S	S	S	W	B	S	S	S	S	S	S
2024	S	S	S	W	B	S	S	S	S	S	S
2025	S	S	S	W	B	S	S	S	S	S	S
2026	S	S	S	W	B	S	S	S	S	S	S
2027	S	S	S	W	B	S	S	S	S	S	S
2028	S	S	S	W	W	S	S	S	S	S	S
2029	S	S	S	W	W	S	S	S	S	S	S
2030	S	S	S	W	W	S	S	S	S	S	S
2031	S	S	S	W	W	S	S	S	S	S	S
2032	S	S	S	W	W	S	S	S	S	S	S

Notes: S-Summer W-Winter B - Both (The peaks are within 5% of each other)

The Base Case resource adequacy results show that:

- The New York Control Area (NYCA) loss of load expectation (LOLE in days/year) through the ten-year planning horizon is below the New York State Reliability Council's (NYSRC's) and Northeast Power Coordinating Council's (NPCC's) criterion of one day in 10 years, or 0.1 days per year. This is mainly due to the net MW resources included in this RNA Base Case being higher as compared to the prior CRP base cases. Additionally, the RNA Base Case includes the Champlain Hudson Transmission Partners (CHPE) 1,250 MW HVDC project from Hydro Quebec to Astoria Annex 345 kV in Zone J and the NYPA/National Grid Northern New York Priority Transmission Project starting in 2026.
- The MARS events are distributed in June, July (the most), August, and September in the afternoon hours (as shown in the Appendix D event analysis graphs).
- Additionally, there are events observed in the winter months. While the NYCA forecast is still a summer peak, there are additional zones getting closer, or shifting, to a winter peak throughout the study period (as shown in the Appendix D event analysis graphs). Figure 38 shows a comparison of the distribution of summer versus winter forecasts between the 2022 Gold Book and 2020 Gold Book.

Base Case Variation Scenarios

The NYISO, in conjunction with stakeholders and Market Participants, developed reliability scenarios pursuant to Section 31.2.2.5 of Attachment Y of the OATT. 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 Reliability Needs identification or mitigation. The NYISO evaluated the following scenarios as part of this RNA, with an identification of the type of assessment performed:

1. **High Load Forecast Scenario**
    - The 2022 Gold Book High Load forecast was used for the resource adequacy analysis.
2. **Zonal Resource Adequacy Margins (ZRAM)**
    - Identification of the maximum level of zonal MW capacity that can be removed without either causing NYCA LOLE violations or exceeding the zonal capacity.
3. **"Status-quo" Scenario**
    - Removal of proposed major transmission and generation projects assumed in the RNA Base Case.
4. **Winter Scenarios**
5. **CLCPA Scenarios – Policy Case Scenario for Study Year 2030**

The results of the scenarios are summarized in the following sections.

High Load Forecast Scenario

The RNA Base Case forecast includes impacts associated with projected energy reductions coming from statewide energy efficiency and BtM solar PV programs. The High Load Forecast Scenario excludes these energy efficiency program impacts from the peak forecast, resulting in higher forecast levels. The comparison of the High and Baseline forecasted loads is provided in the Figure 39 below. There is an increase of 3,484 MW in the peak load in 2032 from the Base Case forecast. Given that the peak load in the High Load Forecast Scenario is higher than in the Base Case, the probability of violating the LOLE criterion increases with violations potentially starting in 2030. The NYCA LOLE results are in Figure 40.

Figure 39: 2022 Gold Book NYCA High Load vs. Baseline Summer Peak Forecast

Study Year	Baseline Load (BL)	High Load (HL)	Delta MW (HL-BL)
2023	32,018	32,780	762
2024	31,778	32,849	1,071
2025	31,505	32,854	1,349
2026	31,339	32,946	1,607
2027	31,292	33,133	1,841
2028	31,317	33,464	2,147
2029	31,468	33,915	2,447
2030	31,684	34,475	2,791
2031	31,946	35,080	3,134
2032	32,214	35,698	3,484

Figure 40: High Load Scenario Resource Adequacy Results

Study Year	RNA Base Case LOLE (days/year)	High Load Scenario LOLE (days/year)	Delta LOLE
2023	0.025	0.044	0.018
2024	0.018	0.039	0.021
2025	0.024	0.068	0.045
2026	0.004	0.027	0.023
2027	0.005	0.035	0.030
2028	0.004	0.052	0.047
2029	0.005	0.079	0.074
2030	0.006	0.149	0.143
2031	0.010	0.342	0.332
2032	0.022	0.676	0.654

This scenario indicates that if expected energy efficiency and peak load reduction programs do not materialize at the expected levels, criterion violations could start in 2030 for a load level that is 2,791 MW higher than the baseline load.

Zonal Resource Adequacy Margins (ZRAM)

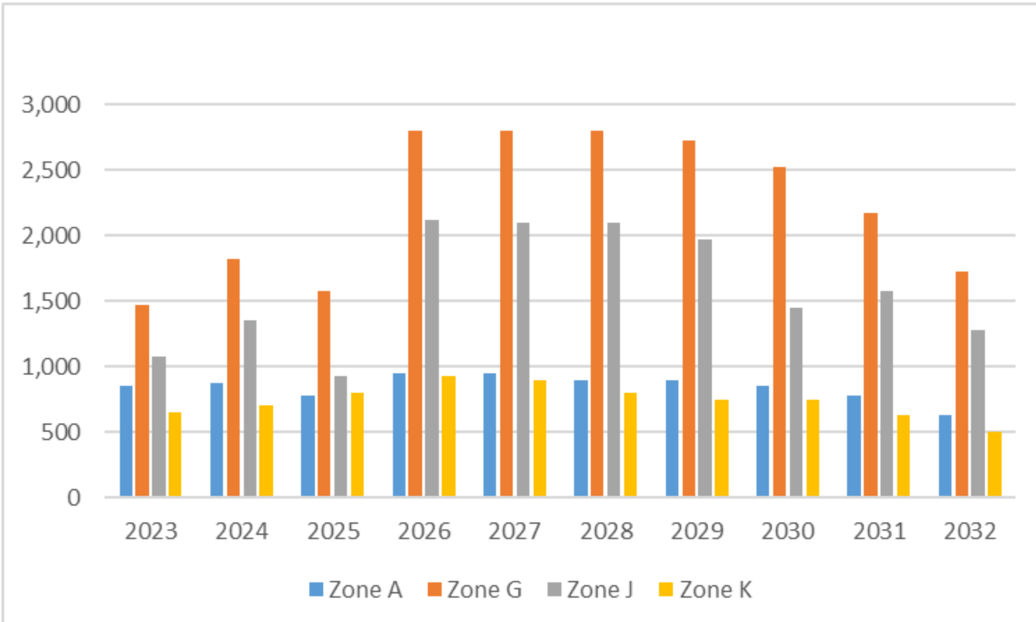
Resource adequacy simulations were performed on the RNA Base Cases[17] to determine the amount of "perfect" capacity" in each zone that could be removed before the NYCA LOLE reaches 0.1 event-days/year (one-event-day-in-ten-years) and to offer another relative measure of how close the system is from not having adequate resources to reliably serve load.

Figure 41 shows the tightening of zonal resource adequacy margins for western New York (Zone A), Hudson Valley (Zone G), New York City (Zone J), and Long Island (Zone K). New York may experience even

[17] The CRP base cases already reflect the DEC Peaker Rule compliance plans submitted by the affected generation owners to DEC, which are summarized in the assumption tables from Appendix B.

smaller resource adequacy margins if additional power plants become unavailable or if demand is greater than forecasted. As shown in Figure 41, the margin is only 500 MW in Long Island (Zone K) and only 625 MW in western New York (Zone A) by 2032. The Long Island margin is likely to increase as a result of the Long Island Offshore Wind Export Public Policy Transmission Need.

Figure 41: Summary of Key Zonal Resource Adequacy Margins



In performing this analysis, 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 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 42, and the zonal resource margin analysis (ZRAM) is summarized in Figure 43**.**

Figure 42: NYISO Load Zone Map

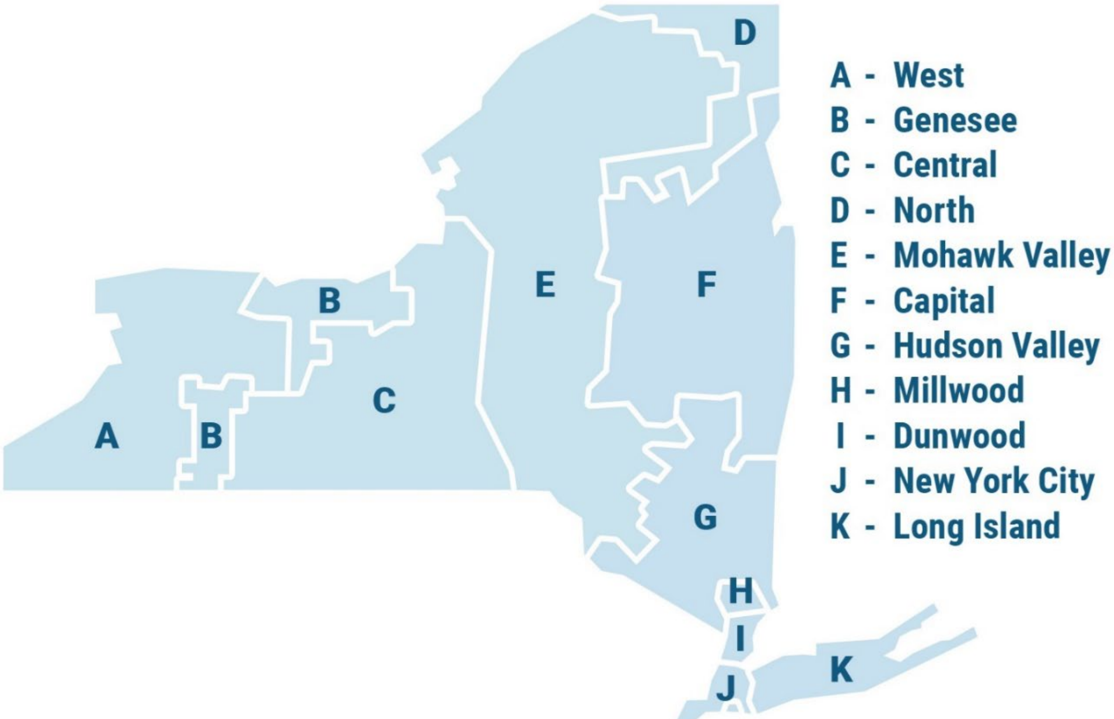


Figure 43: Zonal Resource Adequacy Margins (MW)

