New York ISO
Independent System Operator

DRAFT 2023-2032 Comprehensive Reliability Plan

A Report from the
New York Independent
System Operator

Draft 2 for September 6, 2023 ESPWG/TPAS

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Executive Summary

[TO BE COMPLETED LATER]

Background

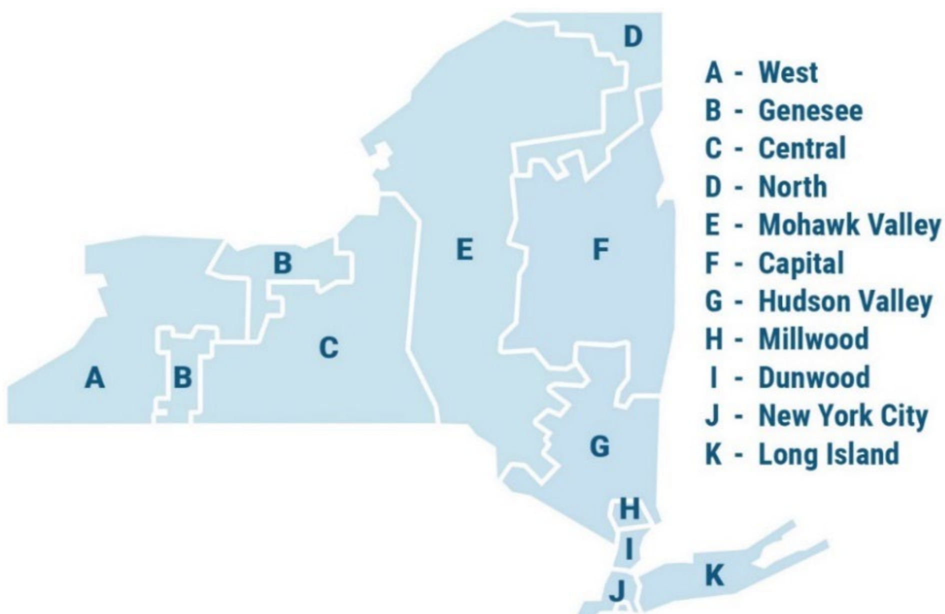
This 2023-2032 Comprehensive Reliability Plan (CRP) completes the NYISO's 2022-2023 cycle of the Reliability Planning Process. The 2022 Reliability Needs Assessment (RNA), approved by the NYISO Board of Directors in November 2022, was the first step of the current cycle. This CRP follows the 2022 RNA and incorporates findings and solutions from the quarterly Short-Term Reliability Process.

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*[1] (Gold Book) and *Power Trends*[2]—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 1**.

Figure 1: 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. Figure 2 depicts the projected mix

[1] 2023 Load & Capacity Data Report (Gold Book)

[2] 2023 Power Trends

of resource capacity expected to be available for the 2022 summer capability period. Figure 3 provides the energy production by fuel sources in 2022. In 2022, zero-emission resources made up 93% of upstate production, while fossil units downstate made up 95% of the production from that region.

Figure 2: Summer Installed Capacity (MW) by Fuel Source – Statewide, Upstate, & Downstate New York: 2023

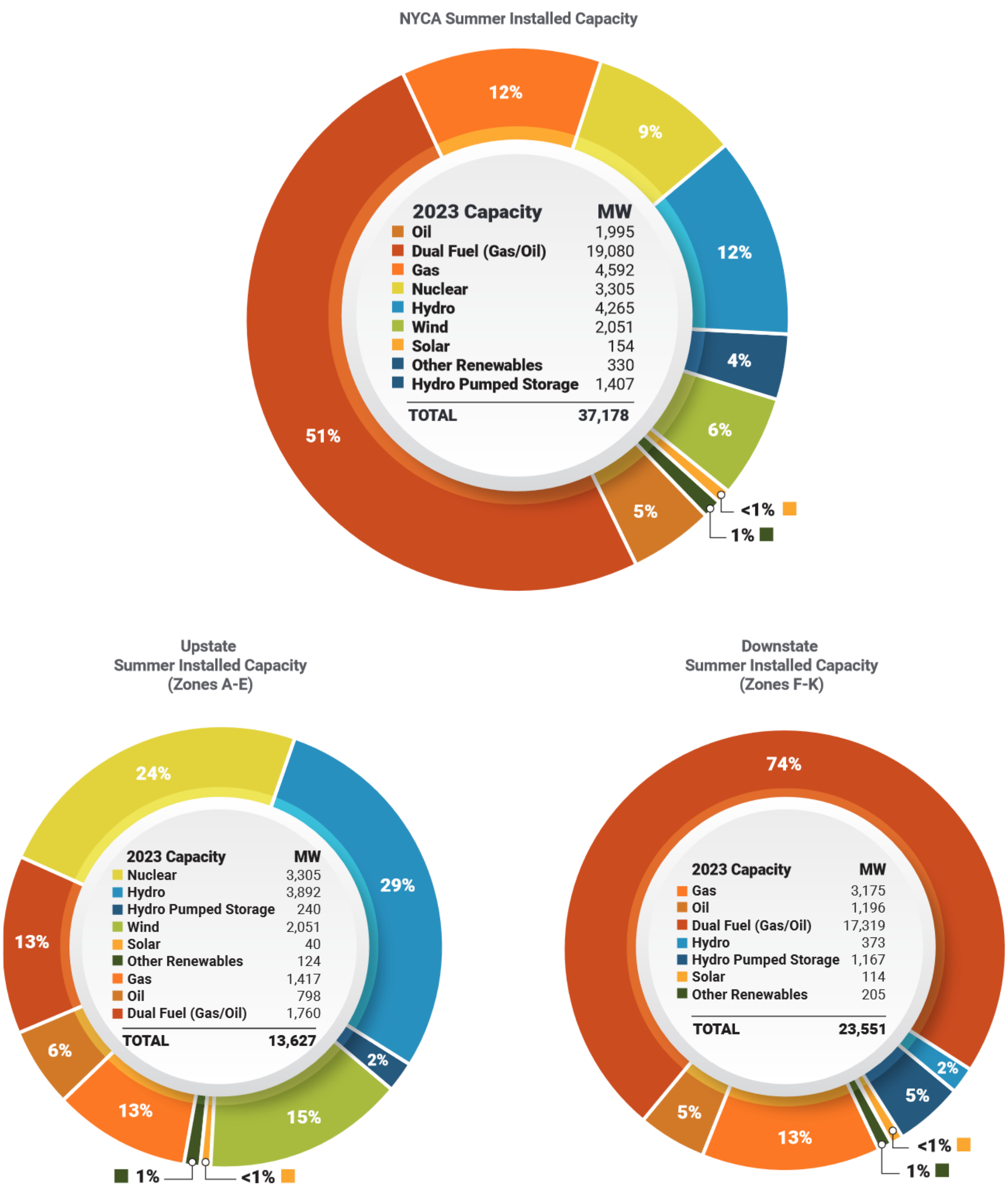
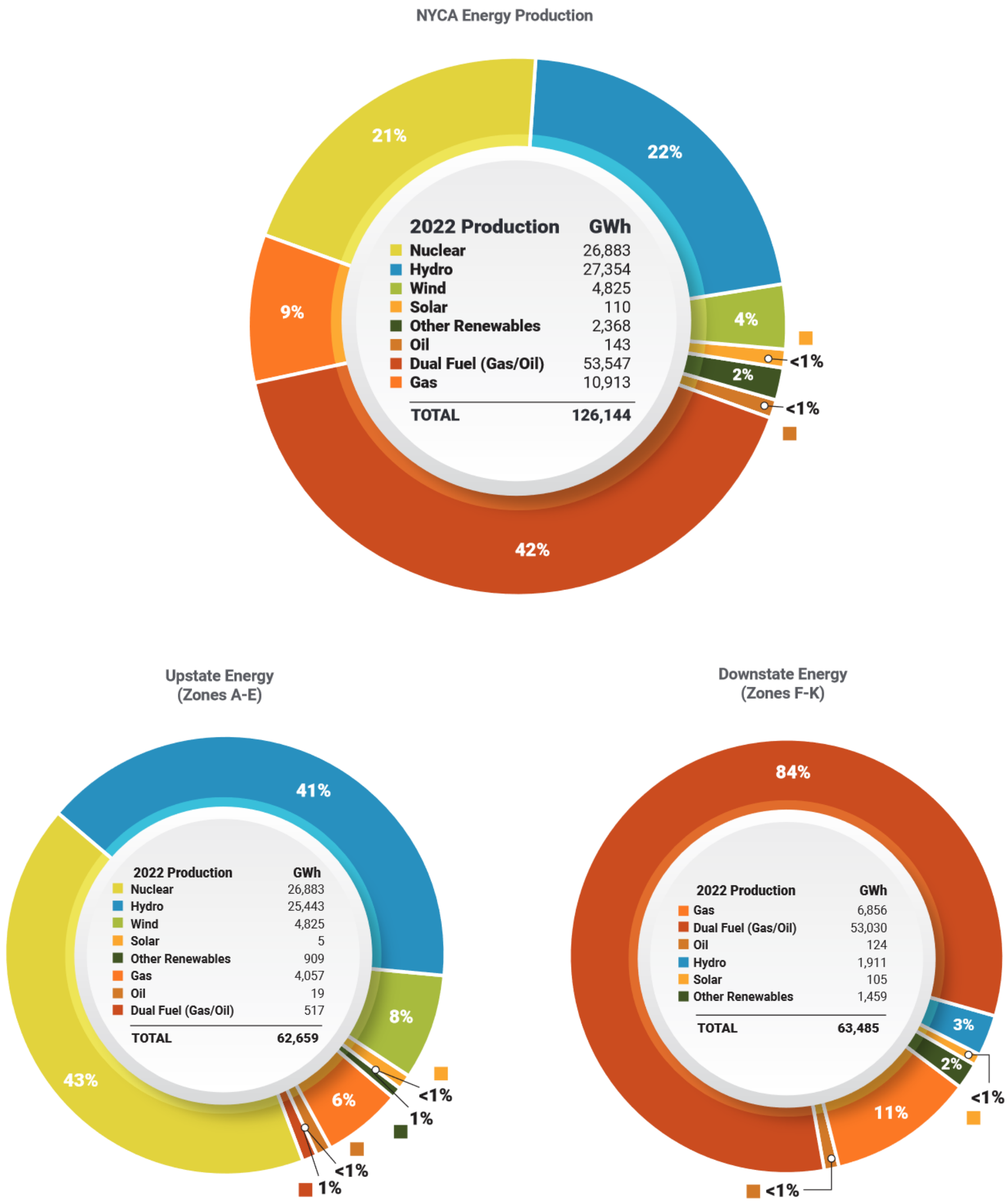


Figure 3: Energy Production by Fuel Source (GWh) – Statewide, Upstate, & Downstate New York: 2022

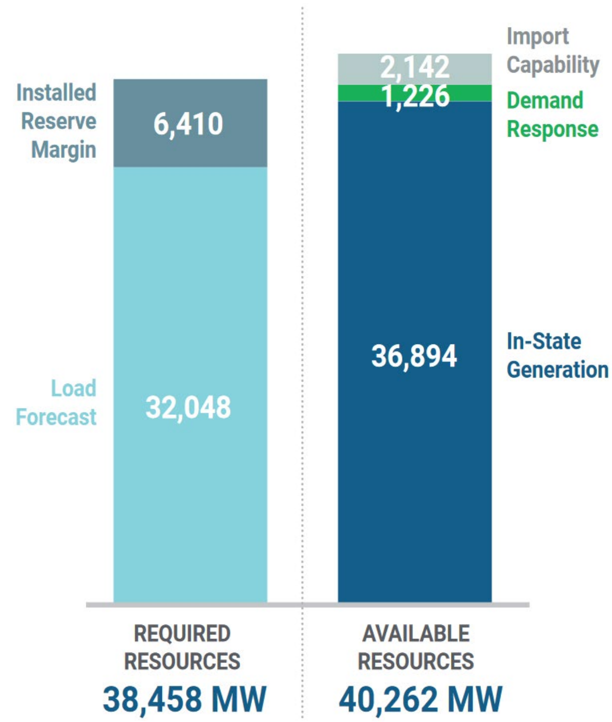


Total generation resource capability in New York for the summer of 2023 is projected to be 40,262 MW, which includes 36,894 MW of generating capability, 1,226 MW of Demand Response, and 2,142 MW of net long-term purchases and sales with neighboring control areas.

The New York system's minimum Installed Reliability Margin (IRM) is established every year by the NYSRC. The IRM represents the minimum level of capacity, beyond the forecasted peak demand, which must be procured to serve consumers. The IRM is established every year for each following capability year (May 1 through April 30) and is used to quantify the minimum capacity required to meet the NPCC and NYSRC resource adequacy rules. The NYISO, in assisting the NYSRC, analyzes forecasted demand, supplier performance, transmission capability, and factors such as extreme weather, to measure the grid's ability to meet reliability requirements. NYSRC has noted in several of its annual Installed Capacity Requirement Technical Study reports[3] that the inclusion of intermittent resources to the grid is a leading factor in establishing higher IRM requirements. The IRM for the May 1, 2023 - April 30, 2024 capability year is 20.0% of the forecasted NYCA peak load, representing an increase from the 19.6% established last year. Based on a projected summer 2023 peak demand of 32,048 MW and the IRM, the total installed capacity requirement for the upcoming summer capability period (May 1, 2023 through April 30, 2024) is 38,458 MW.

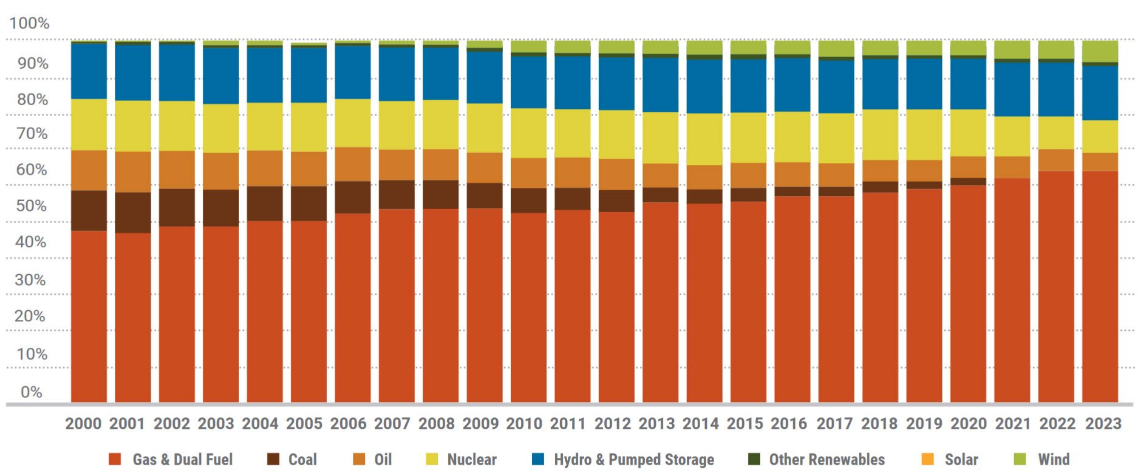
[3] Link to the NYSRC's IRM Reports: https://www.nysrc.org/NYSRC_NYCA_ICR_Reports.html

Figure 4: Statewide Resource Availability: Summer 2023



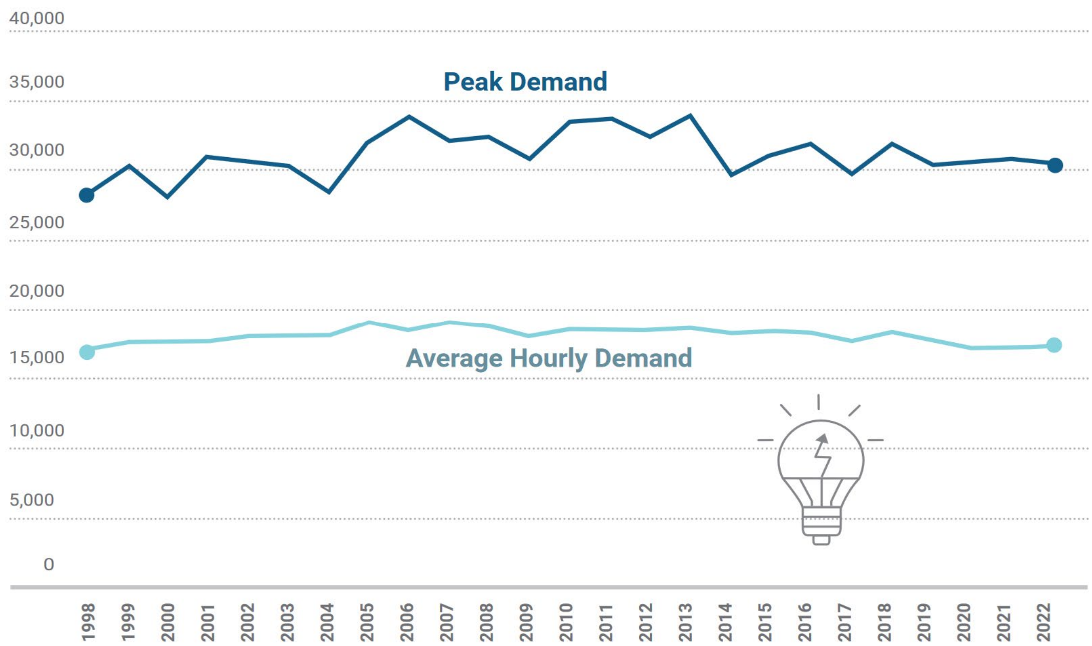
The historical generating capacity fuel mix in New York State 2000-2023 is depicted in the figure xx below.

Figure 5: Historical Generating Capacity Fuel Mix in NY 2000-2023



Historical average hourly demand versus actual yearly peak demand is shown in the **Figure 6** below.

Figure 6: Historical Average Hourly Demand versus Actual Yearly Summer Peak Demand



Regulatory Policy Activities

Increasingly ambitious environmental and energy policies, market rules, technological progression and economic factors impact the decisions by market participants and are driving the accelerated transition in the state's resource supply mix. During this transition, the pace of both the addition of new resource additions and the retirement of older, higher emitting resources are projected to exceed historical levels. Federal, state, and local government regulatory programs may impact the operation and reliability of New York's bulk power system. Compliance with state and federal regulatory initiatives and permitting requirements may require investment by the owners of New York's existing thermal power plants to continue operation. If the owners of those plants must make significant investments to comply, the cost of these investments could lead to retirements and, therefore, could necessitate replacement resources to maintain the reliability of New York's bulk power system.

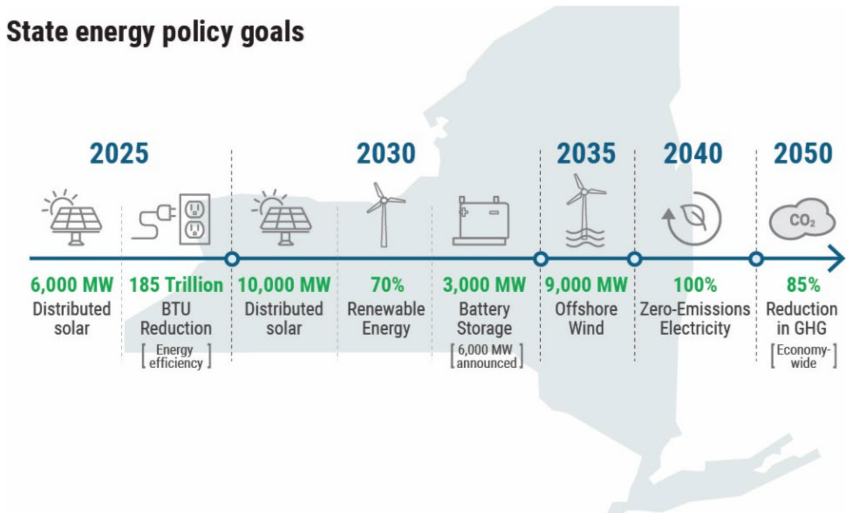
Balancing the grid throughout this transition not only requires maintaining sufficient capacity to meet demand but also requires that new resources entering service comparably replace the capabilities and attributes of the resources leaving the system (*e.g.,* fast starting/ramping and dispatchable both up and down, available when and for as long as needed, providing essential reliability services such as voltage and frequency control, support system's stability during disturbances, *etc.*). Continued dialogue and engagement among market participants, policymakers, and the NYISO will be essential to support the planning processes that can identify the needs and services required to maintain a reliable system during and after this transition period.

The following table summarizes key environmental regulations and energy policies affecting New York.

Public Policy Initiative	Policy Goal	Policy Implications
Climate Leadership and Community Protection Act (CLCPA)	Overarching goal to reduce New York's greenhouse gas emissions by 40% of 1990 levels by 2030 and 85% by 2050. Includes many power sector targets including: 10,000 MW of distributed solar installed by 2030; 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. Formation of the Climate Action Council to develop a Final Scoping Plan to inform regulations and programs to achieve CLCPA economy-wide decarbonization goals. Environmental Justice and Just Transition policy goals.	Transformation of the economy to one powered primarily by electricity as a form of overall emissions reduction. A central pillar in this approach is the power grid, necessitating examination of market structures, planning processes, flexible load, and investment in bulk power system infrastructure. Electrification of building and transportation sectors will increase load substantially and impact when it is in most demand. Identification of future generation resources with potential to achieve policy goals while maintaining electric system reliability will be necessary. Modeling platforms and metrics need to be updated and improved to capture more dynamic, weather dependent systems.
"Peaker Rule:" Ozone Season Oxides of Nitrogen (NOx) Emission Limits for Simple Cycle and Regenerative Combustion Turbines	Reduce ozone-precursor nitrogen oxide emissions associated with New York State-based peaking unit generation during the May-September ozone season. Compliance obligations phased in between May 2023 and May 2025. To aid system planners, generators submit compliance plans to the DEC outlining the compliance approach for each unit before the initial compliance date. For units identified as needed for reliability, the rule allows for several years of extended operations.	DEC rule impacts approximately 3,300 MW of peaking unit capacity in New York State, primarily in New York City and Long Island. 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.
New York Power Authority Small Gas Turbine Phase Out	Advance decarbonization date of NYPA simple-cycle combustion turbine fleet to 2030.	Impacts 517 MW nameplate capacity in New York City and Long Island. Requires study to replace with renewable and storage resources and must consider reliability in the plan to replace these resources.
Clean Energy Standard (CES)	Predated by the Renewable Portfolio Standard, and now aligned with the CLCPA targets, the CES requires utilities procure Renewable Energy Credits (RECs) and Zero Emission Credits (ZECs) from eligible generators to support clean electricity content requirements. NYSERDA administers the CES through regular REC solicitation and tracking initiatives while the PSC provides oversite to these programs.	Eligible renewable resources are supported through various Tiers.: Tier 1 RECs support new renewable resources, Tier 2 supports pre-2015 resources, Tier 4 supports development of transmission to deliver RECS into New York City, and offshore wind RECs (ORECs) to support the state's offshore wind targets. ZECs support upstate nuclear generators. RECs and ZECs represent the environmental attributes associated with one MWh of eligible generation.
NYS Accelerated Renewable Energy Growth and Community Benefit Act (AREA)	Provides for an accelerated path for the permitting and construction of renewable energy projects, calls for a comprehensive study to identify cost-effective electric system upgrades, and to file the study with the New York State Public Service Commission. Allows the PSC to designate priority transmission projects. NYSERDA administers a Build Ready program which supports development of brownfield and other industrial sites.	Establishes new transmission investment priorities to facilitate the achievement of state policies, including through the use of NYISO's Public Policy Planning Process. The PSC oversees a coordinated planning process among the utilities to identify local transmission and distribution upgrades throughout the state. Following this process $4.2B+ in local transmission and distribution upgrades and
New York City Residual Oil Elimination	Eliminate combustion of fuel oil numbers 6 and 4 in New York City by 2020 and 2025, respectively. Rule allows additional compliance pathway allowing for direct conversion directly to fuel oil number 2 by 2023.	The rule impacts 2,946 MW of generation in New York City Affected generators have taken steps to convert their facilities to comply with the law.
New York City Local Law 97	Requires greenhouse gas emissions from covered buildings be reduced by 40% by 2030 and 80% by 2050. Compliance under the program begins in 2024,	Mandate applies to any building in NYC larger than 25,000 square feet; 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 40,000 of the city's more than one million buildings, representing nearly 60% of in-city building area. Emissions reduction strategies will be driven by electrification which increase demand for clean electricity.
Proposed Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants	The federal Environmental Protection Agency (EPA) has proposed regulations to reduce carbon dioxide emissions from new and existing fossil fuel-fired generation.	Requires states submit plans limiting CO_2 emissions from affected existing generators. For large, frequently operated existing CC, and coal units operating into the 2040's, 90% emission reductions are required during the 2030's. Generators may retire or limit operations to be categorized to receive less stringent requirements.

Climate Leadership and Community Protection Act (CLCPA)

The Climate Action Council, created under the CLCPA, approved the Final Scoping Plan at the end of 2022 outlining recommendations for the state to achieve the emissions reductions called for by the CLCPA. The Final Scoping Plan lays out programs and regulatory initiatives to decarbonize the economy through electrification of the building and transportation sectors, creating significant but uncertain implications for the future demand for electricity.



As an overarching recommendation the plan called for development of a New York Cap-and-Invest (NYCI) program to price greenhouse gas emissions into nearly all sectors of the New York state economy. DEC and NYSERDA are in the process of developing three regulations this year: the Cap-and-Invest, Mandatory Reporting, and Auction Rules. Together the regulations will put a statewide limit on greenhouse gas emissions and auction allowances to the market, enforcing the statewide limit and generating revenues to support clean energy and consumer rebate programs. Given the power sector's experience with RGGI—the multi-state, power sector, cap and trade program of which New York is a founding member—the DEC has communicated a preference to remain in RGGI and seeks feedback on how sources in the power sector might or might not be regulated under the NYCI program, RGGI, or both.

Provisions in the CLCPA have increased thresholds for permitting of fossil fuel-fired generation facilities as inconsistency with the CLCPA targets must be considered in all state decisions. The DEC finalized DAR-21 to assist in processing these CLCPA determinations within the state's air permitting process. The CLCPA and DAR-21 allow DEC to permit an inconsistent facility if justification is also provided for the need for that specific facility, which may include its necessity to support electric system reliability.

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 (referred to as the "Peaker Rule").[4]

Combustion turbines known as "peakers" typically operate to maintain bulk power system reliability during the most stressful operating conditions, such as periods of peak electricity demand. Many of these units also maintain transmission security by supplying energy within certain constrained areas of New York City and Long Island — known as load pockets.[5] The Peaker Rule, which phases in compliance obligations between 2023 and 2025, will affect approximately 3,300 MW of simple-cycle turbines, nameplate capacity, located mainly in the lower Hudson Valley, New York City, and Long Island. Of this affected capacity, more than 1,200 MW (nameplate) retired or became unavailable to the NYISO by the May 1, 2023 initial compliance date, reducing peaking supply available to serve load. In addition, more than 670 MW of dual fuel capacity committed to discontinue the use of oil during the 2023-2024 May – September ozone seasons. The Peaker Rule required all impacted plant owners to file compliance plans by March 2, 2020. Importantly, the Peaker Rule allows the NYISO to designate affected resources that are needed to maintain reliability to continue operation on a temporary basis beyond 2023 and 2025 depending on their compliance obligations.

As further described in the Short-Term Reliability section of this report, the 2023 Quarter 2 STAR identified a reliability need beginning in summer 2025 within New York City primarily driven by a combination of forecasted increases in peak demand and the assumed unavailability of certain generation in New York City affected by the Peaker Rule. As generators that are subject to the DEC's Peaker Rule submit their Generator Deactivation Notices, the NYISO and the responsible Transmission Owners will continue to evaluate in future STARs whether Generator Deactivation Reliability Needs arise from the deactivation of Initiating Generators.[6]

New York Power Authority Small Gas Turbine Phase Out

Provisions included in the approved budget for fiscal year 2024 broadened NYPA's authority to develop renewable energy and advanced NYPA's commitment to phase-out their small simple-cycle gas turbine fleet. NYPA is required to publish a plan by May 2025 to phase-out the production of electricity from its seven simple cycle combustion turbine natural gas plants in New York City and Long Island by December 31, 2030, unless those plants are determined to be necessary for electric system reliability, emergency

[4] https://www.dec.ny.gov/regulations/116131.html

[5] The Con Edison criteria reference "Transmission Load Areas," which are analogous to load pockets.

[6] Per OATT § 38.1, an "Initiating Generator" is "a Generator with a nameplate rating that exceeds 1 MW that submits a Generator Deactivation Notice for purposes of becoming Retired or entering into a Mothball Outage or that has entered into an ICAP Ineligible Forced Outage pursuant to Section 5.18.2.1 of the ISO Services Tariff, which action is being evaluated by the ISO in accordance with its Short-Term Reliability Process requirements in this Section 38 of the ISO OATT."

power service, or the proposed replacement of the resource would result in more than a de minimis net increase in emissions within a disadvantaged community. The plan is required to include recommendations to replace the plants with renewable energy systems, wherever appropriate. The basis for such determinations, which are required to be updated at least every two years, must be made publicly available along with the supporting documentation for the determination.

NYS Clean Energy Standard (CES)

The CES requires that utilities purchase Renewable Energy Credits (RECs) and Zero Emission Credits (ZECs) from eligible resources to support the state's clean energy goals. ZECs provide financial support to the upstate nuclear generation facilities for each MWh generated between April 2017 and March 2029 while RECs provide comparable support to eligible renewable resources. RECs and ZECs represent the environmental attributes associated with one MWh of eligible generation.

The CES was predated by the Renewable Portfolio Standard. When it was initiated in 2016, the CES called for 50% renewable generation by 2030. To align with the CLCPA, the PSC modified the CES in 2020 by:

- laying out a schedule of annual REC procurements of 4,500 GWh/year towards attaining the 2030 70% renewable energy requirement;
- adopting a competitive Tier 2 to support baseline renewable generators in operation before 2015; and
- adding a new Tier 4 REC program to target displacement of local fossil fuel-fired generation in New York City.

Following a Tier 4 REC solicitation in 2021, the Clean Path NY (1,300 MW) and Champlain Hudson Power Express (1,250 MW) were selected for Tier 4 contract awards, which the PSC approved on April 14, 2022, to deliver renewable energy from upstate NY and Quebec through direct HVDC links to locations in New York City.

In addition, currently over 4,300 MW of offshore wind (OSW) generators are under contract with state entities. On July 27, 2022, NYSERDA issued its third offshore wind REC solicitation for a minimum of 2,000 MW and up to 4,640 MW of OSW capacity. Bids have been received by NYSERDA and award announcements are expected later in 2023.

Other programs supporting behind-the-meter (BTM) or distributed solar (PV) and storage resources are complimentary to the CES program and also administered by NYSERDA. Together these REC contracts and distributed resource programs represent nearly all the clean energy supplies expected to enter the system in the coming years.

On May 18, the PSC opened a new process to solicit feedback on potential zero-emissions resources that can fill the gap between renewables and load and comply with the CLCPA. The order specifically pointed to the NYISO's study work characterizing the need for resources that can balance renewable energy production lulls in soliciting feedback.

NYS Accelerated Renewable Energy Growth and Community Benefit Act

The Accelerated Renewable Energy Growth and Community Benefit Act (AREA) 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 AREA also authorized the New York Power Authority (NYPA) to undertake the development of transmission investments needed to achieve CLCPA targets. The PSC utilized this authority to authorize NYPA to pursue construction of its "Smart Path Connect" transmission expansion project in northern New York. The project, which NYPA is undertaking in partnership with National Grid, is expected to increase the capacity of transmission lines, where significant wind and hydro capacity exists, and constraints contribute to curtailment of these resources.

The AREA 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 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 PSC, 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.

Based upon subsequent NYPSC orders and additional studies stemming from the AREA, the PSC approved $4.4 billion for 62 Phase 2 local transmission upgrades to unbottle upstate renewable energy. The PSC also recently approved Con Edison's Scalable Reliability version of the Brooklyn Clean Energy Hub to address local reliability needs expected in 2028 while offering a point of interconnection for future offshore wind capacity.

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. This rule provides an additional compliance pathway, allowing for direct conversion directly to fuel oil number 2 by 2023. The rule impacts 2,946 MW of generation in New York City. Affected generators have taken steps to convert their facilities to comply with the law.

Many generators in New York City that are connected to the local gas distribution network are required to maintain alternative fuel combustion capabilities. While oil accounts for a relatively small percentage of the total electricity production in New York, 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 for New York City and Long Island that is intended to maintain electric system reliability in the event of gas supply interruptions: the two areas have a loss of gas supply dual-fuel requirement and certain combined cycle gas units participate in the "Minimum Oil Burn" program. While oil accounts for a relatively small percentage of the total energy production in New York, it is often called upon to fuel generation during critical periods, such as when severe cold weather limits access to natural gas.

New York City Local Law 97

The New York City Council passed Local Law 97 in 2019, which mandates that any building larger than 25,000 square feet reduce its greenhouse gas emissions by 40% by 2030 and 80% by 2050, with compliance starting in 2024. Covered buildings are required to begin annually reporting emissions in May 2025. 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 in New York City and the proportion that is sourced from cleaner supplies. Officials estimate the law would apply to roughly 40,000 of the city's more than one million buildings, representing nearly 60% of in-city building area.

Proposed Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants

Following the federal Clean Power Plan (2015) and Affordable Clean Energy Rule (2019), which were blocked in various courts, the EPA in May 2023 proposed new regulations aimed at limiting CO2 emissions from existing power plants. The EPA proposes that states would have two years to submit plans categorizing each existing affected generator and requiring an emissions rate reduction applicable to the selected subcategory. The proposed regulations provide two pathways to achieve deep reductions: (a) 90% carbon capture and sequestration (CCS) in 2030/2035 or (b) low-GHG intensity hydrogen co-firing (at 30% by volume in 2032 increasing to 96% in 2038).

Existing plants would have emissions compliance obligations beginning in 2030 for steam turbines (ST) and in 2032 for combined cycle (CC) and simple cycle (CT) generators. Existing large (>300MW) CT/CCs that operate at least half the year would ultimately need to achieve 90% emissions reductions, as would coal plants that do not commit to retire by 2040. These required reductions would follow the CCS pathway or the hydrogen co-fire pathway. Existing gas/oil STs would generally be required to maintain emissions rate performance. The proposal also contains regulations applicable to new CT/CCs combustion turbine generators.

Under the proposal, plants may limit operations (annual capacity factor limit) and/or commit to cease operations before a specified date in order to be placed in less stringently regulated categories or avoid regulation all together. Existing oil/gas STs could avoid emissions limitations if committing to operate below 8% annual capacity factor. Existing small (less than 300 MW) or CC/CT generators that operate less than half the year would have no obligations under this proposal. Also, as proposed, all new CC/CT units which operate below a 20% capacity factor would be required to burn gas and/or oil. While no coal fired generators operate in New York, those that commit to cease or limit operations face tiered compliance requirements based upon their operational lifetimes. Significant amounts of coal capacity the south and west would be impacted and may lead to reduced resource availability in our neighbors.