Study Year	RNA Base Case LOLE *(days/year)*	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G	Zone H	Zone I	Zone J	Zone K
2023	0.025	-850	-850	-1,475	-1,425	-1,500	-1,500	-1,475	-1,375	-1,375	-1,075	-650
2024	0.018	-875	-875	-1,800	-1,675	-1,800	-1,800	-1,825	-1,700	-1,700	-1,350	-700
2025	0.024	-775	-775	-1,475	-1,475	-1,550	-1,550	-1,575	-1,475	-1,475	-925	-800
2026	0.004	-950	-950	-2,625	-1,925	-2,800	-2,800	-2,800	-2,575	-2,600	-2,125	-925
2027	0.005	-950	-950	-2,600	-1,925	-2,800	-2,800	-2,800	-2,575	-2,575	-2,100	-900
2028	0.004	-900	-900	-2,600	-1,925	-2,800	-2,800	-2,800	-2,575	-2,575	-2,100	-800
2029	0.005	-900	-900	-2,500	-1,925	-2,700	-2,700	-2,725	-2,450	-2,450	-1,975	-750
2030	0.006	-850	-850	-2,325	-1,925	-2,525	-2,525	-2,525	-2,175	-2,175	-1,450	-750
2031	0.010	-775	-775	-2,050	-1,775	-2,175	-2,175	-2,175	-1,975	-1,975	-1,575	-625
2032	0.022	-625	-625	-1,700	-1,450	-1,725	-1,725	-1,725	-1,625	-1,625	-1,275	-500

Notes:

- Negative numbers indicate the amount of "perfect MW" that can be removed from a zone without causing a violation.
- EZR - Exceeds Zonal Resources (all generation can be removed without causing a violation).
- The generation pockets in Zone J and Zone K are not modeled in detail for this analysis and the margins identified here may be smaller as a result.

The ZRAM assessment identifies a maximum level of "perfect capacity" that can be removed from each zone without causing a NYCA LOLE criterion violation. However, the impacts of removing capacity on the reliability of the transmission system and on transfer capability are highly location dependent. 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.

Binding Interfaces

To determine whether a specific transmission interface impacts system resource adequacy, “free-flow” simulations were performed for targeted interfaces. 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”). 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 these simulations shown in Figure 44.

Figure 44: Binding Interface Analysis

Study Year	2022 RNA Base Case NYCA LOLE	Free Flow NYCA LOLE	Delta LOLE
2026	0.004	0.003	-0.001
2027	0.005	0.003	-0.002
2028	0.004	0.003	-0.002
2029	0.005	0.002	-0.002
2030	0.006	0.004	-0.002
2031	0.010	0.005	-0.005
2032	0.022	0.010	-0.012

The results show that while NYCA LOLE is below its 0.1 event-days/year criterion, increasing transmission system limits can allow more power to come across the state.

Status-Quo Scenario

This scenario evaluates the reliability of the system based on the assumption that no major transmission or generation projects come to fruition within the RNA study period. This includes the removal of all proposed transmission and generation projects that have met the inclusion rules for the 2022 RNA Base Case and removal of generators that require modifications to comply with the DEC’s Peaker Rule (Figure 21, Figure 22, and Figure 23). The AC Transmission Public Policy Projects and the Western New York Public Policy Project are not removed for this scenario due to their advancement in development.

Figure 45: Status-quo Scenario Resource Adequacy Results

	2022 RNA 1st Pass Base Case vs Status-Quo Scenario LOLE *(days/year)*		
Study Year	RNA Base Case	Status Quo	Delta
2023	0.025	0.028	0.003
2024	0.018	0.024	0.007
2025	0.024	0.033	0.010
2026	0.004	0.022	0.018
2027	0.005	0.026	0.021
2028	0.004	0.020	0.015
2029	0.005	0.021	0.017
2030	0.006	0.042	0.036
2031	0.010	0.041	0.031
2032	0.022	0.068	0.046

	2022 RNA 1st Pass Base Case vs Remove CHPE Sensitivity LOLE *(days/year)*		
Study Year	RNA Base Case	TDI/CHPE Removed	Delta
2023	0.025	0.025	0.000
2024	0.018	0.018	0.000
2025	0.024	0.024	0.000
2026	0.004	0.015	0.011
2027	0.005	0.016	0.011
2028	0.004	0.014	0.010
2029	0.005	0.015	0.011
2030	0.006	0.033	0.026
2031	0.010	0.033	0.023
2032	0.022	0.047	0.025

From a resource adequacy perspective, this scenario indicates that even if the LOLE is still below its 0.1 event-days/year criterion, there may be a significant impact if the expected generation and transmission projects are not built. Figure 45 shows the LOLE results when removing the proposed additions from the Base Case while leaving in-service the generators that require modifications to comply with the DEC's Peaker Rule. For those generators requiring modifications, the total MW capability exceeds the zonal resource adequacy margin for Zone K shown in Figure 43, signifying that the resource adequacy criterion would not be met if those modifications are not completed. An additional sensitivity was performed with only removing the CHPE project. Those results indicate that most of the NYCA LOLE impact is due to this project's removal.

The steady state transmission security results show, as compared to the RNA Base Case, overloads are observed under N-1-1 conditions in the NYSEG, National Grid, Con Edison, and PSEG-LI service territories. The results of the steady state transmission security N-1-1 evaluation of the BPTF for this scenario are shown in Figure 46. Figure 47 provides a comparison of the statewide system margin under the status quo scenario assumptions to the RNA baseline conditions. Similarly, Figure 48 and Figure 49 show the New York City and Long Island transmission security margins for the status quo scenario compared to the RNA baseline assumptions. The status quo assumptions show that the statewide system margin is insufficient in 2032 by about 10 MW. The New York City transmission security margin under status quo assumptions is insufficient to serve demand starting in year 2028 (about 25 MW) with 2032 being deficient by about 600

MW. The New York City transmission security margin analysis includes the removal of CHPE.[18] If the CHPE project experiences a significant delay, the forecasted demand in New York City increases by as little as 60 MW in 2025, or there are additional generator deactivations beyond what is already planned, some generation affected by the Peaker Rule may need to remain in service until permanent solutions are completed to avoid exceeding the reliability margins. The Long Island transmission security margin under the status quo assumptions is deficient as early as 2023 by about 300 MW, which increases to just under 600 MW in 2032. The Lower Hudson Valley transmission security margins are sufficient throughout the study period for all load conditions.

Figure 46: Status-quo Scenario Transmission Security Overloads

Zone	Owner	Circuit
A	NYSEG	North Gardenville 230/115/34.5
C	NGRID	Clay - Volney 345kV (6)
I/K	ConEd/LIPA	Dunwoodie - Shore Rd 345kV (Y50)
I/K	NYPA	Sprainbrook - East Garden City 345kV (Y49)
J	ConEd	Fresh Kills - Fresh Kills PAR 138kV (21192)
J	ConEd	Fresh Kills 345/138 (TA1)
J	ConEd	Fresh Kills 345/138 (TB1)
J	ConEd	Fresh Kills PAR 138kV (R1)
J	ConEd	Fresh Kills PAR 138kV (R2)
J	ConEd	Gowanus 345/138 (T14)
J	ConEd	Gowanus 345/138 (T2)
J	ConEd	Rainey West - Farragut East 345kV (61)
K	LIPA	Carle Pl - East Garden City 138kV (361)
K	LIPA	Edwards Avenue - Riverhead 138kV (893)
K	LIPA	Elwood - Northport 138kV (678)
K	LIPA	Glenwood - Shore Rd 138kV (365)
K	LIPA	Northport - Pilgrim 138kV (672)
K	LIPA	Northport - Pilgrim 138kV (677)
K	LIPA	Northport - Pilgrim 138kV (679)
K	LIPA	Shore Rd 345/138kV (Bank #1)
K	LIPA	Shore Rd 345/138kV (Bank #2)

[18] In a recent press issued in August 2022, CHPE updated the project's full operation date to the spring of 2026, shifting from the originally anticipated in-service date of late 2025. The press release is available at: https://chpexpress.com/news/champlain-hudson-power-express-provides-update-on-anticipated-full-operation-date/.