2022 Reliability Needs Assessment (2026-2032)

The 2022 RNA, issued in November 2022, provided an evaluation and review of the reliability of the New York Bulk Power Transmission Facilities (BPTF) for the study period (2026-2032). The 2022 RNA evaluated the BPTFs based upon assumed forecasts of peak power demand during normal weather, proposed large loads, planned upgrades to the transmission system, and changes to the generation mix expected over the next ten years (2023-2032). System performance was measured against currently applicable reliability criteria established by the North American Reliability Corporation (NERC), the Northeast Power Coordinating Council (NPCC), and the New York State Reliability Council (NYSRC). The

RNA assessed an actionable "base case" set of assumptions, as well as various scenarios that are provided for information. The 2022 RNA base case included projected impacts driven by limitations on generator emissions, while the scenarios included an in-depth look at certain policy goals from the CLCPA. The RNA also discussed the reliability risks associated with the cumulative impact of environmental laws and regulations, which may affect the availability and flexibility of power plant operation.

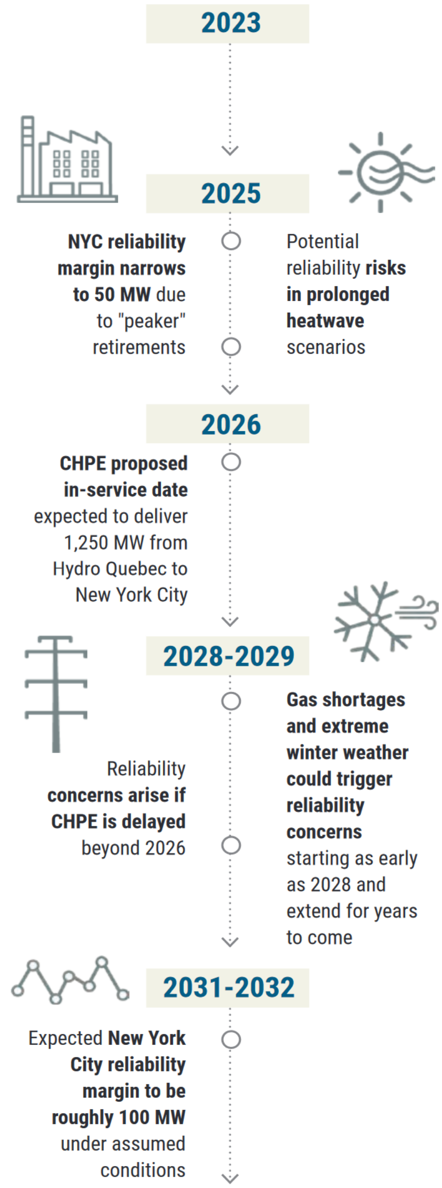
The 2022 RNA found no long-term actionable reliability needs for the BPTF, as planned, from 2026 through 2032 for the assumed future system demand and with the assumed planned projects meeting their proposed in-service dates. This finding is based on the Reliability Planning Process assumptions, which 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.

The 2022 RNA also found that 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 in 2025 to comply with regulations adopted by the DEC to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines (*i.e.,* the "Peaker Rule")[7]. The summer margin improves in 2026 with the scheduled addition of the Champlain Hudson Power Express (CHPE) connection project 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 scenarios performed under the 2022 RNA provided insight into reliability risks, such as, among others, narrow reliability margins, potential reliability risks in prolonged heat waves, proposed projects delays (such as the 1,250 proposed HVDC line from Hydro Quebec into New York City), gas shortage and extreme winter weather, and inverter-based resources penetration.

[7] The DEC Peaker Rule is more fully discussed in Regulatory Policy Activities above.

FIGURE 1: **NYISO 2022 RELIABILITY NEEDS ASSESSMENT RELIABILITY RISK SCENARIOS**



Short-Term Reliability (2023-2028)

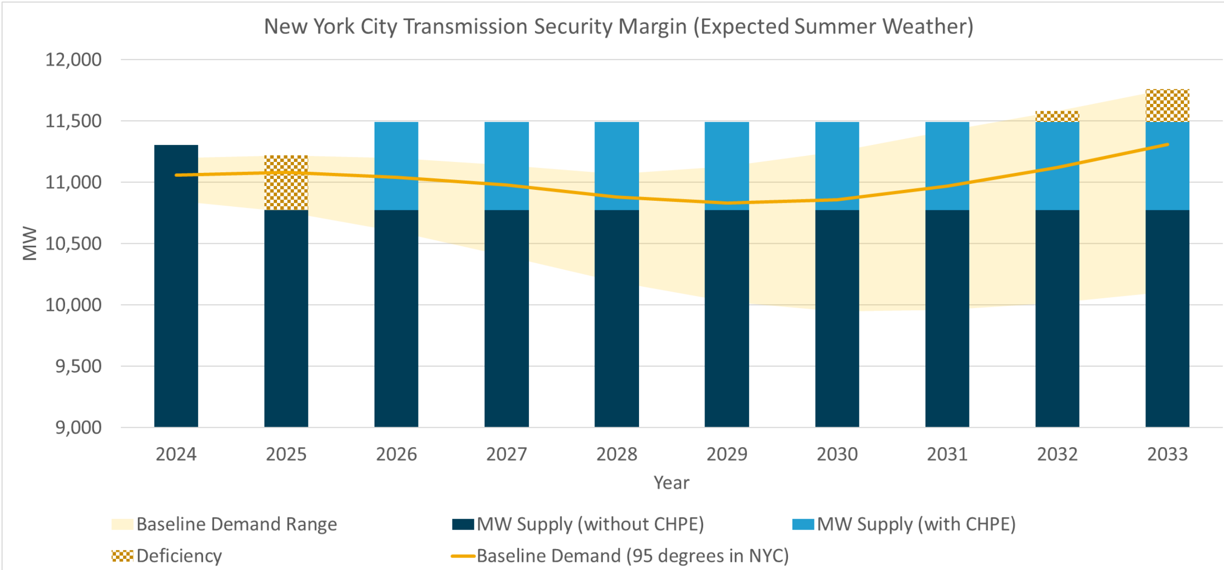
In parallel with the biennial RNA and CRP process, the NYISO uses the quarterly Short-Term Reliability Process, as prescribed in Attachments Y and FF of the NYISO's Open Access Transmission Tariff, to evaluate the first five years of the planning horizon. This evaluation focuses on needs arising in the first three years of the study period, while the RNA and CRP focuses on solutions to longer term needs.

The first step in the process is the Short-Term Assessment of Reliability (STAR). STARs are performed quarterly to proactively address reliability needs that may arise within five years (i.e., Short-Term Reliability Needs)[8] due to various changes to the grid such as generator deactivations, revised transmission plans, and updated load forecasts. Transmission Owners also assess the impact of generator deactivations on their local systems. A Short-Term Reliability Need that is observed within the first three years of the study period constitutes a "Near-Term Reliability Need."[9] Should a Near-Term Reliability Need be identified in a STAR, the NYISO solicits and selects the solution to address the need. If a need arises beyond the first three years of the study period, the NYISO may choose to address the need within the Short-Term Reliability Processor, if time permits, through the long-term Reliability Planning Process.

While the 2022 RNA did not observe an actionable long-term Reliability Need, the recent 2023 Quarter 2 STAR observed a Near-Term Reliability Need beginning in summer 2025 within New York City. This reliability need is primarily driven by a combination of forecasted increases in peak demand and the assumed unavailability of certain combustion turbines in New York City affected by the DEC Peaker Rule. "Peakers" typically operate to maintain bulk power system reliability during the most stressful operating conditions, such as periods of peak electricity demand. As of May 1, 2023, 1,027 MW of the affected peakers have deactivated or limited their operation. An additional 590 MW of peakers are expected to become unavailable beginning May 1, 2025 - all of which are in New York City. Specifically, as identified in the 2023 Quarter 2 STAR, the New York City zone is deficient by as much as 446 MW for a duration of nine hours on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand.

[8] OATT Section 38.1 contains the tariff definition of a "Short-Term Reliability Process Need."
[9] OATT Section 38.1 contains the tariff definition of a "Near-Term Reliability Need." See also OATT Section 38.3.6.

Figure 7: New York City Transmission Security Margin



The reliability need is based on a deficient transmission security margin that accounts for expected generator availability, transmission limitations, and updated demand forecasts using data published in the 2023 Load & Capacity Data Report ("Gold Book"). The transmission security margin represents the balance between demand for electricity and the power supply available from generation and transmission to serve that demand. This assessment recognizes that there is uncertainty in the demand forecast due to uncertainties in key assumptions including population and economic growth, the proliferation of energy efficiency, the installation of behind-the-meter renewable energy resources, and electric vehicle adoption and charging patterns.

Overall, as seen in **Figure 7**, the New York City transmission security margin is expected to improve in 2026 if the CHPE project enters service on schedule in spring 2026, but the margin gradually erodes through time thereafter as expected demand for electricity grows. Beyond 2025, the forecasted reliability margins within New York City may not be sufficient if (i) the CHPE project experiences a significant delay, (ii) additional power plants become unavailable, or (iii) demand significantly exceeds current forecasts. Without the CHPE project in service or other offsetting changes or solutions, the reliability margins continue to be deficient for the ten-year planning horizon. In addition, while CHPE is expected to contribute to reliability in the summer, the facility is not expected to provide any capacity in the winter.

As a result of the need being observed in the first three years of the short-term process, solutions will be solicited, evaluated, and addressed in accordance with the NYISO Short-Term Reliability Process. The NYISO issued the solution solicitation to address this need in early August with responses due back to the

NYISO in early October.[10]

After the solution solicitation window has closed, the NYISO will evaluate the submitted proposals to determine if they are viable and sufficient. If proposed solutions, either individually or in combination, are not viable or sufficient to meet the identified Short-Term Reliability Need, interim solutions must be in place to keep the grid reliable. One potential outcome could include relying on generators that are subject to the DEC Peaker Rule to remain in operation until a permanent solution is in place. The DEC Peaker Rule anticipated this scenario when it authorized the NYISO to designate certain units to remain in operation beyond 2025 on an as-needed basis for reliability. Based on findings from its Short-Term Reliability Process, the NYISO may designate certain units, in sufficient quantity, to remain in operation for an additional two years (until May 1, 2027) with the potential of an additional two-year extension (to May 1, 2029) if a permanent solution that is needed to maintain reliability has been selected but is not yet online. The NYISO would only temporarily retain peakers as a last-step approach if it does not expect solutions to be in place by the time the identified reliability need is expected in 2025.

[10] The 2023 Q2 STAR solution solicitation letter is available at: https://www.nyiso.com/documents/20142/15930765/STRP-Q2-2023-Solicitation-Letter-Draft-vFinal.pdf

Comprehensive Reliability Plan for 2023-2032

The Comprehensive Reliability Plan to reliably serve New York demand for the 2023-2032 timeframe requires forecasting the balance between generation, load, and transmission. A key part of the reliability process is to apply conservative inclusion rules so that only those projects that have a high level of certainty of being completed are planned for, based on review of their regulatory, financial, and construction status. This often results in only limited amounts of generation and transmission projects being included in the base case. It is important to note that the NYISO Interconnection Queue contains an unprecedented number of proposed projects in various stages of development. The NYISO's Gold Book (or Load and Capacity Data) Tables IV and VII contain proposed generation and transmission projects that are in a more advanced stages of the interconnection process—of which only a few have achieved sufficient milestones to be included in this plan.

This section summarizes the key future projects and assumptions that have been included as part of this Comprehensive Reliability Plan, and the resultant reliability metrics for the system as planned. As discussed in the next major section of this report (Risk Factors to the Comprehensive Reliability Plan), the NYISO identifies numerous risk factors that could adversely affect the implementation of the plan and hence system reliability over the planning horizon.

Demand

The 2023 Gold Book provides an in-depth review of the load forecast and changing resource mix. In general, the baseline forecast published in the 2023 Gold Book is higher than the level published in the 2022 Gold Book. The higher forecasted growth in energy usage can be attributed primarily to increased large load projects and electric vehicle (*i.e.,* EV charging impacts), including greater coincidence with periods of peak electric demand. Baseline energy and coincident peak demand increases significantly throughout the 30-year Gold Book forecast period, driven largely by large load project growth in the early forecast years, and electrification of space heating, non-weather sensitive appliances, and electric vehicle charging in the outer forecast years. As discussed further in the Risk Factors section of this report, New York is projected to become winter peaking in future decades due to space heating electrification and electric vehicle penetration. There is uncertainty in the demand forecast driven by uncertainties in key assumptions, such as population and economic growth, energy efficiency, the installation of behind-the-meter renewable energy resources, and electric vehicle adoption and charging patterns. These risks to the baseline demand forecast are seen through the incorporation of the lower and higher policy demand forecast which provides a bounding to the range of forecasted conditions during expected weather. The lower and higher demand policy scenarios reflect achievement of policy targets through alternative pathways and assume the same weather factors as the baseline demand forecast. The baseline demand range in consideration of these uncertainties in shown in the figures below for NYCA, as well as the Lower Hudson Valley (Zones G-J), New York City (Zone J), and Long Island (Zone K) localities. **Figure 8** shows the forecasted statewide summer peak load under baseline normal weather conditions (maximum temperature of 91 degrees Fahrenheit), as well as a 95-degree Fahrenheit heatwave expected once every ten years (90/10) and an extreme 1-in-100 year heatwave with a maximum temperature of 98 degrees Fahrenheit.