Figure 47: Status-quo Scenario Statewide System Margin

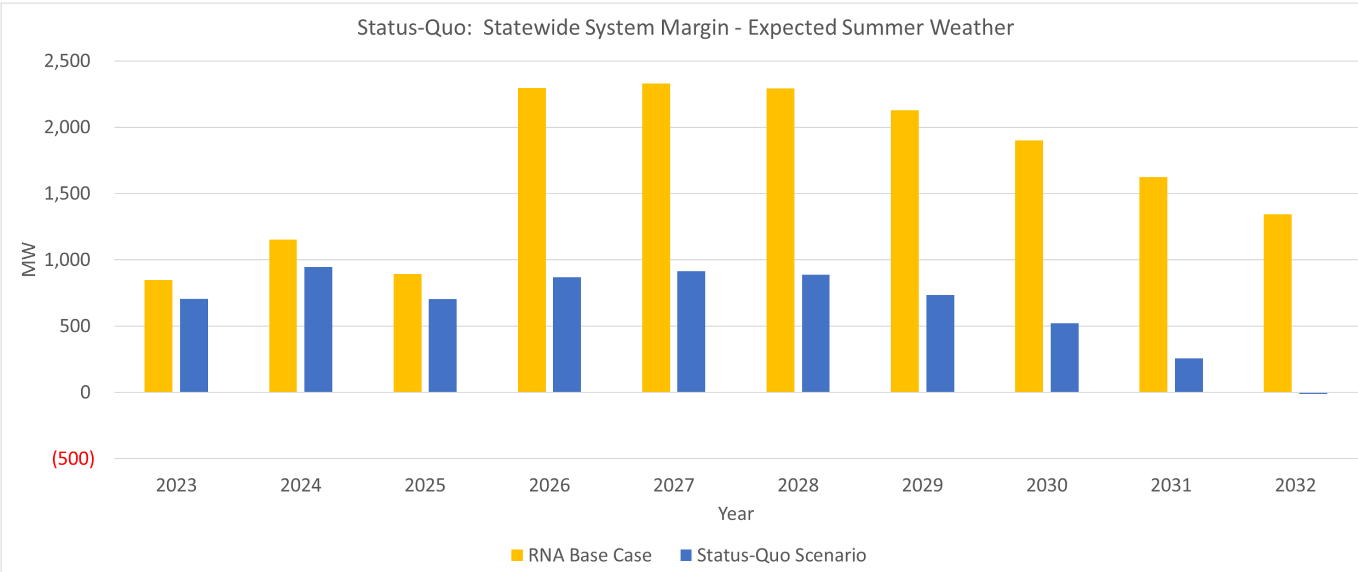


Figure 48: Status-quo Scenario New York City Transmission Security Margin

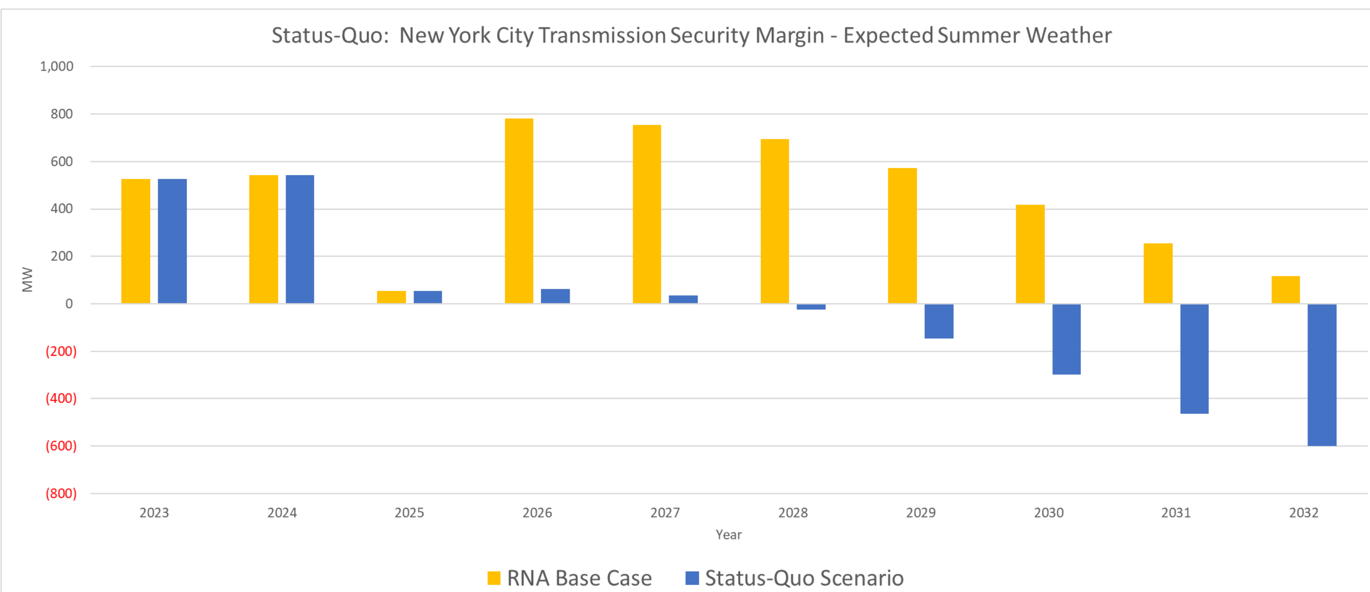
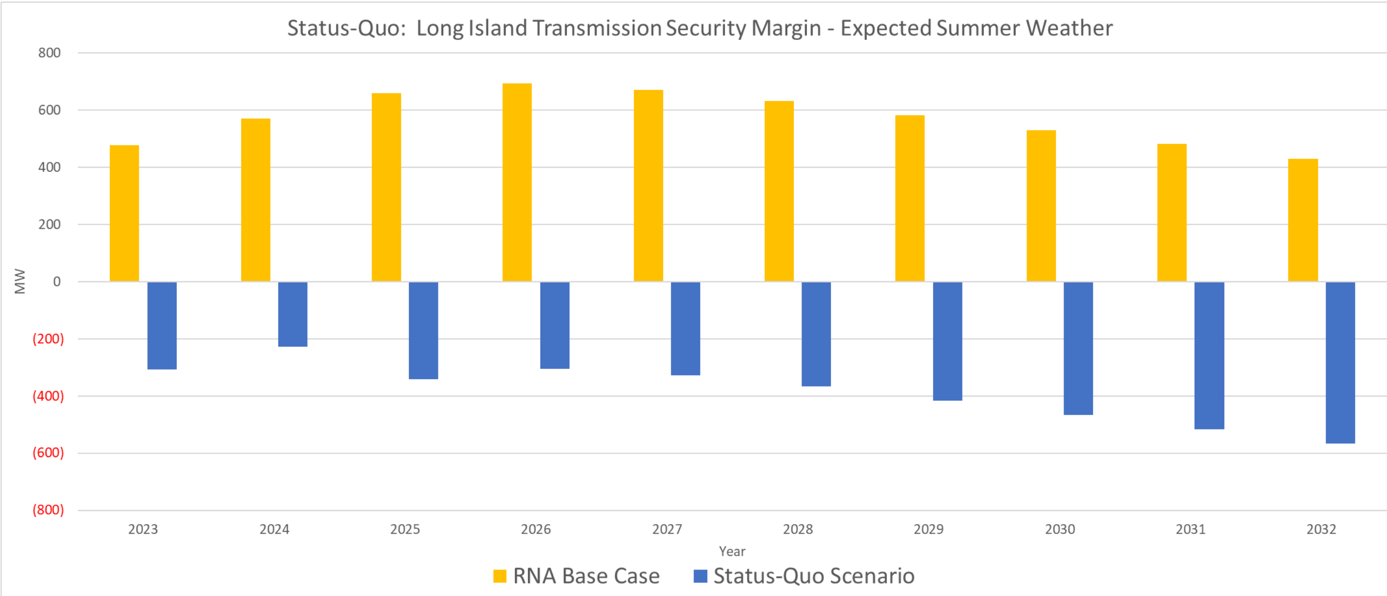


Figure 49: Status-quo Scenario Long Island Transmission Security Margin



Winter Scenarios: Gas Shortage

For this RNA, the NYISO assessed winter reliability for cold snap and gas supply shortage conditions. With input from NYISO's ongoing fuel & energy security initiatives, approximately 6,300 MW of existing gas-fueled generation was identified as potentially at-risk under gas shortage conditions. Natural gas fired generation in the NYCA is supplied by various networks of major gas pipelines. From a statewide perspective, New York has a relatively diverse mix of generation resources. Details of the fuel mix in New York are outlined in the *2022 Gold Book*, as well as the *2022 Power Trends Report*.[19]

The study conditions for evaluating the impact of the gas fuel supply shortages are identified in NPCC Directory #1 and the NYSRC Reliability Rules as an extreme system condition. Extreme system conditions are beyond design criteria conditions and are meant to evaluate the robustness of the system. However, efforts are underway nationally, regionally, and locally to review the established design criteria and conditions in consideration of heatwave, cold snaps, and other system conditions. For instance FERC issued a Notice of Proposed Rulemaking in 2022 to "address reliability concerns pertaining to transmission system planning for extreme heat or cold weather events that impact the Reliable Operation of the Bulk-Power System."[20] In response to this NOPR, the NYISO supported the Commission's guidance to NERC and the industry at large that will help stakeholders plan for, and develop responses to, extreme heat and cold

[19] Power Trends 2022

[20] Transmission System Planning Performance Requirements for Extreme Weather, *Notice of Proposed Rulemaking,* Docket No. RM22-10-000 (June 16, 2022).

weather events.[21] Locally, the NYSRC has established goals to identify actions to preserve NYCA reliability for extreme weather events and other extreme system conditions.[22]

Even prior to the 2022 initiative, the Analysis Group conducted an assessment in 2019 of the fuel and energy security in New York to examine the fuel and energy security of the New York electric grid.[23] Following this report, the NYISO has continued to evaluate and update stakeholders regarding the key factors that could impact fuel and energy security in New York.[24] The NYISO identified a 2023 project, *Enhancing Fuel and Energy Security*, to refresh the assumptions from the Analysis Group's 2019 fuel and energy security report to assess emerging operational and grid reliability concerns.[25] At the nationwide level, NERC identified a project, entitled Project 2022-03 Energy Assurance with Energy-Constrained Resources, that proposes to address several energy assurance concerns related to both the operations and planning time horizons.[26]

For the transmission security margin evaluation of gas shortage conditions, all gas-only units within the NYCA are assumed unavailable with consideration of firm gas fuel contracts. Dual-fuel units with duct-burn capability are also assumed to be unavailable. This assessment assumes the remaining units have available fuel for the peak period.

Figure 50 shows the statewide system margin for winter weather conditions including cold snap and extreme cold snap conditions. A cold snap with a statewide daily average temperature of 6 degrees Fahrenheit (1-in-10-year, or 90/10) has sufficient margin throughout the study period. Additionally, an extreme cold snap with a statewide daily average temperature of 0 degrees Fahrenheit (1-in-100-year, or 99/1) also has sufficient margin. Under the extreme system condition of a gas fuel shortage the statewide system margin is deficient by winter 2031-32. These deficiencies are exacerbated under cold snap and extreme cold snap conditions.

Figure 51 shows the New York City transmission security margin for similar winter weather conditions, including the gas fuel shortage condition. For New York City, in winter 2032-33 the system is deficient under the shortage of gas fuel supply conditions with a cold snap. The Lower Hudson Valley and Long Island localities show sufficient margins for all conditions throughout the study period.

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[21] NYISO comments to RM22-10-000 are found here

[22] A copy of the NYSRC 2022 goals is available here.

[23] Analysis Group, Final Report on Fuel and Energy Security In New York State, An Assessment of Winter Operational Risks for a Power System in Transition (November 2019), which is available here.

[24] One example is the 2021-2022 Fuel & Energy Security Update that the NYISO presented at its Installed Capacity Working Group in June of 2022, which is available at here.

[25] Additional details on the 2023 Enhancing Fuel and Energy Security project are available here.

[26] Additional details on NERC's Project 2022-03 Energy Assurance with Energy-Constrained Resources are available here.