Figure 8: Statewide Summer Peak Load Forecasts

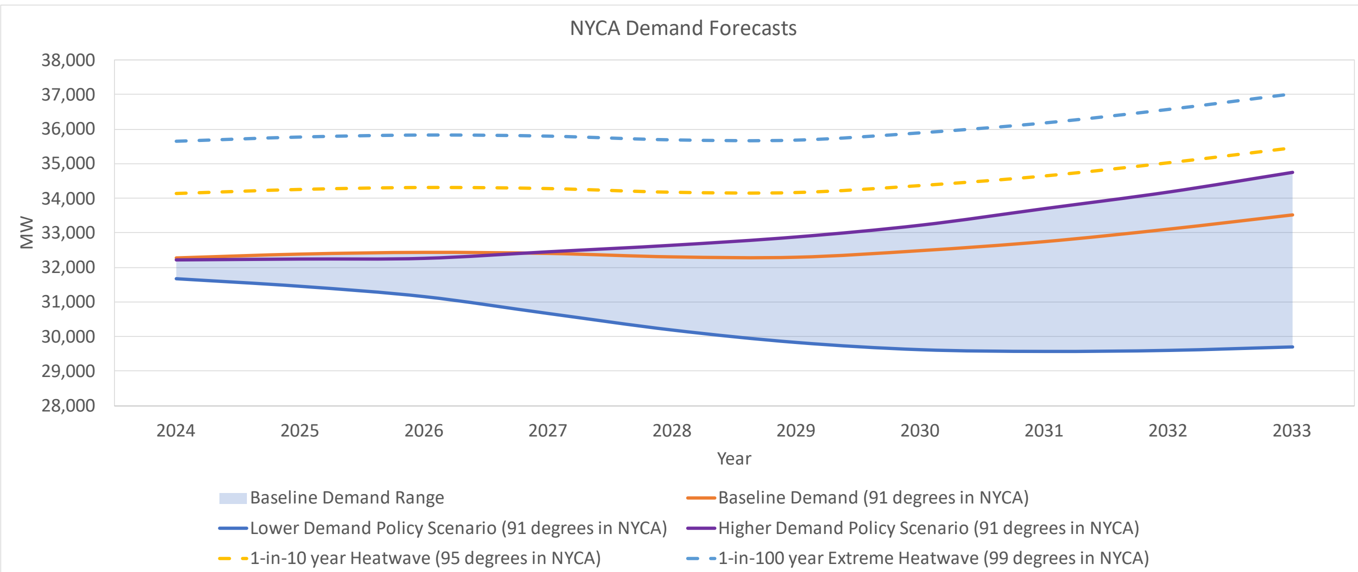


Figure 9: Lower Hudson Valley Summer Peak Load Forecasts

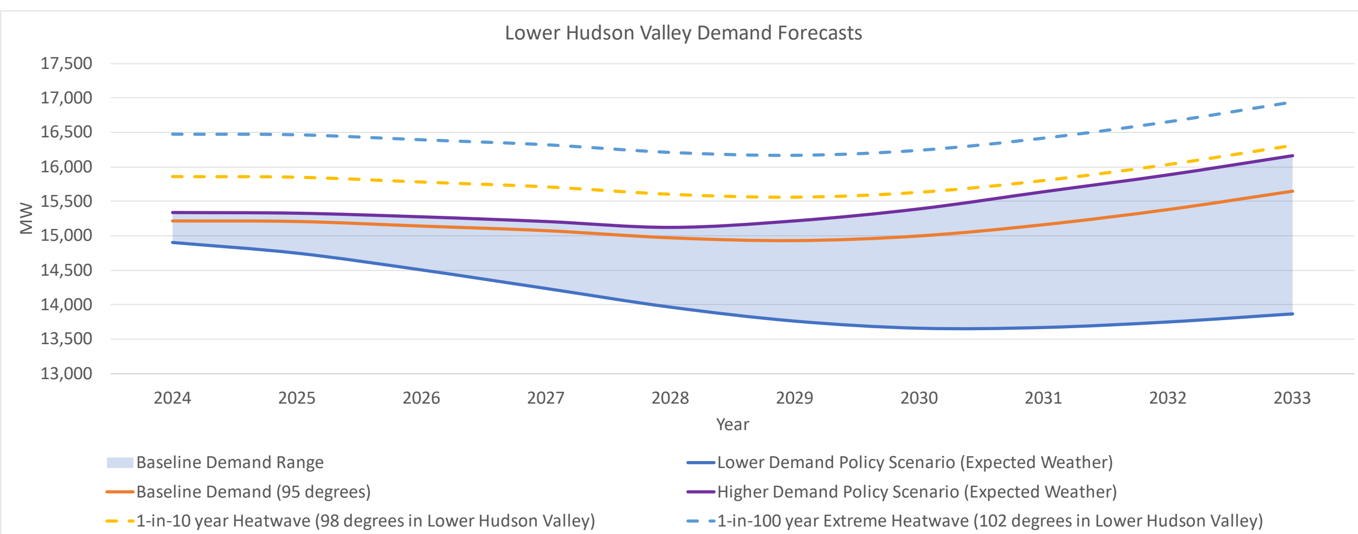


Figure 10: New York City Summer Peak Load Forecasts

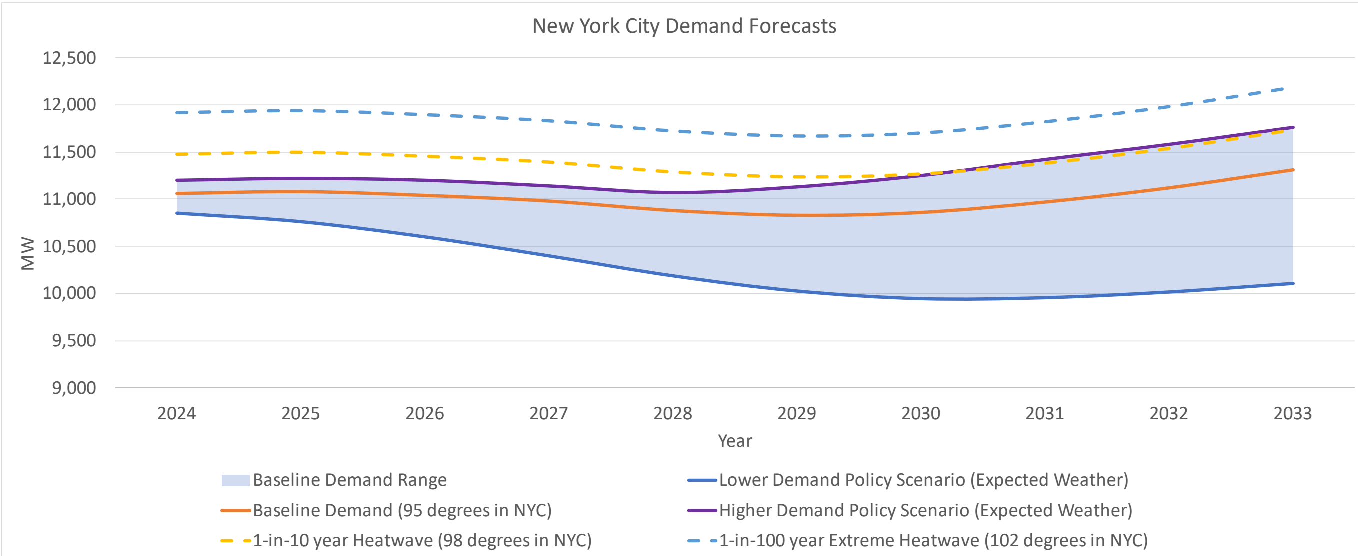
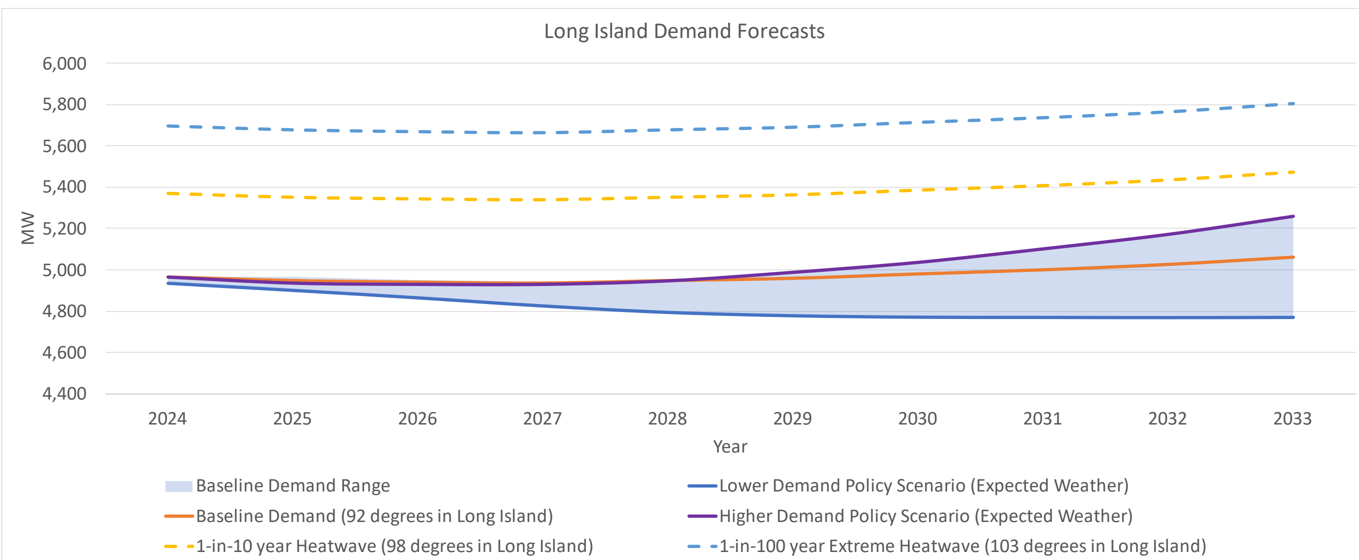


Figure 11: Long Island Summer Peak Load Forecasts



Generation

Figure 13 provides a list of future planned generation projects as well as deactivations that were included in the 2022 RNA as well as the 2023 Quarter 2 STAR. **Figure 12** provides a graphical representation of these resources. A new generation resource is included in reliability studies when the project has reached a key milestone in the NYISO interconnection process and is making significant progress in construction, project financing, and/or regulatory approvals.[11] For the 2022 RNA and 2023 Quarter 2 STAR the generating resources include a total of 315.7 MW of land-based wind generation, 130 MW of solar generation, and 20 MW of battery storage planned to be in-service by summer 2023. In 2024, there is 136 MW of offshore wind connecting into Long Island with 340 MW of solar generation. In 2025 there is an additional 117 MW of land-based and 698.5 MW of solar. The NYISO continues to track numerous additional generation projects active in the interconnection process.

For deactivations, the 2022 RNA assumed approximately 1,700 MW of generating units unavailable, primarily driven by policy changes such as the DEC peaker rule. Their removal from the existing system representation is due to the units entering a deactivated state (*e.g.,* retired, mothball outage, or in an ICAP-Ineligible Forced Outage (IIFO), or proposed to retire or mothball) or being operationally impacted by the DEC Peaker Rule. Approximately 320 MW Of generation deactivated by the end of 2022 with about 650 MW of generation having retired or changed status to comply with the DEC peaker rule prior to summer 2023 2023. An additional 590 MW of retirements or status changes to comply with the DEC peaker rule is planned by summer 2025. For instance, some of the Peaker units are assumed out of service in the May through October ozone season only. **Figure 14** provides a summary of the units impacted by the DEC peaker rule.

[11] NYISO Reliability Planning Process Manual, Section 3.2, dated December 12, 2019.

Figure 12: Planned Generation Additions and Deactivations (Summer Capability (MW))

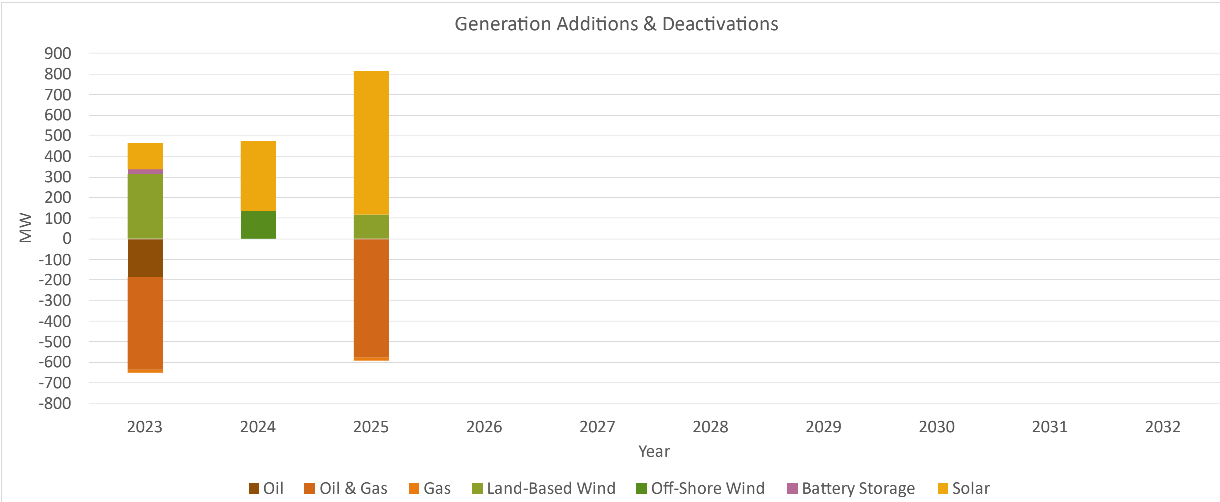


Figure 13: List of Planned Additional Generating Resources (Nameplate MW)

NYISO Interconnection Queue #	Project Name/(Owner)	Zone	Point of Interconnection	Type	COD or I/S Date	Summer Peak MW	Notes
758	Independence GS1 to GS4 {Dynegy Marketing and Trade, LLC)	C	Scriba 345 kV	Gas	I/S	9.0	3
396	Baron Winds (Baron Winds, LLC)	C	Hillside - Meyer 230kV	W	I/S	238.4	2, 4
422	Eight Point Wind Energy Center (NextEra Energy Resources, LLC)	C	Bennett 115kV	W	I/S	101.8	2
775	Puckett Solar (Puckett Solar, LLC)	C	Chenango Forks Substation 34.5kV	S	I/S	20	1
731	Branscomb Solar (Branscomb Solar, LLC)	F	Battenkill - Eastover 115kV	S	I/S	20	1
748	Regan Solar (Regan Solar, LLC)	F	Market Hill - Johnstown 69kV	S	I/S	20	1
678	Calverton Solar Energy Center (LI Solar Generation, LLC)	K	Edwards Substation 138kV	S	I/S	22.9	2
769	North Country Energy Storage (New York Power Authority)	D	Willis 115kV	ES	I/S	20	
768	Janis Solar (Janis Solar LLC)	C	Willet 34.5kV	S	I/S	20	1
682	Grissom Solar (Grissom Solar, LLC)	F	Ephratah - Florida 115kV	S	I/S	20	1
531	Number 3 Wind Energy (Invenergy Wind Development LLC)	E	Taylorville - Boonville 115kV	W	I/S	103.9	2
759	KCE NY6	A	Gardenville - Bethlehem Steel Wind 115kV	ES	04/2022	20	1
670	Skyline Solar (SunEast Skyline Solar LLC)	E	Campus Rd - Clinton 46kV	S	04/2022	20	1
807	Hilltop Solar (SunEast Hilltop Solar LLC)	F	Eastover - Schaghticoke 115kV	S	07/2022	20	
734	Ticonderoga Solar (ELP Ticonderoga Solar LLC)	F	ELP Ticonderoga Solar LLC	S	08/2022	20	1
735	ELP Stillwater Solar (ELP Stillwater Solar LLC)	F	Luther Forest - Mohican 115kV	S	09/2022	20	
666	Martin Solar (Martin Solar LLC)	A	Arcade - Five Mile 115kV	S	10/2022	20	1

NYISO Interconnection Queue #	Project Name/(Owner)	Zone	Point of Interconnection	Type	COD or I/S Date	Summer Peak MW	Notes
667	Bakerstand Solar (Bakerstand Solar LLC)	A	Machias - Maplehurst 34.5kV	S	10/2022	20	1
579	Bluestone Wind (Bluestone Wind, LLC)	E	Afton - Stilesville 115kV	W	10/2022	111.8	2
565	Tayandenega Solar (Tayandenega Solar, LLC)	F	St. Johnsville - Inghams 115kV	S	10/2022	20	1
505	Ball Hill Wind (Ball Hill Wind Energy, LLC)	A	Dunkirk - Gardenville 230kV	W	11/2022	100.0	2
721	Excelsior Energy Center (Excelsior Energy Center, LLC)	B	N. Rochester - Niagara 345 kV	S	11/2022	280.0	2
618	High River Solar (High River Energy Center, LLC)	F	Inghams - Rotterdam 115kV	S	11/2022	90.0	2
619	East Point Solar (East Point Energy Center, LLC)	F	Cobleskill - Marshville 69kV	S	11/2022	50.0	2
564	Rock District Solar (Rock District Solar, LLC)	F	Sharon - Cobleskill 69kV	S	12/2022	20	1
570	Albany County 1 (Hecate Energy Albany 1 LLC)	F	Long Lane - Lafarge 115kV	S	12/2022	20	1
598	Albany County 2 (Hecate Energy Albany 2 LLC)	F	Long Lane - Lafarge 115kV	S	12/2022	20	1
638	Pattersonville (Pattersonville Solar Facility, LLC)	F	Rotterdam - Meco 115kV	S	12/2022	20	1
730	Darby Solar (Darby Solar, LLC)	F	Mohican - Schaghticoke 115kV	S	12/2022	20	1
572	Greene County 1 (Hecate Energy Greene 1 LLC)	G	Coxsackie - North Catskill 69kV	S	01/2023	20	1
573	Greene County 2 (Hecate Energy Greene 2 LLC)	G	Coxsackie Substation 13.8kV	S	03/2023	10	1
592	Niagara Solar (Duke Energy Renewables Solar, LLC)	B	Bennington 34.5kV Substation	S	05/2023	20	
584	Dog Corners Solar (SED NY Holdings LLC)	C	Aurora Substation 34.5kV	S	05/2023	20	1
590	Scipio Solar (Duke Energy Renewables Solar, LLC)	C	Scipio 34.5kV Substation	S	05/2023	18	
545	Sky High Solar (Sky High Solar, LLC)	C	Tilden -Tully Center 115kV	S	06/2023	20	1

NYISO Interconnection Queue #	Project Name/(Owner)	Zone	Point of Interconnection	Type	COD or I/S Date	Summer Peak MW	Notes
586	Watkins Road Solar (SED NY Holdings LLC)	E	Watkins Rd - Ilion 115kV	S	06/2023	20	1
581	Hills Solar (SunEast Hills Solar LLC)	E	Fairfield - Inghams 115kV	S	08/2023	20	
612	South Fork Wind Farm (South Fork Wind, LLC)	K	East Hampton 69kV	OSW	08/2023	96.0	2
695	South Fork Wind Farm II (South Fork Wind, LLC)	K	East Hampton 69kV	OSW	08/2023	40.0	2
637	Flint Mine Solar (Flint Mine Solar LLC)	G	LaFarge - Pleasant Valley 115kV, Feura Bush - North Catskill 115kV	S	09/2023	100.0	2
848	Fairway Solar (SunEast Fairway Solar LLC.)	E	McIntyre - Colton 115kV	S	10/2023	20	
617	Watkins Glen Solar Watkins Glen Energy Center, LLC	C	Bath - Montour Falls 115kV	S	11/2023	50.0	2
720	Trelina Solar Energy Center (Trelina Solar Energy Center, LLC)	C	Border City - Station 168 115 KV	S	11/2023	80.0	2
855	NY13 Solar (Bald Mountain Solar LLC)	F	Mohican - Schaghticoke 115kV	S	11/2023	20	
495	Mohawk Solar (Mohawk Solar LLC)	F	St. Johnsville - Marshville 115kV	W	11/2024	90.5	2

Notes

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

(2) All proposed large generators obtained or are assumed to obtain both Energy Resource Interconnection Service (ERIS) and CRIS and are modeled both in 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.

(3) Large generator, ERIS only

(4) Only Part 1 of this generator is in-service (119.2 MW). The remaining MW is planned to be in-service by December 2023.