Figure 50: Winter Weather Statewide System Margins

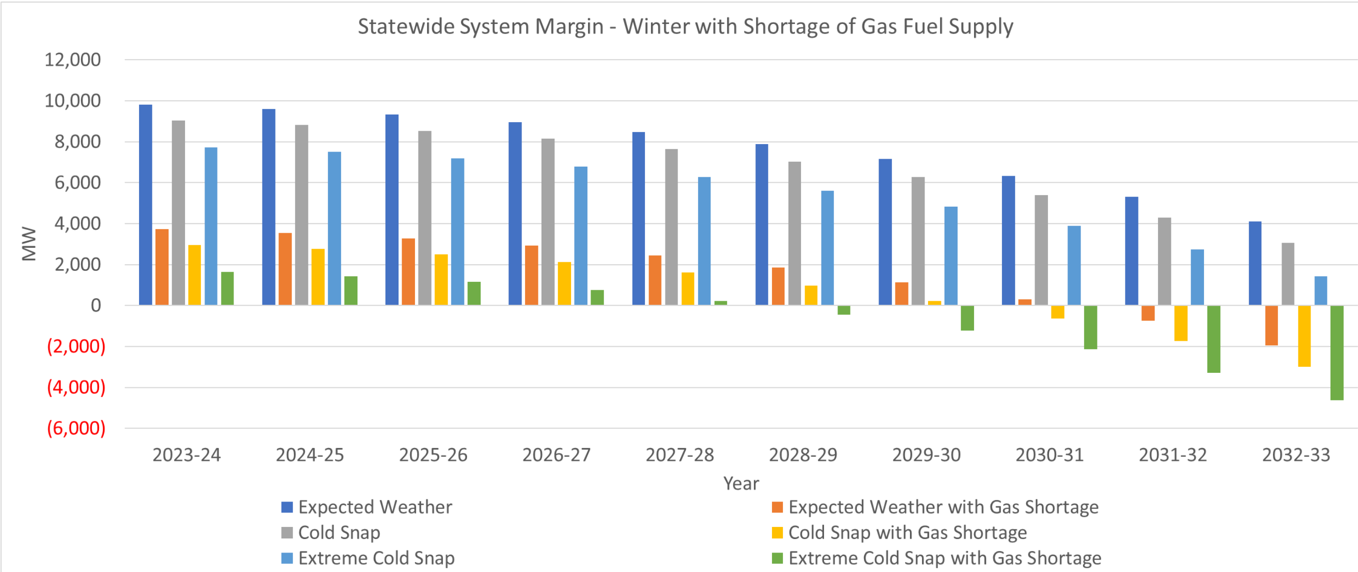
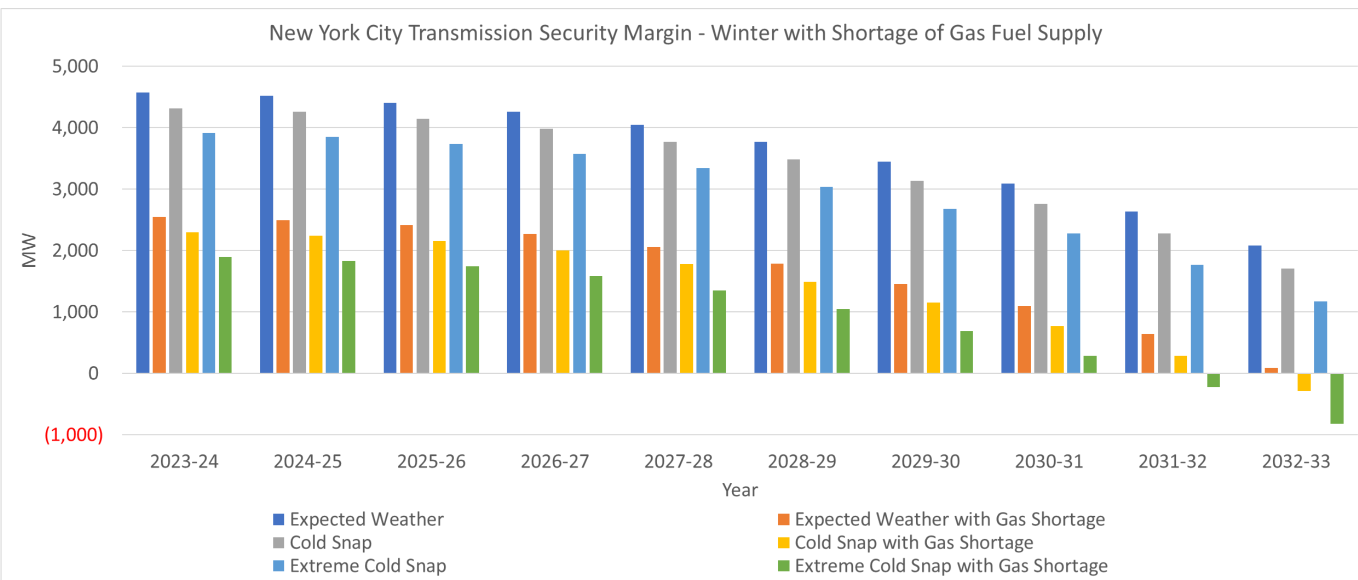


Figure 51: Winter Weather New York City Transmission Security Margins



Additionally, the RNA conducted a resource adequacy scenario that simulated for the gas shortage conditions described above. This scenario removed certain generators for the months of December, January, and February of the study year 2032 and recalculated the NYCA LOLE reliability index.

The results indicate that, while still below the LOLE criterion of 0.1 days/year, there is a significant degradation in the resource adequacy of the system (*e.g.,* LOLE from 0.022 to 0.049 days/year) under a gas shortage scenario.

Figure 52: Winter Scenarios LOLE Results

	MW Reductions* in Winter (Dec-Feb)				NYCA LOLE
Y2032	Zone J	Zone K	Other	Total	
RNA Base Case	0	0	0	0	0.022
Gas Shortage	2,130	394	3,829	6,353	0.049
*The resource adequacy models reflect the lesser of CRIS and DMNC					

However, the NYISO is currently performing its Public Policy Transmission Planning Process that is evaluating solutions to a Public Policy Transmission Need with the goal to increase imports and exports from Long Island. The RNA conducted additional sensitivity to the gas shortage scenario that removes the topology limits into Long Island. The results show an improvement in the system reliability (*e.g.,* LOLE from 0.049 days/year to 0.037 days/year) if the import capability into Long Island is increased.

Road to 2040 – 70x30 Policy Case Scenario

Significant shifts are expected in both the demand and supply sides of the electric grid, and these changes will affect how the power system is currently planned and operated. As part of the *2021-2040 System & Resource Outlook* (the "Outlook"), the NYISO assessed several policy-driven futures to identify potential resource mixes and examine resulting system constraints and operational limitations. This 2022 RNA builds upon the findings of the Outlook and its Policy Case with an analysis of the postulated 2030 system conditions.

Background of the Policy Case

Assumptions in the Outlook Policy Case reflect the federal, state, and local policies that impact the New York power system. Examples of policies modeled in this case include the CLCPA 70x30 renewable mandate and the 2040 zero-emissions directive.

The key input assumptions that drive the types and quantities of resource addition and replacement in the capacity expansion analysis are peak demand forecast, energy demand forecast, capital, operation, and maintenance cost associated with each technology, age of the existing fossil-fueled and nuclear fleet, and energy output from existing resources. The details are included in the *Outlook Report* and its Appendices C and D.

In addition to generation expansion, the capacity expansion optimization allows for generator retirements when their deactivation does not trigger a reliability need. Scenario 2 in the Outlook Policy Case includes an age-based retirement criteria that retires steam turbines at 62 years and gas turbines at 47 years of age, based on industry trends for the age at which 95% of the specified generation type historically retires.

System Resource Mix Scenarios from the Outlook

The NYISO uses a capacity expansion model to estimate possible system resource mixes over the next 20 years. In the Outlook Policy Case, two specific generation buildout scenarios were selected from the multitude of capacity expansion simulations performed to reasonably bound impacts and formulate a detailed nodal production cost simulation model.

- **Scenario 1 (S1)** utilizes industry data and NYISO load forecasts, representing a future with high demand (57,144 MW winter peak and 208,679 GWh energy demand in 2040) and assumes less restrictions in renewable generation buildout options.
- **Scenario 2 (S2)** utilizes various assumptions more closely aligned with the Climate Action Council Integration Analysis and represents a future with a moderate peak but a higher overall energy demand (42,301 MW winter peak and 235,731 GWh energy demand in 2040).

For this RNA resource adequacy scenario, the NYISO uses the Scenario 2 results from 2030. Projected resource mixes for Scenario 2 are provided in Figure 53. Historical zonal capacity by type is shown in Figure 54 for comparison to the Outlook Policy Case results for Scenario 2, which are provided in Figure 55.

Figure 53: Outlook Policy Case Scenario 2 Capacity Expansion Results

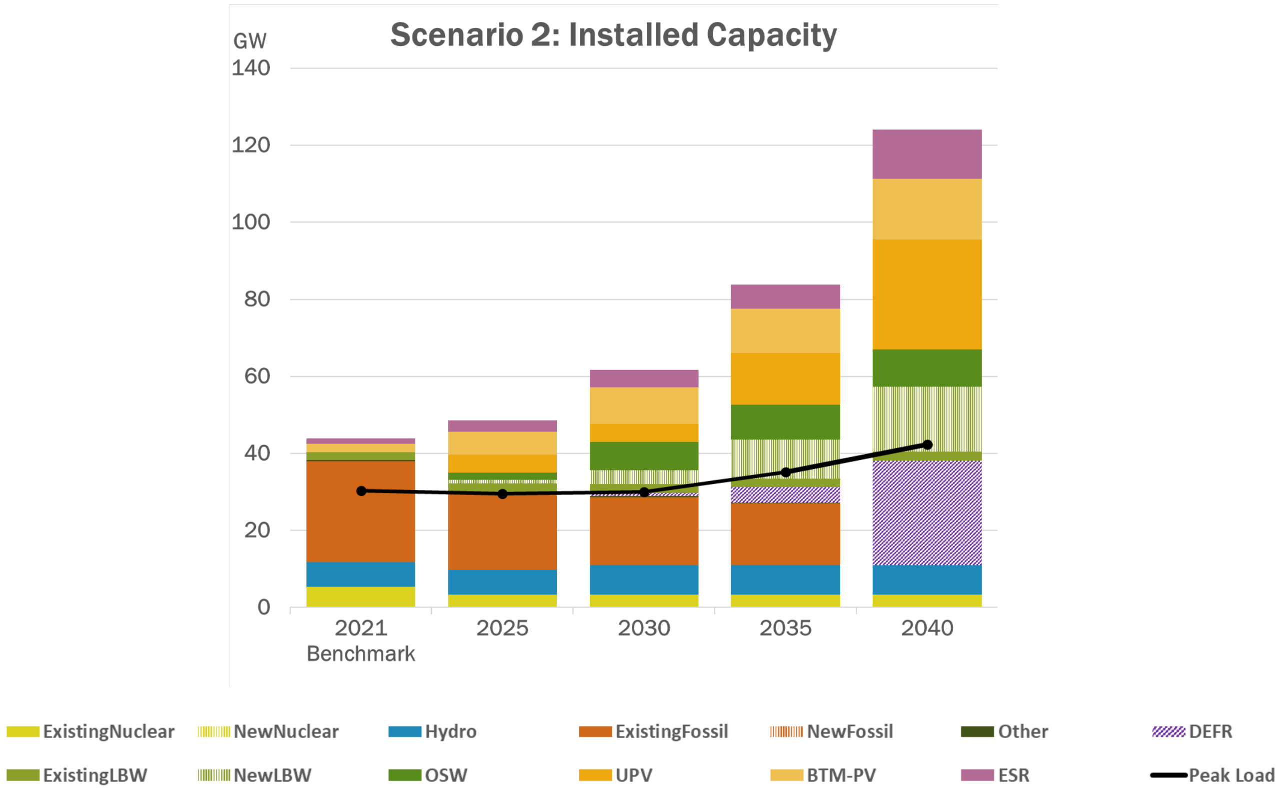


Figure 54: 2021 Actual Installed Capacity By Zone

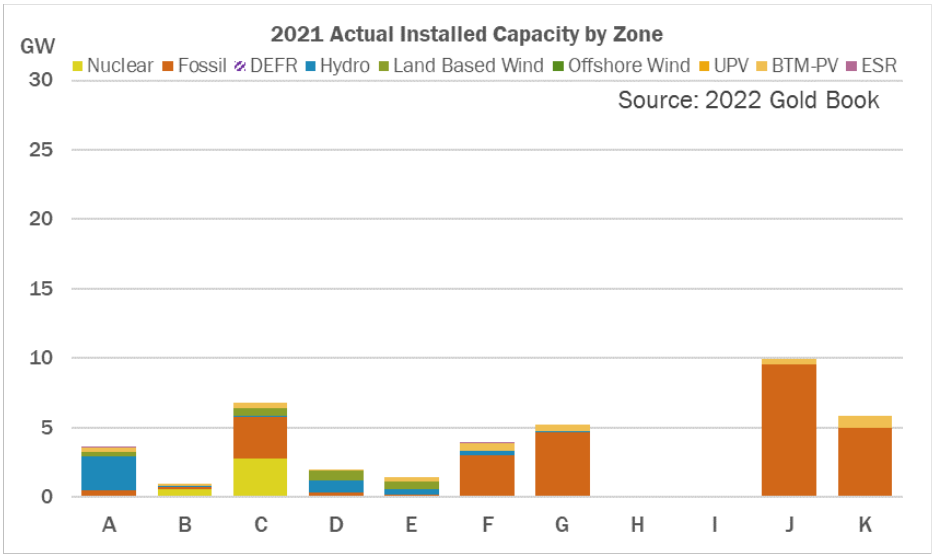
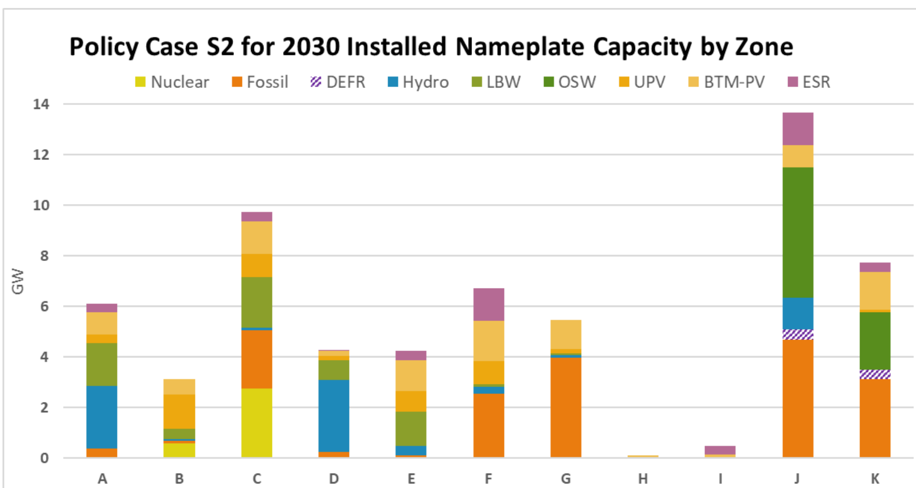


Figure 55: Outlook Policy Case Scenario 2 Installed Nameplate Capacity by Zone - 2030



Policy Case Scenario Assumptions

The key modeling assumptions and approaches will have a significant impact on the results. The following detail those assumptions used in the Policy Case scenario for this RNA, with additional details in Appendix E.

Load Assumptions

The same 8,760 hourly load shape from the Outlook Policy Case Scenario 2 for 2030 is used for the resource adequacy modeling for each of the seven probabilistic load bins. The load forecast uncertainty from the 2022 RNA Base Cases is applied. The assumed forecasts are shown in the Figure 56 below, with BtM solar forecast added back.

Figure 56: 2030 Policy Case Demand Forecasts

Annual Energy	Summer Peak	Winter Peak
GWh	MW	
164,256	30,070	25,892

Figure 57: 2030 Policy Case Summer Energy and Peak Demand Forecast Zonal Distribution

2030 Outlook S2 Energy Details	A	B	C	D	E	F	G	H	I	J	K	NYCA
Net Load Energy (GWh)	14,547	9,438	14,955	4,802	6,305	10,183	7,732	2,632	5,769	53,937	19,518	149,817
+ BtM-PV Energy (GWh)	1,277	899	1,866	332	2,067	2,433	1,870	192	225	1,217	2,060	14,439
Total Energy (GWh)	15,824	10,337	16,821	5,134	8,372	12,616	9,602	2,824	5,993	55,155	21,578	164,256

2030 Outlook S2 Peak Details	A	B	C	D	E	F	G	H	I	J	K	NYCA
Net Load Peak (MW)	2,319	1,499	2,348	769	907	1,795	1,537	535	1,178	9,867	3,989	26,743
+ BtM-PV at NYCA Peak (MW)	293	208	429	79	475	562	432	45	51	280	475	3,327
Total Load Peak (MW)	2,612	1,706	2,777	847	1,382	2,357	1,969	579	1,229	10,147	4,464	30,070

Note: *Non-coincident zonal peak

Coincident peak demand is the projected zonal load during the date and hour of the NYCA system-wide peak. The NYCA coincident peak typically occurs in late afternoon during July or August. Non-coincident peak demand is the projected maximum load for each individual zone across a year or season.

Renewable Mix Assumptions

The NYISO assumed a renewable resource mix distributed across the state by zone, corresponding to the load modeled in the Outlook Policy Case Scenario 2 for 2030. This RNA scenario models the same zonal renewable resource distribution.

Additional modeling details, by type:

- **Land-based wind (LBW):** Hourly dispatch profiles (MWh shapes) are applied from the Outlook Policy Case Scenario 2 for 2030 simulation output, including curtailments observed in the production simulation. The Outlook used the 2009 weather year National Renewable Energy Laboratory (NREL) data as input.
- **Off-shore wind (OSW):** Hourly dispatch profiles (MWh shapes) are applied from the Outlook Policy Case Scenario 2 for 2030 simulation output, including curtailments observed in the production simulation, for each of the two load shapes. The Outlook used the 2009 weather year NREL data as input.
- **Utility-scale Solar PV (UPV):** Hourly dispatch profiles (MWh shapes) are applied from the Outlook Policy Case Scenario 2 for 2030 simulation output, including curtailments observed in

the production simulation, for each of the two load shapes. The Outlook used the 2006 weather year NREL data as input.

- **Behind-the-Meter Solar PV (BtM PV):** Hourly dispatch profile (MWh shapes) are applied from the Outlook Policy Case Scenario 2 for 2030 simulation output. The underlying BTM PV shapes used in the Outlook Policy Case Scenario 2 forecast were from the *Climate Impact Study Phase II.* [27] They were modified to align with the projected BtM PV capacity from Berkley's Lab Integration Analysis.[28]

Storage Assumptions

The MARS Energy Storage (ES) model was used with the energy storage nameplate by zone summary provided from the Outlook data. If a zone had more than 100 MW of energy storage nameplate, the units were split into approximately 100 MW increments. All energy storage units have four hours of full capability, consistent with the Outlook Policy Case Scenario 2 assumptions.

This scenario assumes the same zonal MW distribution modeled in the Outlook Policy Case, as shown in the Figure 55 above. In these simulations, the energy storage units discharge their power when the system is deficient and recharge their energy when the system has an excess of capacity. Units are modeled with a maximum energy discharge per day of four times their maximum hourly discharge value. This paradigm allows the unit to discharge fully in four hours, or for longer if not at full discharge.

Contracts and External Areas

This scenario models PJM, Ontario, and ISO-NE systems using same method as the 2022 RNA Base Case. Hydro Quebec (HQ) is modeled as an import (*i.e.*, no generation or load). All contracts currently tied to HQ (*i.e.*, HQ Wheel and HQ Import) were removed. All ties to and from HQ set to 0. The following HQ contracts are modeled as shapes from the Outlook output data:

- Champlain Hudson Power Express (CHPE)
- HQ Import (including Cedars)

Transmission

This scenario is not an interconnection-level assessment of the renewable buildouts and does not review detailed engineering requirements, capacity deliverability, or impact to the New York system reserve margin. No other change was implemented, as compared with the 2022 RNA Base Case topology, to reflect the impacts of any modification simulated in the scenarios.

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[27] Climate Change Phase II is available at: https://www.nyiso.com/documents/20142/16884550/NYISO-Climate-Impact-Study-Phase1-Report.pdf.

[28] Berkley's Lab Integration Analysis is available at: https://climate.ny.gov/-/media/Project/Climate/Files/IA-Tech-Supplement-Annex-1-Input-Assumptions.xlsx.

This scenario includes two significant proposed HVDC projects that have received awards under NYSERDA's Tier 4 REC program, of which CHPE is also included in the 2022 RNA Base Case. Both projects are reflected in the resource adequacy model using the Outlook Policy Case 8,760 hourly MW flow.