Figure 14: Status Changes Due to DEC Peaker Rule

Owner/Operator	Station	Zone	Nameplate (MW)	CRIS (MW) (1)		Capability (MW) (1)		Status Change Date (2)	STAR Evaluation or Other Assessment
				Summer	Winter	Summer	Winter		
National Grid	West Babylon 4 (6) (7)	K	52.4	49.0	64.0	41.2	63.4	12/12/2020 (R)	Other
National Grid	Glenwood GT 01 (4) (7)	K	16.0	14.6	19.1	13.0	15.3	2/28/2021 (R)	2020 Q3
Helix Ravenswood, LLC	Ravenswood 11	J	25.0	20.2	25.7	16.1	22.4	12/1/2021 (IIFO)	2022 Q1
Helix Ravenswood, LLC	Ravenswood 01	J	18.6	8.8	11.5	7.7	11.1	1/1/2022 (IIFO)	2022 Q1
Astoria Generating Company, L.P.	Gowanus 1-1 through 1-8	J	160.0	138.7	181.1	133.1	182.2	11/1/2022 (R)	2022 Q2
Astoria Generating Company, L.P.	Gowanus 4-1 through 4-8	J	160.0	140.1	182.9	138.8	183.4	11/1/2022 (R)	2022 Q2
Consolidated Edison Co. of NY, Inc.	Hudson Ave 3	J	16.3	16.0	20.9	12.3	15.6	11/1/2022 (R)	2022 Q2
Consolidated Edison Co. of NY, Inc.	Hudson Ave 5	J	16.3	15.1	19.7	15.3	18.6	11/1/2022 (R)	2022 Q2
Central Hudson Gas & Elec. Corp.	Coxsackie GT (8)	G	21.6	21.6	26.0	19.0	23.6	5/1/2023	
Central Hudson Gas & Elec. Corp.	South Cairo (8)	G	21.6	19.8	25.9	18.7	23.1	5/1/2023	
Consolidated Edison Co. of NY, Inc.	74 St. GT 1 & 2 (10)	J	37.0	39.1	49.2	37.8	43.6	5/1/2023	2022 Q2
Astoria Generating Company, L.P.	Astoria GT 01	J	16.0	15.7	20.5	13.4	19.1	5/1/2023	2022 Q4
NRG Power Marketing, LLC	Astoria GT 2-1, 2-2, 2-3, 2-4	J	186.0	165.8	204.1	138.0	184.2	5/1/2023 (R)	2022 Q2
NRG Power Marketing, LLC	Astoria GT 3-1, 3-2, 3-3, 3-4	J	186.0	170.7	210.0	139.1	180.4	5/1/2023 (R)	2022 Q2
NRG Power Marketing, LLC	Astoria GT 4-1, 4-2, 4-3, 4-4	J	186.0	167.9	206.7	138.5	178.6	5/1/2023 (R)	2022 Q2
Helix Ravenswood, LLC	Ravenswood 10	J	25.0	21.2	27.0	16.1	20.3	5/1/2023 (R)	2022 Q3
National Grid	Glenwood GT 03 (3) (4)	K	55.0	54.7	71.5	49.9	67.2	5/1/2023	
National Grid	Northport GT (9)	K	16.0	13.8	18.0	8.3	12.7	5/1/2023	
National Grid	Port Jefferson GT 01 (9)	K	16.0	14.1	18.4	13.0	15.3	5/1/2023	
National Grid	Shoreham 1 (3) (4)	K	52.9	48.9	63.9	41.3	61.4	5/1/2023	
National Grid	Shoreham 2 (3) (4)	K	18.6	18.5	23.5	16.5	20.3	5/1/2023	
Consolidated Edison Co. of NY, Inc.	59 St. GT 1	J	17.1	15.4	20.1	13.1	18.8	5/1/2025	
NRG Power Marketing, LLC	Arthur Kill GT 1	J	20.0	16.5	21.6	12.3	15.8	5/1/2025	
Astoria Generating Company, L.P.	Gowanus 2-1 through 2-8 (5)	J	160.0	152.8	199.6	142.1	182.0	5/1/2025	
Astoria Generating Company, L.P.	Gowanus 3-1 through 3-8 (5)	J	160.0	146.8	191.7	136.9	179.9	5/1/2025	
Astoria Generating Company, L.P.	Narrows 1-1 through 2-8 (5)	J	352.0	309.1	403.6	285.9	369.2	5/1/2025	
	Prior to Summer 2022		112.0	92.6	120.3	78.0	112.2		
	Prior to Summer 2023		1,190.3	1,081.7	1,369.3	949.1	1,249.6		
	Prior to Summer 2025		709.1	640.6	836.6	590.3	765.7		
	Total		2,011.4	1,814.9	2,326.2	1,617.4	2,127.5		

Notes

1. MW values are from the 2023 Load and Capacity Data Report
2. Dates identified by generators in their DEC Peaker Rule compliance plan submittals for transitioning the facility to Retired, Blackstart, or will be out-of-service in the summer ozone season or the date in which the generator entered (or proposed to enter) Retired (R) or Mothball Outage (MO) or the date on which the generator entered ICAP Ineligible Forced Outage (IIFO)
3. Generator changed DEC peaker rule compliance plan as compared to the 2020 RNA and all STARs prior to 2021 Q3
4. Long Island Power Authority (LIPA) has submitted notifications to the DEC per part 227-3 of the peaker rule stating that these units are needed for reliability allowing these units to operate until at least May 1, 2025. Due to the future nature of these units being operated only as designated by the operator as an emergency operating procedure the NYISO will continue to plan for these units be unavailable starting May 2023
5. These units have indicated they will be out-of-service during the ozone season (May through September) in their compliance plans in response to the DEC peaker rule.
6. This unit was evaluated in a stand-alone generator deactivation assessment prior to the creation of the Short-Term Reliability Process
7. Unit operating as a load modifier
8. Central Hudson submitted notification to the DEC per part 227-3 of the peaker rule stating these units are needed for reliability. The most recent LTP update from Central Hudson notes the planned retirement of South Cairo and Coxsakie generators in December 2024. https://www.nyiso.com/documents/20142/26630522/Local-Transmission-Plan-2021.pdf/
9. On May 24, 2023 National Grid notified the New York State Public Service Commission that these units have been classified as black-start only units.
10. Unit no longer subject to NYISO dispatch and is used for local reliability only

Transmission

Transmission projects are considered firm plans in the CRP if (1) the project was selected by the NYISO as a regulated transmission solution, or (2) the project has completed necessary interconnection studies and siting applications and is making significant progress in construction, project financing, and/or regulatory approvals. [12] Planned additions to the New York transmission system include the following (included in the 2022 RNA and the subsequent 2022 STAR Base Cases):

- **December 2023: 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.
- **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. These projects target completion of the majority of the components by December 2023.
- **May 2026: 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.
- **December 2025: 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.
- **Transmission Owner Local Transmission Plans (LTPs)** that meet the inclusion rules:
    - **Summer 2023:**
        - Orange & Rockland: Lovett 345/138 kV substation.
        - Con Edison: A new (2nd) 345/138 kV PAR controlled 138 kV Rainey – Corona feeder.
        - Short-Term Reliability Process solution for addressing the 2023 Short-Term Reliability Need identified in the 2020 Quarter 3 STAR. The solution changed the planned operating status of existing series reactors, starting in summer

[12] NYISO Reliability Planning Process Manual, Section 3.2, dated December 12, 2019.

2023:

- In-service, starting summer 2025: series reactors on the following Con Edison 345 kV cables: 71, 72, M51, M52.
- Bypass, starting summer 2025: series reactors on the following Con Edison 345 kV cables: 41, 42, Y49.

- **Summer 2025:**
  - Con Edison: A new (3rd) 345/138 kV PAR controlled 138 kV Gowanus – Greenwood feeder.
  - Con Edison: A new 345/138 kV PAR controlled 138 kV Goethals – Fox Hills feeder.

The NYISO continues to track other transmission projects that are in conceptual and engineering stages of development, some of which are discussed further in the Transmission portion of the Road to 2040 section.

Reliability Metrics

With the plans and assumptions described above, and in Appendix B of the 2022 RNA,[13] the system, as planned, meets all currently applicable reliability criteria from 2026 through 2032 for forecasted system demand in normal weather. As described in the Short-Term Reliability section above, the 2023 Quarter 2 STAR observed a Short-Term Reliability Need beginning in summer 2025 within New York City, which will be addressed through the Short-Term Reliability Process. This reliability need is primarily driven by a combination of forecasted increases in peak demand and the assumed unavailability of certain combustion turbines in New York City affected by the DEC Peaker Rule. Specifically, the New York City zone (Zone J) is deficient by as much as 446 MW for a duration of nine hours on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand.

Grid reliability is determined by transmission security and resource adequacy. Transmission security is the ability of the electric system to withstand disturbances such as electric short circuits or unanticipated loss of system elements without involuntarily disconnecting firm load. Resource adequacy is the ability of the electric systems to supply the aggregate electrical demand and energy requirements of their customers, taking into account scheduled and reasonably expected unscheduled outages of system elements. The NYISO assesses grid reliability with metrics including transmission security margins, loss of load expectation, zonal resource adequacy margins, and binding interfaces.

[13] 2022 RNA Appendices: https://www.nyiso.com/documents/20142/34651464/2022-RNA-Appendices.pdf

Transmission Security Margins

Within all reliability planning studies beginning with the 2022 RNA, transmission security margin assessments are performed for the statewide system margin and for the Lower Hudson Valley, New York City, and Long Island localities. In the Lower Hudson Valley and Long Island localities, the BPTF is designed to be prepared for design contingency events following an outage (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 reliable and return to normal ratings after the occurrence of two non-simultaneous outages (N-1-1-0).

In the 2022 RNA, the NYISO did not identify a reliability need. However, the NYISO did identify that the reliability margins within New York City would not be sufficient if, among other reasons, the forecasted demand increased by as little as 60 MW in 2025. Comparing the baseline summer coincident peak demand forecast found for New York City (Zone J) in the 2022 Gold Book to the that included in the 2023 Gold Book, the demand increased by 294 MW. As expected, the 2023 Quarter 2 STAR identified a Short-Term Reliability Need on the BPTF within Con Edison's transmission district beginning in year 2025. The reliability need is based on a deficient transmission security margin that accounts for expected generator availability, transmission limitations, and demand forecasts. The deficient margin within New York City is primarily due to the increased demand forecasts within New York City combined with the planned unavailability of simple-cycle combustion turbines to comply with the DEC's Peaker Rule in 2025. Additionally, decreased summer capabilities of generators within the area and increased generator forced outage rates also contribute to the deficiency.

Figure 15 provides a summary of the margins evaluated statewide, as well as within the Lower Hudson Valley, New York City, and Long Island localities, under expected summer weather baseline forecast, normal transfer criteria conditions as observed in the 2023 Quarter 2 STAR. While the margins are sufficient statewide with the baseline demand (as well as in the Lower Hudson Valley and Long Island localities), the margin within New York City is deficient by as much as 446 MW for a duration of nine hours on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand. With the planned addition of the CHPE project, there is an increase in the observed margin beginning summer 2026. The margin changes in each year between 2026 and 2033, and those changes due to changes in the demand forecast. By 2033, the margin within New York City reduces to just under 200 MW.

Figure 15: Summary of Expected Summer Weather, Normal Transfer Criteria Margins

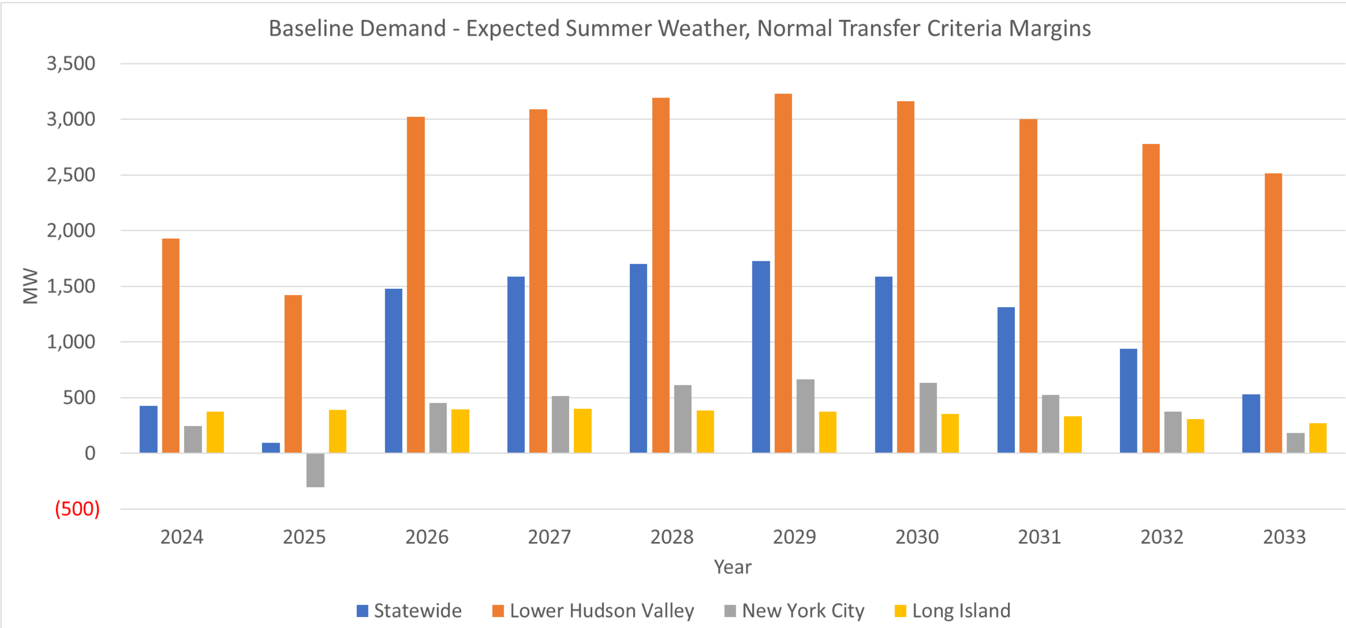
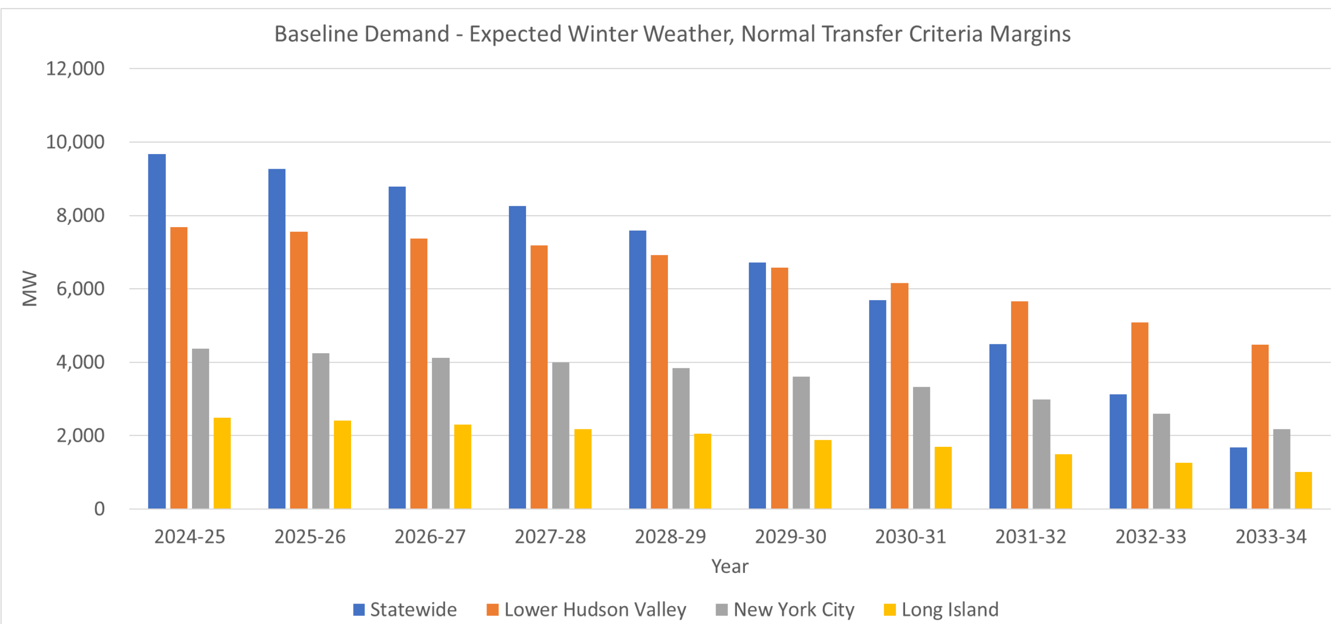


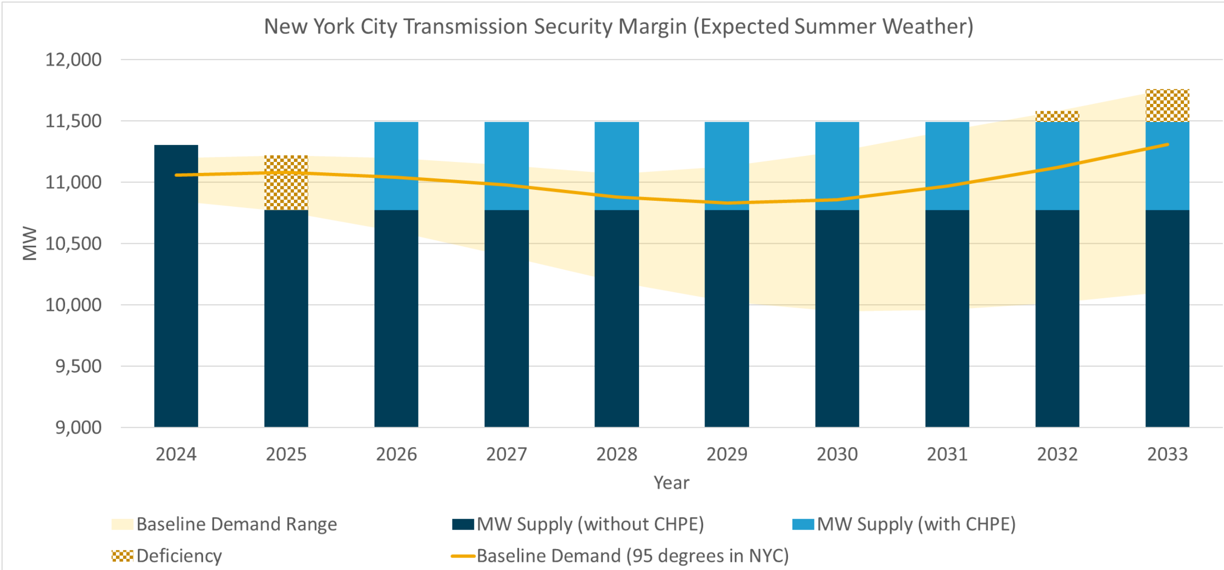
Figure 16: Summary of Expected Winter Weather, Normal Transfer Criteria Margins



Beyond 2025, as seen in **Figure 15** the statewide system margin as well as the Lower Hudson Valley and New York City margins improve with the anticipated addition of the CHPE project. However, the margin gradually erodes following the addition of CHPE as the baseline demand grows. As shown in **Figure 16**, the reliability margins within New York City with CHPE in-service are only sufficient through summer 2031. By summer 2032 the New York City transmission security margin is deficient by 88 MW which worsens to

268 MW in summer 2033. The New York City transmission security margins may not be sufficient for the baseline forecast or higher demand policy scenario if (i) the CHPE project experiences a significant delay, (ii) additional power plants become unavailable, or (iii) demand significantly exceeds current forecasts. In addition, while the CHPE project will contribute to reliability in the summer, the facility is not expected to provide any capacity in the winter.