- 1,250 MW Champlain Hudson Power Express project,[29] jointly developed by Transmission Developers, Inc. and Hydro-Québec, is a 375-mile submarine and underground HVDC transmission project delivering power from Québec, Canada to New York City.
- 1,300 MW Clean Path New York (CPNY) project,[30] jointly developed by Forward Power (a joint venture of Invenergy and EnergyRe) and the New York Power Authority, is a 174-mile underground and submarine HVDC transmission line from Fraser substation in upstate New York to New York City.

Dispatchable Emissions-Free Resources (DEFRs)

The Outlook Policy Case Scenario 2 modeled 819 MW installed capacity of DEFRs for 2030; however, in the output data, only a single unit was dispatched by the production simulation program and for only 50 MWh. Therefore, for the purposes of this reliability analysis, no DEFRs are modeled in this Policy Case scenario.

Policy Case Analysis and Findings

New cases were developed based on the assumptions described above, and two fossil removal sensitivities (age-based and zonal MW removal) were performed to better understand the impact of various factors.

Initial resource adequacy simulations show that the modeled system is well below the 0.1 days/year criterion, at NYCA LOLE of 0.008 event-days/year as shown in Figure 58 below. This result occurs because large amounts of additional renewable generation are modeled in this scenario, while still retaining some of the existing fossil fuel generators. This, in turn, leads to a surplus of available generation for resource adequacy purposes.

[29] Additional details of the Champlain Hudson Power Express project are available at https://chpexpress.com/.

[30] Additional details of the Clean Path New York project are available at https://www.cleanpathny.com/.

Figure 58: 2030 Policy Case Resource Adequacy Results

NYCA Metric	Value
LOLE (days/year)	0.008
LOLH (hours/year)	0.020
EUE (MWH/year)	3.264

Policy Case Zonal Resource Adequacy Margins

Additional simulations were performed to gauge the sensitivity of the system to capacity removal. A zonal resource adequacy margin (ZRAM) analysis identifies the amounts of generic "perfect capacity" resources that can be removed from a single zone while still meeting the LOLE criterion. "Perfect capacity" is capacity that is not derated (*e.g.,* due to ambient temperature or unit unavailability caused by factors such as equipment failures or lack of fuel), not subject to energy duration limitations (*i.e.*, available at maximum capacity every hour of the study year) and not tested for transmission security or interface impacts. Actual resources must be larger in order to achieve the same impact as perfect-capacity resources.

Figure 59: 2030 Policy Case: Zonal Resource Adequacy Margins

Study Year 2030	NYCA LOLE	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G	Zone H	Zone I	Zone J	Zone K
Base Case	0.006	-850	-850	-2,325	-1,925	-2,525	-2,525	-2,525	-2,175	-2,175	-1,450	-750
Policy Case S2	0.008	-2,300	-2,300	-2,700	-1,150	-2,700	-2,725	-2,750	-2,700	-2,700	-1,900	-450

Notes:

- Negative numbers indicate the amount of MW that can be removed from a zone (one zone at a time in this case) without causing a violation. For instance, NYCA LOLE reaches 0.1 days/year when 450 MW of "perfect capacity" is removed from Zone K in the Policy Case, and 750 MW in the 2022 RNA Base Case.
- The generation pockets in Zone J and Zone K are not modeled in detail in MARS, and the values identified here may be larger as a result.

The ZRAM analysis results provided in Figure 59 show that while the NYCA LOLE for the Outlook Policy Case Scenario 2 is below its 0.1 days/year criterion, removing 450 MW of perfect capacity in Zone K (or 1,900 MW in Zone J or 1,150 MW in Zone D) can lead to resource adequacy violations. Removing 450 MW of perfect capacity in Zone K results in approximately 17,200 MW of fossil generation remaining to maintain an adequate system.

Age-Based Retirement Analysis

An age-based retirement analysis was also performed, where fossil units are removed from the model, starting with the oldest, until the New York system is at its LOLE criteria. This age-based approach is a simple analytical approach as a proxy to represent unit retirements that may occur as surplus resources increase. In reality, many factors will affect specific generator status decisions.

Both the Outlook Policy Case and this RNA already reflect proposed deactivations and status changes such as the impact of the DEC Peaker Rule. The Outlook Policy Case Scenario 2 also already includes an age-based retirement criteria that retires steam turbines at 62 years and gas turbines at 47 years of age, based on industry trends for the age at which 95% of the specified generation type historically retires.

Figure 60: 2030 Policy Case: Fossil Removal by Age

	Total Thermal Capacity Left (MW)				Total Thermal Capacity Removed (MW)					
Cases (Age >=)	Zone J	Zone K	Other Zones	Total	Zone J	Zone K	Other Zones	Total	Total**	NYCA LOLE
2022 RNA Base	8,755	4,946	11,688	25,389	0	0	0	0	-	-
Outlook S2 Base	4,848	3,145	9,657	17,650	3,907	1,801	2,031	7,739	0	0.01
62	4,848	2,737	9,635	17,220	3,907	2,209	2,053	8,169	430	0.04
61*	4,848	2,499	9,635	16,982	3,907	2,447	2,053	8,407	668	0.10
61	4,848	2,341	9,616	16,805	3,907	2,605	2,072	8,584	845	0.19

*A special evaluation of Case 61 where the marginal unit was derated, instead of fully removed, to obtain an LOLE of close to 0.1 days/year

** Total removal compared to the Outlook S2 Case

This age-based scenario shows that approximately 17,000 MW must be retained to have an adequate system with a net peak demand of 26,700 MW. For different conditions such as higher peak load or different zonal resources and types, this value can be higher. If the higher RNA base case peak load materializes, additional existing fossil generation will be needed to maintain reliability of the system. Additional fossil generation may also be needed to provide other reliability services such as black start, voltage support, governor response, etc.

This finding, however, is sensitive to location. The age-based fossil removal method has the effect of primarily removing the units from Long Island (Zone K), which is already near its limit in the model, and thus accelerating the rate of LOLE reaching its criterion violation. Because Zone K (and not upstate generation) is driving the LOLE at criterion, additional fossil generation could be removed from the upstate zones without affecting the LOLE at criterion.

Figure 61 and Figure 62 below show the resulting resource mixes for the state, New York City (Zone J) and Long Island (Zone K), respectively. All generation percentages are calculated based on nameplate rating.

Figure 61: 2030 Policy Case: NYCA Resource Mix after the Age-Based Fossil Removal

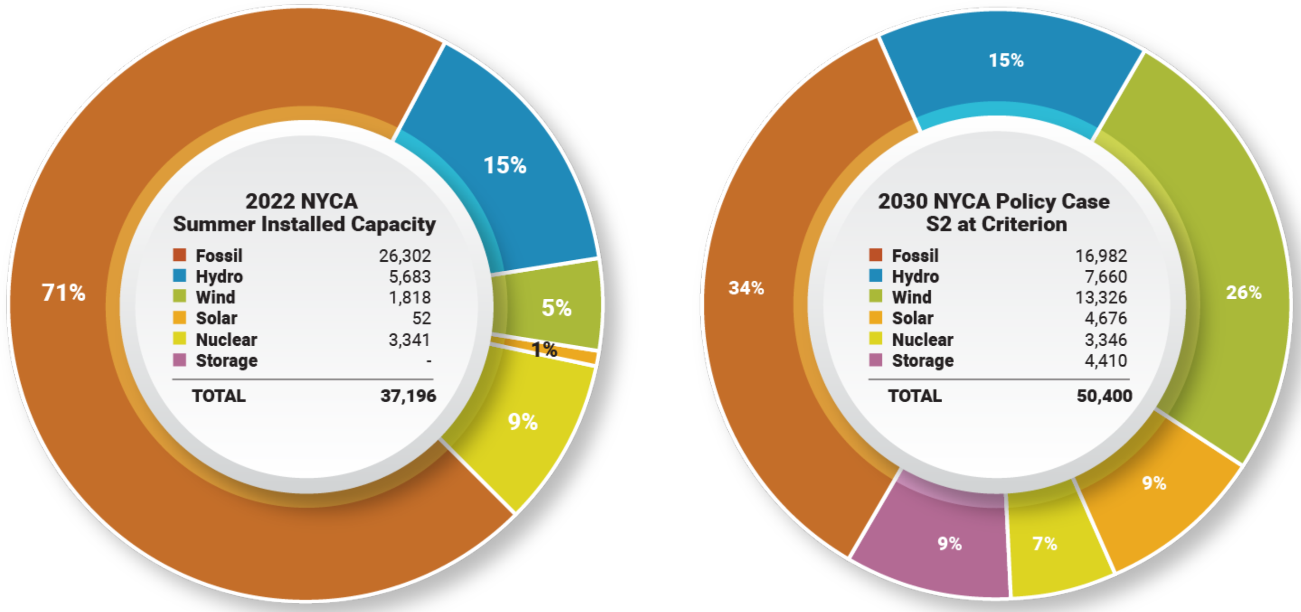

Figure 62: 2030 Policy Case: New York City (Zone J) and Long Island (Zone K) Resource Mix at Criterion

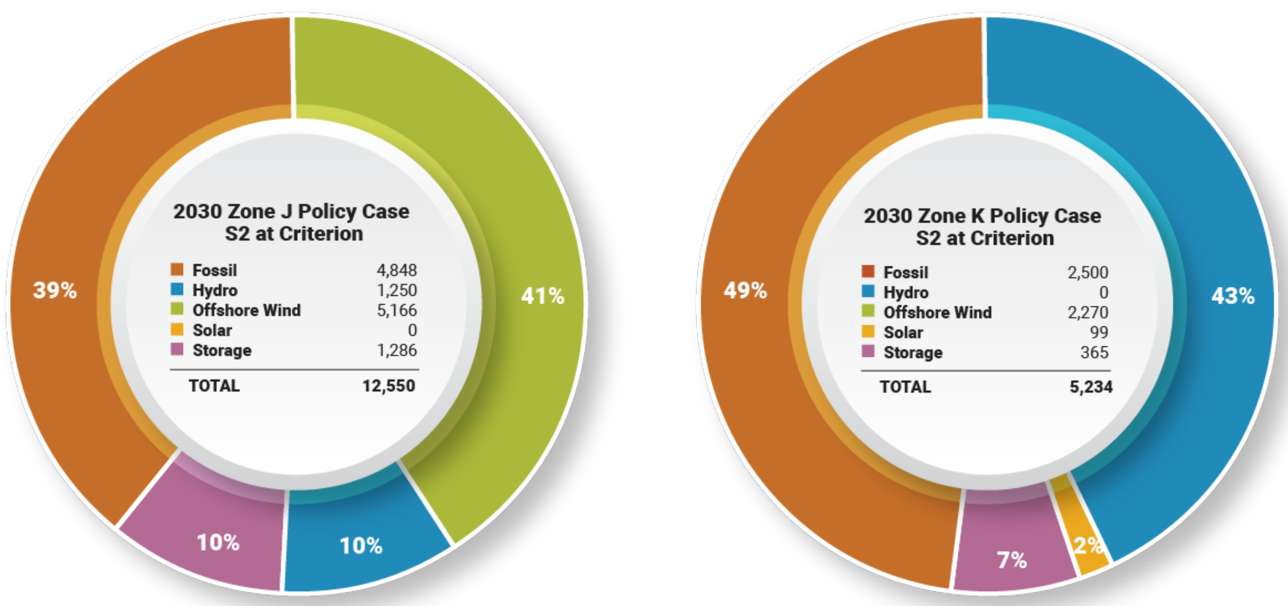

Figure 63 shows a comparison between the total installed capacity and unforced capacity (with consideration for unit unavailability) for the scenario case when the system is close to LOLE criterion. After removal of fossil generation to bring the model to criterion, the remaining resources result in a statewide total capacity-to-load ratio of 188.5%, equivalent to an unforced capacity-to-load ratio of 135.8%.