Figure 17: New York City Transmission Security Margin (Summer, With and Without CHPE)



Within the Lower Hudson Valley, both with and without the CHPE project, the anticipated transmission security margins are sufficient (see **Figure 17**). Similarly, within the Long Island locality, the transmission security margin is sufficient for all study years (see **Figure 18**).

Figure 18: Lower Hudson Valley Transmission Security Margin (Summer, With and Without CHPE)

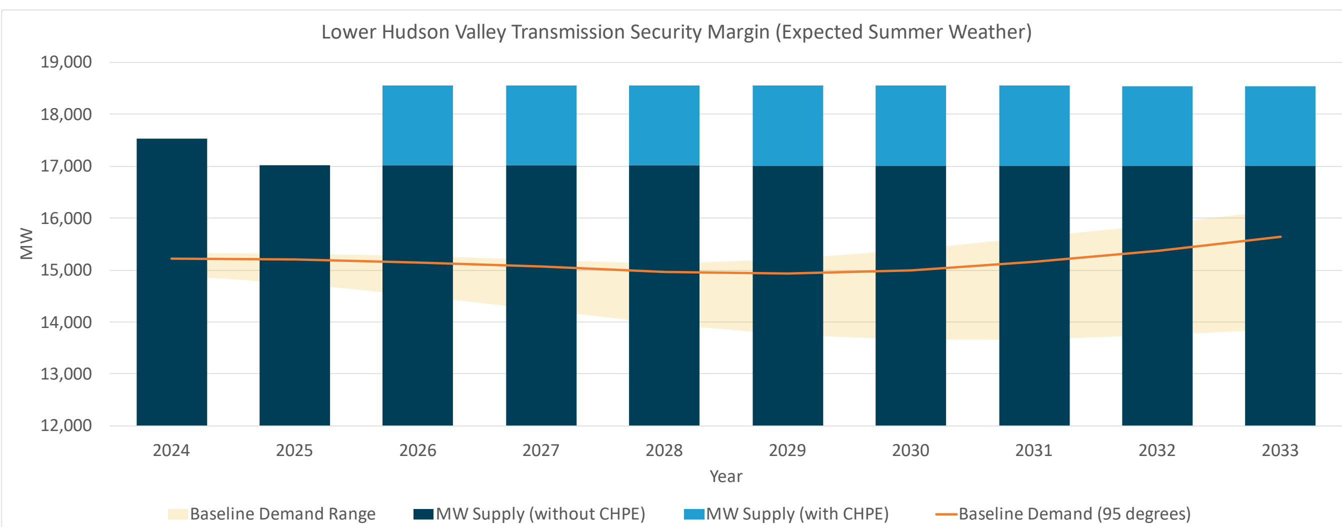
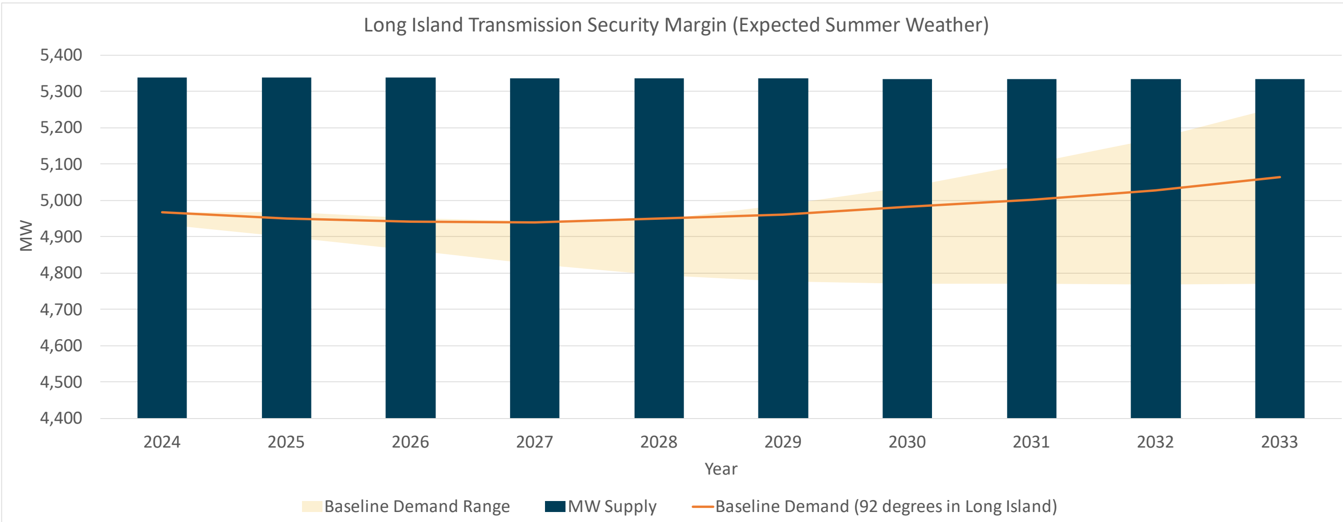


Figure 19: Long Island Transmission Security Margin (Summer)



Statewide System Margin

From a statewide system margin perspective, as identified in a scenario in the 2023 Quarter 2 STAR, there is the potential for a deficient statewide system margin with the addition of large load interconnections primarily in western and central New York in year 2025. The additional large load interconnections included the Micron New York semiconductor manufacturing (Q#1536), the Air Products and Chemicals (Q#1446), and other load changes not captured in that STAR but are included in the 2023 Gold Book.

Figure 20: Baseline Large Load Forecast

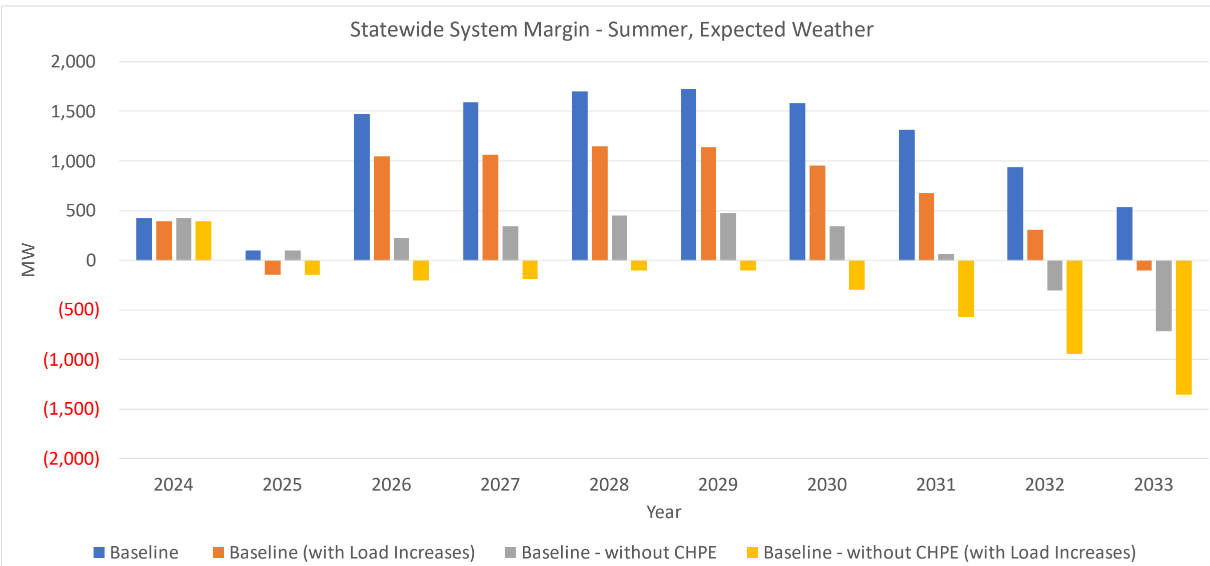
Interconnecting Large Loads Forecast - Summer Peak Demand by Zone - MW

ear	A	B	C	D	E	F	G	H	I	J	K	NYCA
2023	95	0	0	166	0	0	0	0	0	0	0	261
2024	110	151	50	169	37	0	0	0	0	0	0	517
2025	130	175	240	169	50	0	0	0	0	0	0	764
2026	150	200	430	169	55	0	0	0	0	0	0	1,004
2027	170	200	480	213	55	0	0	0	0	0	0	1,118
2028	170	200	480	241	55	0	0	0	0	0	0	1,146
2029	170	200	480	269	55	0	0	0	0	0	0	1,174
2030	170	200	530	269	55	0	0	0	0	0	0	1,224
2031	170	200	530	269	55	0	0	0	0	0	0	1,224
2032	170	200	530	269	55	0	0	0	0	0	0	1,224
2033	170	200	530	269	55	0	0	0	0	0	0	1,224

As shown in the 2023 Quarter 2 STAR scenario, with the inclusion of these large load projects in the demand forecast, in 2025 the statewide system margin would be deficient by 145 MW. As shown in **Figure 20**, the statewide system margin again becomes sufficient in 2026 with the addition of the CHPE project and remains sufficient through 2032. In 2033, the statewide system margin is deficient by 104 MW (as depicted in **Figure 20**). In consideration of a delay in CHPE, the system would be sufficient through 2031 but with an extremely narrow margin of 44 MW. In 2031 the system is deficient by 329 growing to 739 MW by 2033.

Additional risk factors, such as accounting for the load forecast uncertainty from economic growth and policy-driven increases in demand for electricity, on the statewide system margin are provided in the risk factors to the comprehensive reliability plan section of this report.

Figure 21: Statewide System Margin (Summer, With and Without CHPE)



Resource Adequacy

The New York Control Area (NYCA) loss of load expectation (LOLE in days/year) through the ten-year planning horizon is within reliability criteria, as shown in Figure 20. For reference, the previous results from the 2022 RNA are provided along with the current results for this CRP.

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 cannot exceed one day in 10 years, or LOLE < 0.1 days/year. LOLE accounts for events but does not account for the magnitude (MW) or duration (hours) of the deficit. Therefore, two additional reliability indices are added for information purposes: loss of load hours (LOLH) described in hours per year and expected unserved energy (EUE) described in MWh per year.[14]

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). Within an hour, if the zonal demand exceeds the resources, 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.

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

Figure 22: 2022 RNA Loss of Load Expectation Metrics

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

Notes:

- LOLE: Loss of load expectation (days per year). The criterion is that the LOLE not exceed one day in 10 years, or LOLE < 0.1 days/year.
- LOLH: Loss of load hours (hours per year).
- EUE: Expected unserved energy (megawatt-hours per year).

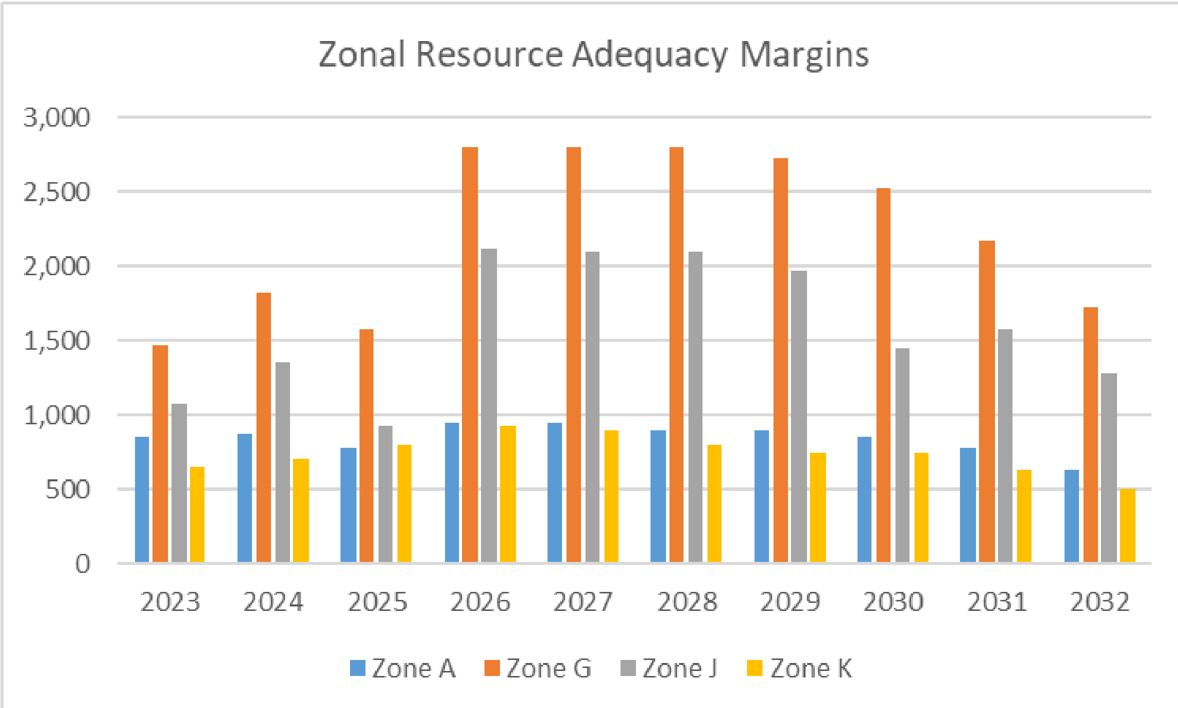
The NYISO performed resource adequacy simulations on the CRP base cases[15] to determine the amount of "perfect" capacity in each zone that could be removed before the NYCA LOLE reaches 0.1 days/year. This simulation offers another relative measure of how close the system is from not having adequate resources to reliably serve load.

As shown in Figure 22, this analysis found tightening margins across the New York grid through time, with a margin of only 1,275 MW in New York City (Zone J), 500 MW in Long Island, and 625 MW in western New York (Zone A) by 2032.

Additionally, the updated demand forecast developed for the 2023 Gold Book shows an increasing trend and captures additional proposed large loads and will further contribute to decreasing the zonal resource adequacy margins.

[15] The CRP base cases already reflect the DEC Peaker Rule compliance plans submitted by the affected generation owners to DEC; summarized in the assumption's tables from Appendix B of this report.

Figure 23: 2022 RNA Summary of Key Zonal Resource Adequacy Margins



Resource capacity is reduced one zone at a time to determine when violations occur, 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 23**, and the zonal resource margin analysis (ZRAM) is summarized in **Figure 24.**

Figure 24: NYISO Load Zone Map

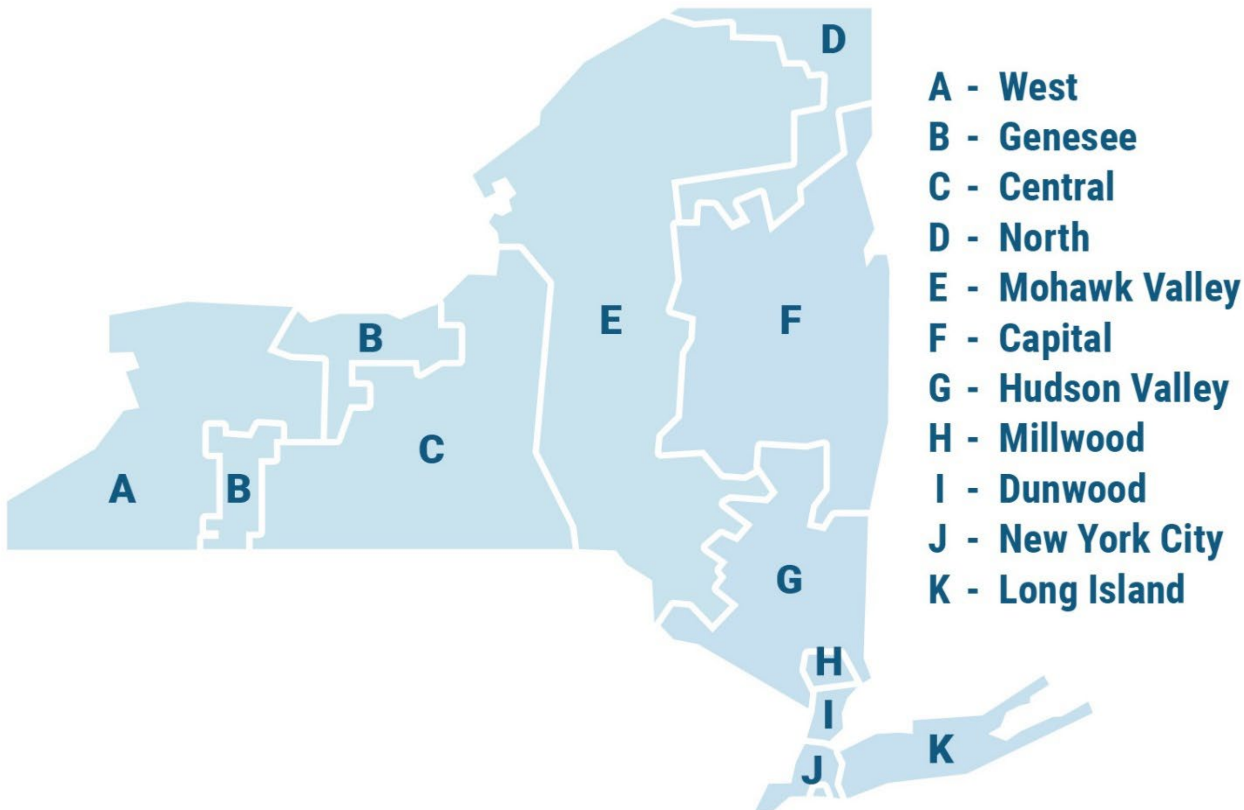


Figure 25: 2022 RNA Zonal Resource Adequacy Margins (MW)

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.
- Exceeds Zonal Resources (EZR) is all of the generation that 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 NYCA LOLE criterion violations. However, the impacts of removing capacity on the reliability of the transmission system and on transfer capability are highly location dependent. Thus, lower amounts of capacity removal may result in reliability issues at a specific transmission location, which may not cause an issue in another transmission location. With these simulations, the NYISO did not attempt to assess a comprehensive set of potential scenarios that might arise from specific unit retirements. Actual proposed capacity removal from any of these zones would 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, would be necessary under the applicable process for any contemplated plant retirement in any zone.