Figure 63: 2030 Policy Case: Load and Capacity Totals, ICAP vs. UCAP

NYCA Totals	Outlook S2 Y2030 (ICAP)	Outlook S2 Y2030 (UCAP)
Load (net of BtM Solar)	**26,743**	**26,743**
*Capacity from 2022 RNA Base Case**	37,625	32,670
Outlook Renewable Additions (*offshore & land-based wind, utility solar)* *	13,805	4,521
HQ Imports	3,035	3,035
Outlook Storage Additions	3,005	2,254
Outlook Thermal Removals*	6,402	5,616
Total capacity in the Outlook S2 model before age-based capacity removal*	51,068	36,864
Age-based capacity removed to get to 0.1 LOLE ("model at criterion")	668	548
Total capacity ("model at criterion")	**50,400**	**36,316**
Capacity/ Load Ratio	**188.5%**	**135.8%**

Zone J Totals		
Load (net of BtM Solar)	**9,867**	**9,867**
Total capacity in Outlook S2 Case*	12,550	8,182
Total thermal units in Outlook S2 model before age-based capacity	4,848	4,546
Age-based capacity removed to get to 0.1 LOLE ("model at criterion")	0	0
Total capacity ("model at criterion")	**12,550**	**8,182**
Capacity/Load Ratio	**127.2%**	**82.9%**

Zone K Totals		
Load (net of BtM Solar)	**3,989**	**3,989**
Total capacity in Outlook S2 Case*	5,880	3,776
Total thermal units in Outlook S2 model before age-based capacity	3,145	2,857
Age-based capacity removed to get to 0.1 LOLE ("model at criterion")*	646	527
Total capacity ("model at criterion")	**5,234**	**3,249**
Capacity/Load Ratio	**131.2%**	**81.4%**

Note: *Renewable UCAP calculated based on average 13:00 to 18:00 hourly output during June, July and August. Thermal UCAP calculated based on MARS unit availability (eford) data. Thermal generator capacities are the minimum of CRIS and DMNC.

Reliability Compliance Obligations and Activities

The Reliability Needs Assessment is not the only NYISO work product or activity related to reliability planning. The NYISO has various compliance obligations under NERC, NPCC, and the NYSRC. The periodicity of these requirements varies among the standards and requirements. The purpose of this section is to discuss the NERC Planning Coordinator and Transmission Planner obligations fulfilled by the NYISO, as well as the other NPCC and NYSRC planning compliance obligations. While achieving compliance with all NERC, NPCC, and NYSRC obligations is critical to ensuring the continued reliability of the transmission system, this section primarily discusses the planning compliance requirements that closely align with this Reliability Needs Assessment. The full details of the compliance obligations are found within the reliability standards and requirements themselves. Publicly available results for the compliance activities listed below can be found on the NYISO's website under Planning – Reliability Compliance.[31]

The purpose of the NERC Reliability Standards is to "define the reliability requirements for planning and operating the North American bulk power system and are developed using a results-based approach that focuses on performance, risk management, and entity capabilities." The objective of NPCC Directory #1 and the NYSRC Reliability Rules and Compliance Manual are to provide a "design-based approach" to design and operate the bulk power system to a level of reliability that will not result in the loss or unintentional separation of a major portion of the system from any of the planning and operations contingencies with the intent of avoiding instability, voltage collapse and widespread cascading outages. Figure 64 shows the various NERC Standards with requirements applicable to the NYISO as a NERC registered Planning Coordinator and/or Transmission Planner. The NPCC planning compliance obligations are primarily located in NPCC Regional Reliability Reference Directory #1 Design and Operation of the Bulk Power System. The NYSRC planning compliance obligations are located in the Reliability Rules and Compliance Manual.

Fundamental to any reliability study is the accuracy modeling data provided by the entities responsible for providing the data. The data requirements for the development of the steady state, dynamics, and short circuit models are provided in the NYISO Reliability Analysis Data Manual (RAD Manual).[32] This data primarily comes from compliance with NERC MOD standards. Much of this data is collected through the annual database update process outlined in the RAD Manual and the annual FERC Form 715 filing to which the transmitting utilities certify, to the best of their knowledge, the accuracy of the data. Additional compliance obligations provide for the accuracy of the modeling data through comparison

[31] https://www.nyiso.com/planning-reliability-compliance.

[32] https://www.nyiso.com/documents/20142/2924447/rel-anl-data-mnl.pdf.

to actual system events (*e.g.,* MOD-026, MOD-026, and MOD-033).

Following the completion of the annual database update, these databases are used for study work, such as the Reliability Planning Process, and for many other compliance obligations, such as those listed in Figure 64. Planning studies similar to the Reliability Planning Process include the NPCC/NYSRC Area Transmission Reviews (ATRs) and the NERC TPL-001 assessments.

Figure 64: List of NERC Standards for Planning Coordinators and Transmission Planners

Standard Name	Title	Purpose
FAC-002	**Facility Interconnection Studies**	To study the impact of interconnecting new or materially modified Facilities to the Bulk Electric System.
FAC-010	**System Operating Limits Methodology for the Planning Horizon**	To ensure that System Operating Limits (SOLs) used in the reliable planning of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.
FAC-014	**Establish and Communicate System Operating Limits**	To ensure that System Operating Limits (SOLs) used in the reliable planning and operation of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.
IRO-017	**Outage Coordination**	To ensure that outages are properly coordinated in the Operations Planning time horizon and Near-Term Transmission Planning Horizon.
MOD-026	**Verification of Models and Data for Generator Excitation Control System or Plant Volt/VAR Control Functions**	To verify that the generator excitation control system or plant volt/var control function model (including the power system stabilizer model and the impedance compensator model) and the model parameters used in dynamic simulations accurately represent the generator excitation control system or plant volt/var control function behavior when assessing Bulk Electric System (BES) reliability.
MOD-027	**Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions**	To verify that the turbine/governor and load control or active power/frequency control model and the model parameters, used in dynamic simulations that assess Bulk Electric System (BES) reliability, accurately represent generator unit real power response to system frequency variations.
MOD-031	**Demand and Energy Data**	To provide authority for applicable entities to collect Data, energy and related data to support reliability studies and assessments to enumerate the responsibilities and obligations of requestors and respondents of that data.
MOD-032	**Data for Power System Modeling and Analysis**	To establish consistent modeling data requirements and reporting procedures for development of planning horizon cases necessary to support analysis of the reliability of the interconnected transmission system.
MOD-033	**Steady State and Dynamic System Model Validation**	To establish consistent validation requirements to facilitate the collection of accurate data and building of planning models to analyze the reliability of the interconnected transmission system.
PRC-002	**Disturbance Monitoring and Reporting Requirements**	To have adequate data available to facilitate analysis of Bulk Electric System (BES) Disturbances

Standard Name	Title	Purpose
PRC-006	Automatic Underfrequency Load Shedding	To establish design and documentation requirements for automatic underfrequency load shedding (UFLS) programs to arrest declining frequency, assist recovery of frequency following underfrequency events and provide last resort system preservation measures.
PRC-006-NPCC	Automatic Underfrequency Load Shedding	The NPCC Automatic Underfrequency Load Shedding (UFLS) regional Reliability Standard establishes more stringent and specific NPCC UFLS program requirements than the NERC continent-wide PRC-006 standard. The program is designed such that declining frequency is arrested and recovered in accordance with established NPCC performance requirements stipulated in this document.
PRC-010	Undervoltage Load Shedding	To establish an integrated and coordinated approach to the design, evaluation, and reliable operation of Undervoltage Load Shedding Programs (UVLS Programs).
PRC-012	Remedial Action Schemes	To ensure that Remedial Action Schemes (RAS) do not introduce unintentional or unacceptable reliability risks to the Bulk Electric System (BES).
PRC-023	Transmission Relay Loadability	Protective relay settings shall not limit transmission loadability; not interfere with system operators' ability to take remedial action to protect system reliability and be set to reliably detect all fault conditions and protect the electrical network from these faults.
PRC-026	Relay Performance During Stable Power Swings	To ensure that load-responsible protective relays are expected to not trip in response to stable power swings during non-Fault conditions.
TPL-001	Transmission System Planning Performance Requirements	Establish Transmission system planning performance requirements within the planning horizon to develop a Bulk Electric System (BES) that will operate reliably over a broad spectrum of System conditions and following a wide range of probable Contingencies.
TPL-007	Transmission System Planned Performance for Geomagnetic Disturbance Events	Establish requirements for Transmission system planned performance during geomagnetic disturbance (GMD) events.

NPCC/NYSRC Area Transmission Reviews

The NPCC/NYSRC Area Transmission Reviews (ATRs) are performed on an annual basis to demonstrate that conformance with the performance criteria specified in NPCC Directory #1 and the NYSRC Reliability Rules. The ATR is prepared in accordance with NPCC and NYSRC procedures that require the assessment to be performed annually, with a Comprehensive Area Transmission Review performed at least every five years. Either an Interim or an Intermediate review can be conducted between Comprehensive reviews, as appropriate. In an Interim review, the planning coordinator summarizes the changes in planned facilities and forecasted system conditions since the last Comprehensive review and assesses the impact of those changes. No new analyses are required for an Interim review. An Intermediate review covers all the elements of a Comprehensive review, but the analysis may be limited to addressing only significant issues, considering the extent of the system changes. In the ATRs, the NYISO assesses the BPTF for a period of four to six years in the future (the NYISO evaluates year five of the study period). The 2021 ATR,[33] which is the most recently completed ATR, evaluated study year 2026 and found that the planned system through year 2026 conforms to the reliability criteria described in the NYSRC Reliability Rules and NPCC Directory #1. The next ATR is planned to be completed in the latter part of 2022 or early 2023. Seven assessments are required as part of each ATR.