Risk Factors to the Comprehensive Reliability Plan

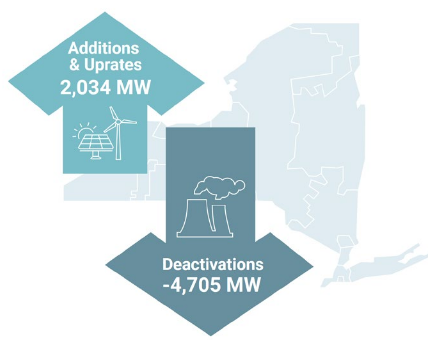
The Reliability Planning Process findings reflect the base case assumptions, which were set in accordance with applicable reliability rules and procedures. There are, however, numerous risk factors that could adversely affect the implementation of the plan and hence system reliability over the planning horizon. These risk factors may arise for several reasons, including climate, economic, regulatory, and policy drivers. If any of these factors materialize, the NYISO will assess the potential impacts and, if necessary, perform an evaluation to determine whether the NYISO should solicit solutions under the Short-Term Reliability Planning Process, Generation Deactivation Process, or Gap Solution Process, as required.

Generation Availability and Performance

Substantial uncertainties exist in the next ten years that will impact the system resources. These uncertainties include, but are not limited to:

a) **Pace of retirements exceeding the pace of resource additions,** such as DEFRs, demand response, and transmission. The figure below shows the additions, uprates, and deactivations based on nameplate capacity since the enactment of the CLCPA.

Figure 26: Additions/Uprates and Deactivation Since the Enactment of the CLCPA (Nameplate Capacity)



b) **If expected generation projects are not built or are delayed, a system deficiency may occur.** The 2022 RNA base cases included approximately 3,350 MW of assumed generation additions in various planning stages. This includes approximately 2,130 MW of proposed generation (mostly wind and solar) and the 1,250 MW proposed HVDC line from Quebec to New York City. The 2022 RNA also simulated a "status-quo" scenario. This scenario evaluated the reliability of the system under the assumption that no major transmission or generation projects come to fruition within the study period. This included the removal of all proposed transmission and generation projects that had met the inclusion rules and removal of generators that require modifications to comply with the DEC Peaker Rule.

This scenario acknowledges that delays can occur throughout the entire developmental life cycle of a proposed generation or transmission project as it seeks to obtain interconnection rights, permits, and financing. The status quo scenario performed in the 2022 RNA observed transmission overloads across many service territories throughout New York. Using the updated data from the 2023 Quarter 2 STAR, the statewide system margin is sufficient through year 2033 using the baseline demand forecast if all reliability planning projects are completed on time. Without the CHPE project, the statewide system margin is deficient as early as 2032 under the baseline demand. Under the higher demand policy scenario and without the CHPE project, the system is deficient by 446 MW by 2031 and grows to 1,459 MW by 2033.

c) Intermittent resources with inverter-based technology replacing fossil generation

Clean energy policies, such as the CLCPA (additional details are provided under G1), are reshaping the New York grid. The increase in the intermittent and distributed generation, along with the related penetration of inverter-based technology, create new challenges. Additionally, clean energy production is a key underlying element of electrification policies. The NYCA is projected to become winter peaking in future decades due to electrification, primarily via heat pumps and electric vehicles.

New York State policy targets include: 6,000 MW of distributed solar PV 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.

With high penetration of renewable intermittent resources, dispatchable, emissions-free, and long-duration resources (DEFRs) are needed to balance intermittent supply with demand. Resources with these characteristics 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. Moreover, essential reliability services usually provided to the system by synchronous fossil generation will continue to be necessary. New technology is being developed to allow for a reliable transition to a clean grid. For instance, grid-forming inverter capabilities, as well as DEFRs, will likely be part of the transformation.
On May 2023, the PSC initiated a process to examine the need for resources to ensure the reliability of the 2040 zero-emissions electric grid mandated by the CLCPA. Under this initiative, the PSC seeks to identify innovative technologies to ensure reliability of a zero emissions electric grid. Additionally, the NYSRC initiated a Proposed Reliability Rule 151 focused on large inverter-based resources. The rule was proposed in response to the reliability findings published in the NERC

disturbance reports from actual system events along with the increased volume of inverter-based resources planned to enter the New York grid to achieve clean energy policy objectives.

d) Additional generating units becoming unavailable or deactivating beyond those units already planned

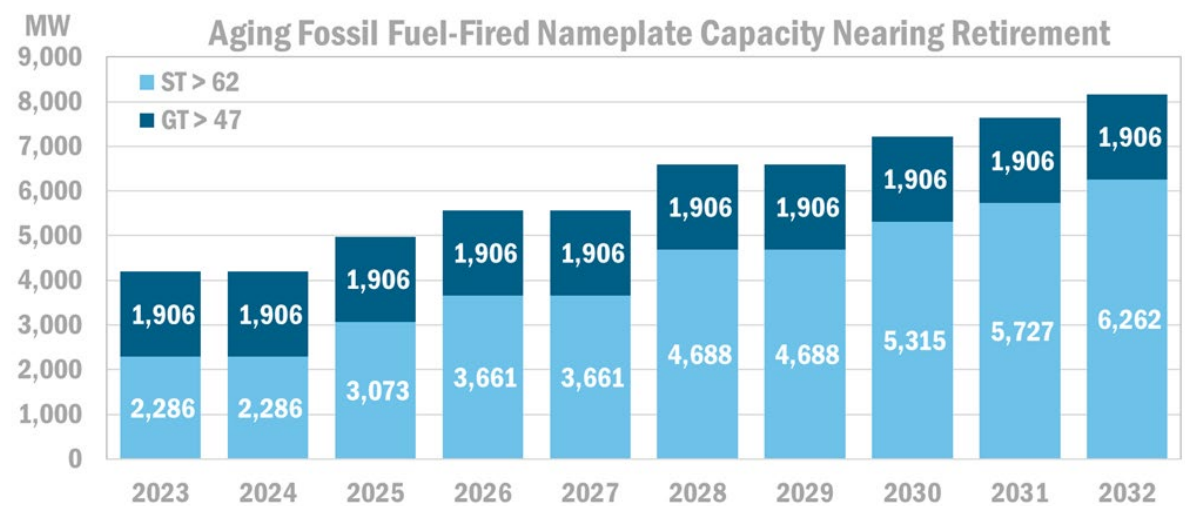
The scenarios performed as part of the RNA indicated that the deactivation of additional generation beyond what is already planned could lead to reliability needs. The RNA also noted that depending on the units affected, the NYISO can take actions through its Short-Term Reliability Process to maintain reliability. Subsequently, the 2023 Q2 STAR found that a Near-Term Reliability Need in 2025, based on the updated forecast in the 2023 Gold Book, similarly identified that additional generator deactivations or unavailability beyond what is already planned may worsen deficiency in the transmission security margin.

The base cases for those studies included approximately 2,000 MW of generating units assumed unavailable (some of the peaker units are assumed out of service in the May through October ozone season only). Their removal from the existing system representation is due to the units entering a deactivated state (e.g., retired, mothballed, or in an ICAP-Ineligible Forced Outage (IIFO), or proposed to retire or mothball) or being operationally impacted by the DEC Peaker Rule. However, there are numerous risk factors related to additional generating units becoming unavailable or deactivate, such as, among other things, aging generation units, additional public policies, or economic considerations.

i) Aging Generation

As generators age and experience more frequent and longer duration outages, the costs to maintain the assets increase. These costs may drive aging generation into retirement. A growing amount of New York's gas-turbine and fossil fuel-fired steam-turbine capacity is reaching an age at which, nationally, a vast majority of similar capacity has been deactivated. As shown in **Figure 26**, by 2028 more than 6,500 MW of gas-turbine and steam-turbine based capacity in New York will reach an age beyond which 95% of these types of generators have deactivated.

Figure 27: Cumulative NYCA Nameplate Capacity MW Past the Age When 95% of Similar Units Have Retired



ii) Legislation Affecting NYPA's Combustion Plants

On May 3, 2023, as a part of New York State's annual budget bill, NYPA received authorization to develop renewables and to phase out its existing natural gas plants.[16] NYPA is required to publish a plan by May 2025 to phase out the production of electricity from its seven simple cycle combustion turbine natural gas plants in and around New York City by December 31, 2030 with certain exceptions. For instance, NYPA may continue to operate such plants that are determined to be necessary for electric system reliability, emergency power service, or the proposed replacement of the resource would result in more than a de minimis net increase in emissions within a disadvantaged community. NYPA's plan is required to include recommendations to replace the plants with renewable energy systems, wherever appropriate. The effect of this new legislation and the phasing out of the seven combustion turbines may further impact the transmission security margins in Zone J.

Building upon the assumptions used in the 2023 Quarter 2 STAR, with the NYPA units within New York City removed in December 2030, the New York City transmission security margin is extremely narrow at 3 MW in 2032 with a deficiency of 187 MW in 2033 utilizing the baseline demand. With the higher policy demand forecast, the system is deficient in 2031 by 297 MW with the deficiency worsening to 637 MW by 2033.

[16] *See* 2023 Laws of New York, Ch. 56, Part QQ, § 5.

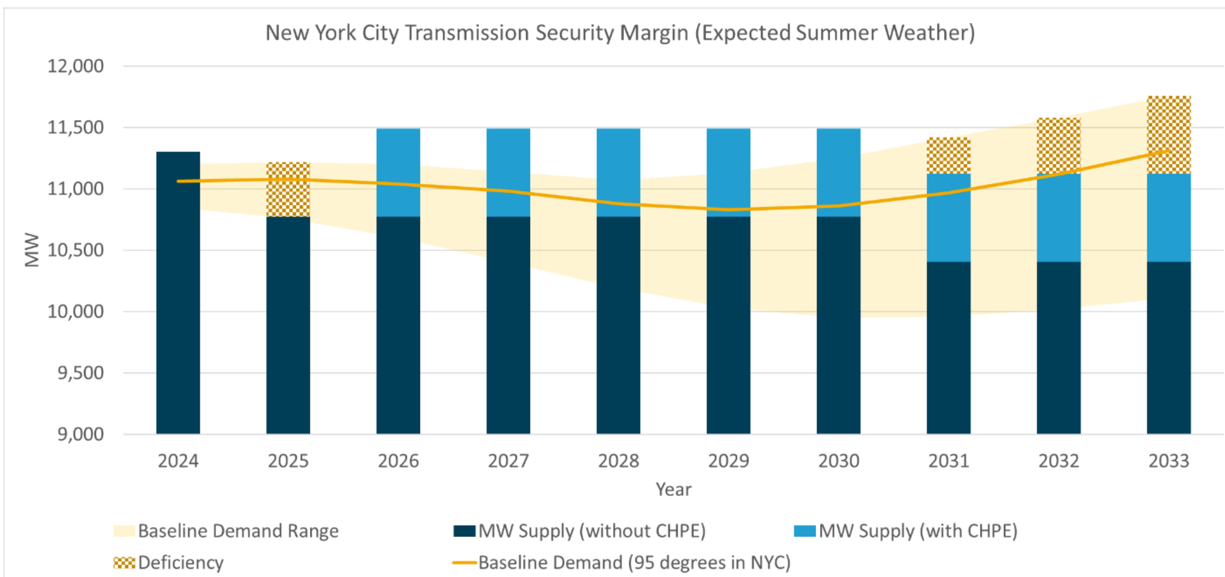
Figure 28: Units Affected by the May 2023 Legislation

Owner/Operator	Station	Zone	Nameplate (MW)	CRIS (MW) (1)		Capability (MW) (1)		Status Change Date (2)
				Summer	Winter	Summer	Winter	
New York Power Authority	Gowanus 5	J	47.0	45.4	45.4	40.0	40.0	12/31/2030
New York Power Authority	Gowanus 6	J	47.0	46.1	46.1	39.9	39.9	12/31/2030
New York Power Authority	Kent	J	47.0	46.9	46.9	45.8	46.0	12/31/2030
New York Power Authority	Pouch	J	47.0	47.1	47.1	45.1	46.0	12/31/2030
New York Power Authority	Hellgate 1	J	47.0	45.0	45.0	39.9	39.9	12/31/2030
New York Power Authority	Hellgate 2	J	47.0	45.0	45.0	40.0	40.0	12/31/2030
New York Power Authority	Harlem River 1	J	47.0	46.0	46.0	39.9	39.9	12/31/2030
New York Power Authority	Harlem River 2	J	47.0	45.2	45.2	40.0	40.0	12/31/2030
New York Power Authority	Vernon Blvd 2	J	47.0	46.2	46.2	40.0	40.0	12/31/2030
New York Power Authority	Vernon Blvd 3	J	47.0	43.8	43.8	39.9	39.9	12/31/2030
New York Power Authority	Brentwood	K	47.0	47.1	47.1	45.5	46.0	12/31/2030

Notes

1. MW values are from the 2023 Load and Capacity Data Report
2. NYPA is required publish a plan within two years to phase-out the production of electricity from its seven simple cycle combustion turbine natural gas plants in and around NYC by December 31, 2030, unless those plants are determined, in consultation with the NYISO (among other parties), to be necessary for electric system reliability, or the proposed replacement of the resource would result in more than a de minimis net increase in emissions within a disadvantaged community, among other stipulations.

Figure 29: Impact of NYPA GTs Affected by May 2023 Legislation



iii) Economic Decisions

Capacity resources could also decide to offer into markets in other regions and, therefore, some of the capability of those resources may not be available to the NYCA.

The impact of the unavailability of system resources can readily be seen through transmission security margin assessments. While transmission security within New York City (Zone J) is maintained beyond 2026 in accordance with design criteria, the margin is deficient in 2025 and would be deficient beginning in 2032 if the higher demand policy is achieved (**Figure 28**).[17] Transmission security within

[17] Additional transmission, resources, or demand reduction within New York City may increase the margin and reduce the likelihood of future reliability needs.

Long Island (Zone K) is also maintained through the ten-year period. If forced outages are experienced at the historical rate the Long Island margin would be sufficient through the study period.

As detailed in the 2023 Quarter 2 STAR, the New York City transmission security margin is deficient in summer 2025 and then again as early as 2032. These findings are based on the assumption that CHPE is in service by summer 2026 and there are no additional generation deactivations or unavailability. If there is a delay in CHPE, the margins in New York City will remain deficient from summer 2025 until CHPE enters service even if there was no change in the MW supply from transmission or additional generator deactivations. As a result, additional deactivations or the unavailability of generation beyond what is already planned increases the risk of further reducing the transmission security margins as studied. Accordingly, the NYISO will continue to monitor imports, exports, generation, and other infrastructure.

Delays in Major Transmission Projects

There are several transmission projects in progress that are being driven by public policies and will increase the system capability to transport power. As part of the NYISO's Public Policy Transmission Planning Process, the PSC identified needs to expand the state's transmission capability to deliver additional power from generating facilities, including important renewable resources, to the population centers statewide. The NYISO is monitoring the progress of the AC Transmission Public Policy Projects under construction, with major components planned to enter service by December 2023. Additionally, the NYISO is closely tracking the status of CHPE and the NYPA/National Grid Northern New York projects. As these transmission projects enter service, the reliability of the New York grid will improve. If the projects are delayed for any reason, the grid's ability to reliably serve customer demand could be jeopardized.

As discussed in the Risk Factors to the Comprehensive Reliability Plan section above, the NYISO noted in both the 2022 RNA and the 2023 Quarter 2 STAR that a delay in the CHPE project entering service in spring 2026 could affect the reliability of the system beyond the findings in those studies. The NYISO is also monitoring a delay to the completion of the AC Segment B project related to a new substation and two phase angle regulators ("PARs") located in Dover, New York. Those facilities are being constructed to address a transfer degradation between the NYISO and ISO New England when the series compensation device is in operation. On June 16, 2023, stakeholders were informed of a delay of the substation and PARs due to a legal challenge to a local permit issued for the project, resulting an injunction against the developer to complete site development.[18] As of the date of this CRP, the NYISO has observed that the current delay to the PARs in the Segment B project will not result in a reliability need, provided the series compensation

[18] New York Transco Presentation, AC Transmission Segment B New York Energy Solution PPTN Project Update (Jun. 16, 2023), *available* here.

device on the new Knickerbocker to Pleasant Valley 345 kV line is not activated.

To be noted that the NYISO Board of Directors selected in June 2023 a project under the Public Policy Transmission Planning Process that was evaluating solutions to a Public Policy Transmission Need with the goal to increase imports and exports from Long Island. This project is not yet modeled as part of the reliability assessments base cases; however, the scenario analysis conducted in the 2022 RNA showed an improvement in the system reliability if the import and export capabilities into Long Island are increased.

The local transmission owner plans (LTPs) are an important part of the overall Comprehensive System Planning Process and this CRP. The proposed LTPs that met certain developmental milestones are included in the reliability plans. Currently, the NYISO is tracking the timely entry into service of three proposed projects in LTPs that will address reliability violations identified in the 2020-2021 cycle of the Reliability Planning Process. The process allowed for subsequent updates, which included three projects in Con Edison, referred to as the TRACE projects to be in-service by 2025. If these projects were delayed, additional reliability issues may arise.