The first assessment evaluates the steady state and dynamics transmission security. For instances where the transmission security assessments results indicate that the planned system does not meet the specified criteria, a corrective action plan is incorporated to achieve conformance. The most resent ATR found that with the identified corrective action plans identified in the reliability planning process, the system meets the applicable performance criteria.

For the second assessment, steady state and dynamics analyses are conducted to evaluate the performance of the system for low probability extreme contingencies. The purpose of the extreme contingency analysis is to examine the post-contingency steady state conditions, as well as stability, overload, cascading outages, and voltage collapse, to obtain an indication of system robustness and to determine the extent of any potential widespread system disturbance. In instances where the extreme contingency assessment concludes there are serious consequences, the NYISO evaluates implementing a change to design or operating practices to address the issues.

The extreme contingency analysis included in the most recent ATR concluded that most events are stable and showed no thermal overloads over Short-Term Emergency (STE) ratings or significant voltage violations on the BPTF. For the events that did show voltage, thermal, or dynamics issues, these events were local in nature (*i.e.*, loss of local load or reduction of location generation) and do not result in a widespread system disturbance.

The third assessment evaluates extreme system conditions that have a low probability of occurrence such as high peak load conditions (*e.g.*, 90th percentile load) resulting from extreme weather or the loss of fuel supply from a given resource (*e.g.,* loss of all gas units under winter peak load). The extreme system conditions evaluate various design criteria contingencies to evaluate the post contingency steady state conditions, as well as stability, overload, cascading outages and voltage collapse. The evaluation of extreme contingencies indicates system robustness and determine the extent of any potential widespread system disturbance. In instances where the extreme contingency assessment concludes that there are serious consequences, the NYISO evaluates implementing a change to design or operating practices to address the

[33] 2021 Interim Area Transmission Review of the New York State Bulk Power Transmission System

issues. For the extreme system conditions evaluated in the most recent ATR, the assessment found no steady state or dynamics transmission security criteria violations.

The fourth assessment evaluates the breaker fault duty at BPTF buses. The most recent ATR found no over-dutied breakers on BPTF buses.

The fifth assessment evaluates other requirements specific to the NYSRC Reliability Rules including an evaluation of the impacts of planned system expansion or configuration facilities on the NYCA System Restoration Plan and Local Area Operation Rules for New York City Operations, loss of gas supply — New York City, and loss of gas supply — Long Island.

The sixth assessment is a review of Special Protection Systems (SPSs). This review evaluates the designed operation and possible consequences of failure to operate or mis-operation of the SPS within the NYCA.

The seventh assessment is a review of requested exclusions to the NPCC Directory #1 criteria.

NERC Planning Assessments (TPL-001)

The NERC TPL-001 assessment (Planning Assessment) is performed annually. The purpose of the Planning Assessment is to demonstrate conformance with the applicable NERC transmission system planning performance requirements for the NYCA Bulk Electric System (BES). The Planning Assessment is a coordinated study between the NYISO and Transmission Owners in the NYCA.

The required system conditions to evaluate for this assessment include planned system representations over a 10-year study period for a variety of system conditions. Figure 65 provides a description of the steady state, dynamics, and short circuit cases required to be evaluated in the Planning Assessment.

Figure 65: Description of NERC TPL-001 Planning Assessment Study Cases

Case Description	Steady State	Dynamics	Short Circuit
System Peak Load (Year 1 or 2)	x		
System Peak Load (Year 5)	x	x	x
System Peak Load (Year 10)	x	x[1]	
System Off-Peak Load (One of the 5 years)	x	x	
System Peak Load (Year 1 or 2) Sensitivity	x		
System Peak Load (Year 5) Sensitivity	x	x	
System Off-Peak Load (One of the 5 years) Sensitivity	x	x	

Notes:

1. Only required to be assessed to address the impact of proposed material generation additions or changes in that timeframe.

The steady state and dynamics transmission security analyses evaluate the New York State BES to meet the applicable criteria. As part of this assessment, the unavailability of major transmission equipment with a lead time of more than a year is also assessed. The fault duty at BES buses is evaluated in the short-circuit representation. When the steady state, dynamics, or short circuit analysis indicates an inability of the system to meet the performance requirements in the standard, a corrective action plan is developed addressing how the performance requirements will be met. Corrective action plans are reviewed in subsequent Planning Assessments for continued validity and implementation status.

For each steady state and dynamics case, the Planning Assessment evaluates the system response to extreme contingencies. Similar to the ATR, when the Planning Assessment extreme contingency analysis concludes that there is cascading caused by an extreme contingency, the NYISO evaluates possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts.

The most recent NERC Planning Assessment for compliance with TPL-001 was completed in July 2022. As this study contains Critical Energy Infrastructure Information (CEII), it is not posted on the NYISO website. Generally, the results of this study are consistent with the ATR studies. The study scope of this assessment is different from the ATR because the ATR evaluates the BPTF while the TPL evaluates the BES. The corrective action plans for criteria violations on the bulk electric system (BES) are generally addressed in the affected Transmission Owner's LTP and/or the proposed transmission facilities listed in Section 7 of the Load and Capacity Data Report.

Resource Adequacy Compliance Efforts

NPCC's Directory 1 defines a compliance obligation for the NYISO, as Resource Planner and Planning Coordinator, to perform a resource adequacy study evaluating a five-year planning horizon. The NYISO delivers a report every year under this study process to verify the system against the one-day-in-ten-years loss of load expectation (LOLE) criterion, usually based on the latest available RNA/CRP results and assumptions. The New York Area Review of Resource Adequacy completed reports are available at: https://www.nyiso.com/planning-reliability-compliance.

NYSRC Reliability Rules require[34] that the NYISO deliver a Long-Term Resource Adequacy Assessment report every RNA year, and an annual update in the non-RNA years. The NYISO first implemented this requirement after finalizing the 2020 RNA.[35]

[34] *See* NYSRC Reliability Rule A.3, R.3.

[35] Links to the latest available 2021 report and presentation are available at:https://www.nysrc.org/PDF/Meeting Material/RCMSMeetingMaterial/RCMS%20Agenda%20262/2021NYSRCLongTermResourceAdequacyAssessment-InterveningYear_Feb3-2022RCMS_Report.pdf and

The NYISO is also actively involved in other activities such as the NERC's annual Long-Term Reliability Assessment (LTRA), along with its biennial Probabilistic Assessment (ProbA), performed by NERC with the input from all the NERC Regions and Areas, as well as NPCC's Long Range Adequacy Overview (LROA).

https://www.nysrc.org/PDF/MeetingMaterial/RCMSMeetingMaterial/RCMS%20Agenda%20262/2021NYSRCLongTermResourceAdequacyAssessment-InterveningYear_Feb3-2022RCMS_Presentation%20(1).pdf.

Observations and Recommendations

This RNA concludes that the New York State Bulk Power Transmission Facilities as planned will meet all currently applicable reliability criteria from 2026 through 2032 for assumed system demand based on expected weather and with the assumed planned projects meeting their proposed in-service dates. However, the margin to maintain reliability over the next ten years will narrow or could be eliminated based upon likely changes in planned system conditions.

Reliability Risk Factors: Key Takeaways

- Resource adequacy and transmission security margins are tightening over time across the New York State Bulk Power Transmission Facilities from Buffalo to Long Island. New York City reliability margins are very tight decreasing to approximately 50 MW by 2025 primarily due to the planned unavailability of simple cycle combustion turbines to comply with the DEC's Peaker Rule. The reliability of the grid is heavily reliant on the timely completion of planned transmission projects, chiefly Champlain Hudson Power Express (CHPE). Increased demand, significant delays in projects, or additional generator deactivations could all cause deficiencies in New York City. Some generation affected by the DEC Peaker Rule may need to remain in service until CHPE or other permanent solutions are completed to maintain a reliable grid.
- Demand forecast uncertainty or potential heatwaves of various degrees pose risks throughout the next ten years, especially in 2025. In fact, the long-term demand forecast for New York City, to be updated in early 2023, is expected to increase due to strong commercial and residential growth along with increased electrification of transportation and home appliances.
- New York's current reliance on neighboring systems is expected to continue through the next ten years. Without emergency assistance from neighboring regions, New York would not have adequate resources throughout the next ten years.
- Extreme events, such as heatwaves or storms, could result in deficiencies to serve demand statewide, especially in New York City, considering the plans included in this RNA. This outlook could improve as more resources and transmission are added to New York City.
- The New York statewide grid is projected to become a winter-peaking system in the mid-2030s, primarily driven by electrification of space heating and transportation. The New York statewide grid is reliable in the winter for the next ten years but will be stressed under gas supply shortage conditions that can occur during cold snaps.
- Planning for the more extreme system conditions of heatwaves, cold snaps, and fuel availability is currently beyond established design criteria. However, several reliability organizations are investigating whether these events should become design conditions.
- With increased renewable intermittent generation for achievement of the CLCPA goal of 70% renewable energy by 2030, at least 17,000 MW of existing fossil must be retained to continue to reliably serve forecasted demand. Beyond 2030, dispatchable emissions-free resources (DEFRs) will be needed to balance intermittent supply with demand.
- The potential risks and resource needs identified in the analyses may be resolved by new capacity

resources, additional transmission facilities, and/or increased energy efficiency and demand-side resources. The NYISO is tracking the progression of many projects that may contribute to grid reliability, including numerous offshore wind facilities that are not yet included in the RNA base case.

Next Steps

As part of its ongoing Reliability Planning Process, the NYISO monitors and tracks the progress of market-based projects and regulated backstop solutions, together with other resource additions and retirements. Through the Short-Term Reliability Process, the NYISO will conduct quarterly Short-Term Assessments of Reliability (STARs) to assess reliability needs within a five-year horizon. If necessary, the NYISO will seek solutions to address any reliability needs identified through that process.

Since the *2022 Reliability Needs Assessment* did not find any actionable Reliability Needs, there will be no need to update the RNA Base Case or solicit for solutions. In 2023, the NYISO will issue the *2022-2032 Comprehensive Reliability Plan*, and will continue to perform quarterly STARs.