The will NYISO continue to monitor the progress of these major transmission projects and evaluate the impact of delays to them entering service.

Increased Demand, Including Large Loads

New York is projected to become a winter peaking system in future decades due to electrification, primarily via heat pumps and electric vehicles. A higher-than-planned load level could expose the system to potential reliability issues, necessitating interim operating procedures up to and including measures such as load shedding in some localized areas of the state. In conducting a resource adequacy scenario in the 2022 RNA with a high load forecast, approximately 2,800 MW higher than the 2022 Gold Book baseline forecast, the NYISO found that the LOLE would exceed criteria starting in 2030. The 2023 Gold Book forecasted an increase in energy usage during 2023 through 2032 period compared to the 2022 Gold Book, driven largely by large load project growth in the early forecast years, and electrification of space heating, non-weather sensitive appliances, and electric vehicle charging in the outer forecast years. Increases in growth rates relative to the 2022 Gold Book are primarily attributed to increased large load projects and EV charging impacts, including greater coincidence with periods of peak electric demand. Over the course of the forecast horizon, significant load-reducing impacts occur due to energy efficiency initiatives and the growth of distributed behind-the-meter (BTM) energy resources, such as solar PV. These impacts result primarily from New York State's energy policies and programs, including the CLCPA, the 2020 Accelerated Renewable Energy Growth and Community Benefit Act ("AREA"), the Clean Energy Standard ("CES"), the Clean Energy Fund ("CEF"), the NY-SUN initiative, the energy storage initiative, and other PSC programs.

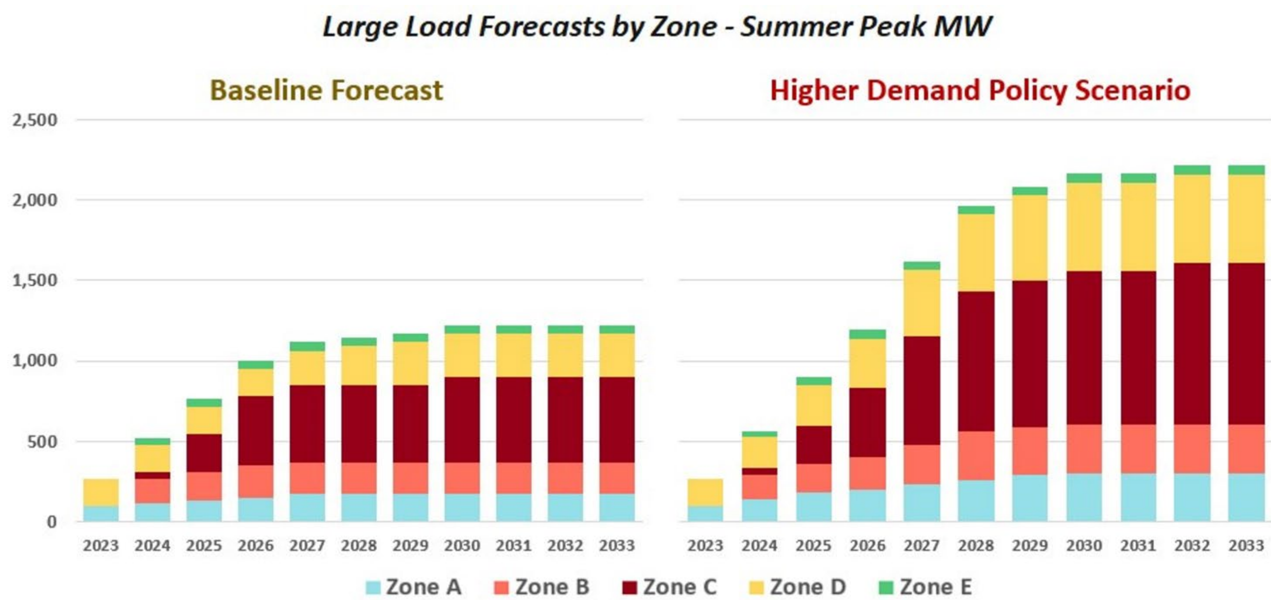
In the past decade, energy provided by the bulk grid has decreased, while energy production from Distributed Energy Resources (DERs), such as solar, has increased. These DERs are beginning to displace energy that was traditionally supplied by conventional generation through the regional electricity grid. The energy provided by many DERs is not continuous, but intermittent, and less visible to the NYISO markets and operations.

Proposed Large Loads

This CRP accounts for several interconnection requests for large load installations in upstate New York, which may exacerbate zonal resource adequacy margins in Zones A, B, C, and D.[19]

Figure 30 below shows the large loads forecasted in the 2023 Gold Book for the baseline and higher demand policy scenario for summer peak.

Figure 30: 2023 Gold Book Large Loads Forecast by Zone (Summer Peak)



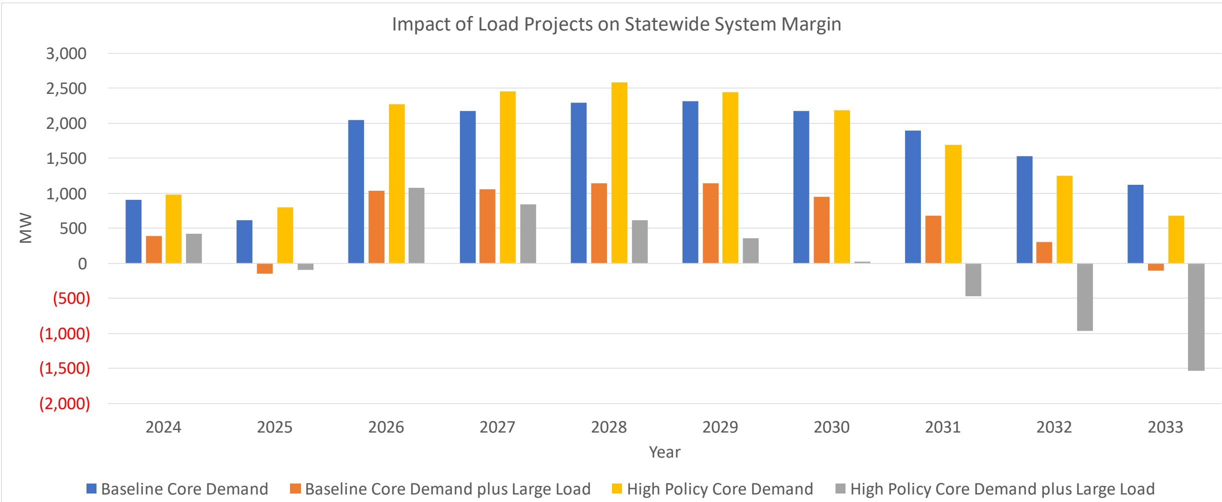
As the baseline core demand[20] forecast grows at a rate greater than the build out of the MW supply from generation and transmission, the available margins projected for the state decrease. The reduction in the available margin is exacerbated with additional load projects along with growth associated with the current customer base. As shown in **Figure 31**, the statewide system margin is deficient in 2025 by 145

[19] Large load requests that have completed the load interconnection process include Q0580 –WNY STAMP, Q0776 – Greenidge Load, Q0849 – Somerset Load (now in service), Q0850 – Cayuga Load, and Q0979 –North Country Data Center. Over 1,000 MW of proposed Large Loads in Zones, A, C, and D are currently undergoing evaluation in the NYISO's interconnection process, including Q1536 White Pine Phase 1 by New York Semiconductor Manufacturing LLC, which is a proposed 480 MW load in Zone C.

[20] Core demand represents existing load and load growth associated with the current customer base.

MW and then again in 2033 by 104 MW with the inclusion of the large loads. With the high policy demand forecast and the inclusion of the large loads, the statewide system margin is deficient in 2031 by 471 MW, which worsens to 1,534 MW by 2034.

Figure 31: Impact of Large Load Projects on Statewide System Margin



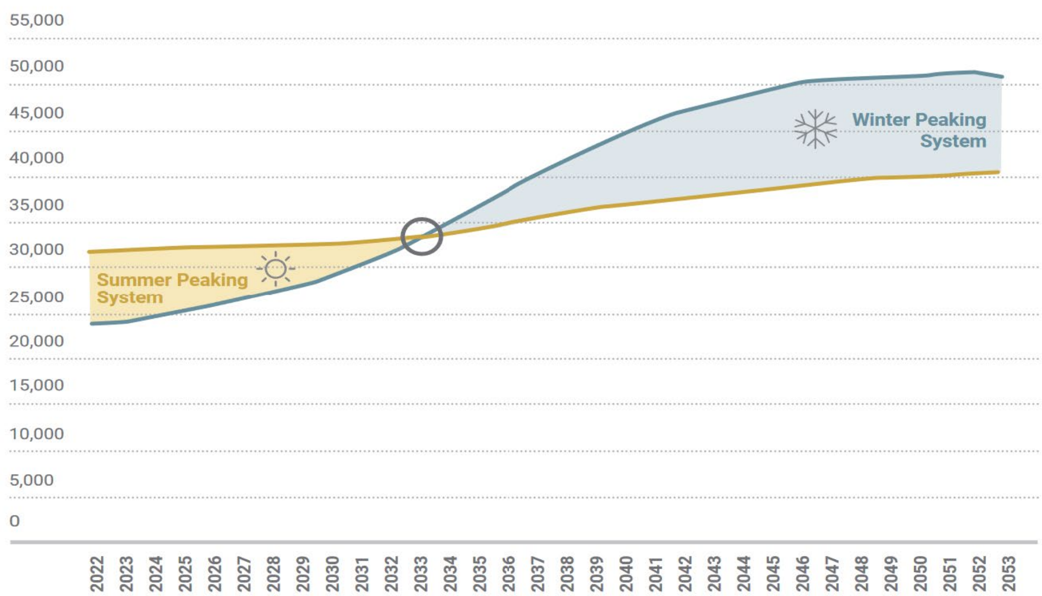
The NYISO will continue to report on energy usage and peak demand trends in its annual Gold Book and assess any reliability impacts through its load interconnection process, quarterly STAR studies, and the 2024 Reliability Needs Assessment.

Winter Peaking and Gas Shortage Risks

Electrification of the transportation and building sectors will drive winter peak demand higher in the future and could result in risks to maintaining reliability. In fact, only 10% of New York's homes rely on electricity for heat today. To meet state policy targets, that level would need to grow to 90% by 2050 with electric heat pumps considered the leading technology to convert fossil-fuel-based furnaces and boilers. As heat pump technology proliferates, peak demand on New York's grid is expected to shift from summer to winter.

The composition of winter peak loads over the next decade is expected to change significantly as the saturation of electric vehicles and heating electrification technologies (such as heat pumps) increase. To prepare for it, it is envisioned that the winter load forecast uncertainty will be captured by implementing the concept of dynamic winter uncertainty multipliers, reflecting the increasing share and load behavior of EV charging load, heating electrification, and large load projects. Large load projects have generally constant load levels regardless of the temperature level. However, EV charging load is higher on colder days due to reduced battery efficiency and reduced EV range in cold temperatures. On a cold winter peak day, electric heating impacts are significantly higher than on a typical winter peak day. The dynamic winter uncertainty increases over the study horizon, reflecting the increasing winter weather sensitivity due to additional EV charging and electric heating load.

Figure 32: Summer and Winter Peak Demand Forecasts (MW)



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 State are provided in the 2023 Gold Book.

The study conditions for evaluating the impact of the loss of gas fuel supply 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."[21] 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

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

weather events.[22] Locally, the NYSRC has established goals to identify actions to preserve NYCA reliability for extreme weather events and other extreme system conditions.[23] 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.[24]

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.[25] 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.[26] The NYISO 2023 project, Enhancing Fuel and Energy Security, has been established to refresh the assumptions from the 2019 fuel and energy security report to assess emerging operational and grid reliability concerns.[27] The study evaluates the supply/demand balance for three future winters—2023/2024, 2026/2027 and 2030/2031—under conditions that include a seventeen-day period of extended cold weather, including an extreme cold snap during three of those days.

Preliminary results of the 2023 fuel and energy security study demonstrate that NYISO will need to rely significantly on dual-fuel generation resources to support winter system reliability into the next decade and changes to the resource mix may complicate system operations during multi-day cold snap conditions. The frequency and severity of projected potential loss of load events grow over the modeling time horizon as the generation mix evolves and the demand for electricity increases. In 2023/2024 fuel supply disruptions are the most prominent concern. In the 2026/2027 winter, lulls in intermittent resource generation resources, particularly offshore wind, also become prominent. Finally, in 2030/2031, the results portend a growing frequency in operational challenges and loss of load events across all assumed disruptions. It remains clear that, the availability of oil and gas remains critical during these modeling periods. The addition of a significant quantity of offshore wind reveals the importance of being prepared for wind lulls during extreme cold weather. In Winter 2030/2031, potential loss of load events are driven by limited transfers from upstate to Zone J, greater reliance on offshore wind (and thus greater

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[22] NYISO comments to RM22-10-000 are available here.

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

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

[25] 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.

[26] 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.

[27] Additional details on the 2023 Enhancing Fuel and Energy Security project are available here. Preliminary study results were presented to stakeholders at the August 8, 2023 ICAPWG/MIWG/PRLWG meeting, which are available here.

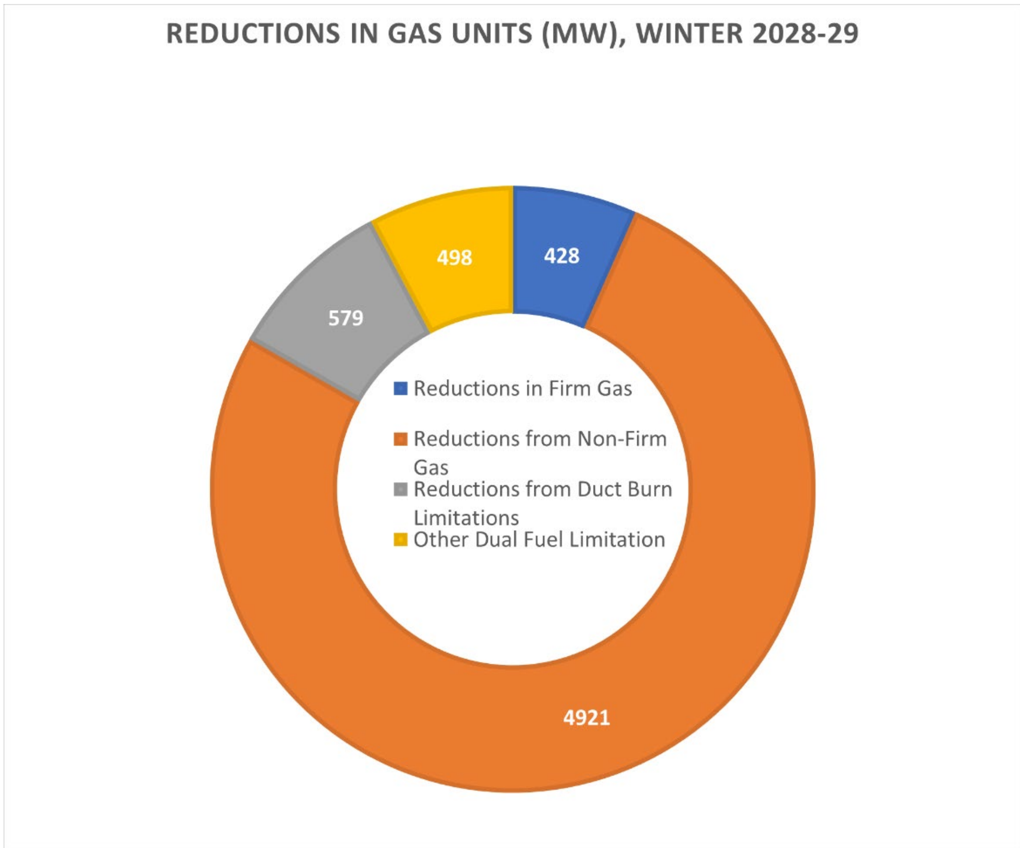
vulnerability to and impact of wind lulls), significant projected electricity demand growth, and limited excess renewable supply to charge battery energy storage systems. The modelling results show the importance of New York's existing gas/oil electric generation resources, and in particular, the importance of ensuring that generation resources have sufficient oil storage during a multi-day cold weather period. In addition, the modelling results show how an increasing reliance on intermittent resources must be carefully assessed as multi-day lulls in offshore wind production call for specific planning and preparation. Finally, with the potential for growing electricity demand in the state, in part due to electrification of the vehicle and building sectors, there will be increased importance in planning to reduce the risk of potential disruptions in fuel and energy supply.

For the transmission security margin evaluations, only the impacts of the peak demand hour are evaluated. For the system condition of a shortage of gas fuel in this report, 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 33 shows a breakdown of the reduction in gas units from units with non-firm gas, units with reductions in firm gas (the amount of firm gas does not equal the stated winter capability for this unit), reductions from duct burn limitations, and other dual-fuel unit limitations. This results in a little more than 6,400 MW of winter generation capability. This value is consistent with the 2022-23 Winter Assessment & Winter Preparedness review, which included an extreme scenario showing the impact of a reduction of 6,484 MW for gas units and duct burn capabilities.[28]

[28] The 2022-23 Winter Assessment & Winter Preparedness review was presented to stakeholders at the November 17, 2022 Operating Committee meeting and is available here. The winter capacity assessment extreme scenarios on slide 8 shows a gas and duct burner reduction of -8,968 MW with an add back of units with firm gas contracts of 2,484 MW. This results in a total gas reduction of -6,484 MW.

Figure 33: NYCA Reductions in Gas Units



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."[29] 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 weather events.[30] Locally, the NYSRC has established goals to identify actions to preserve NYCA reliability

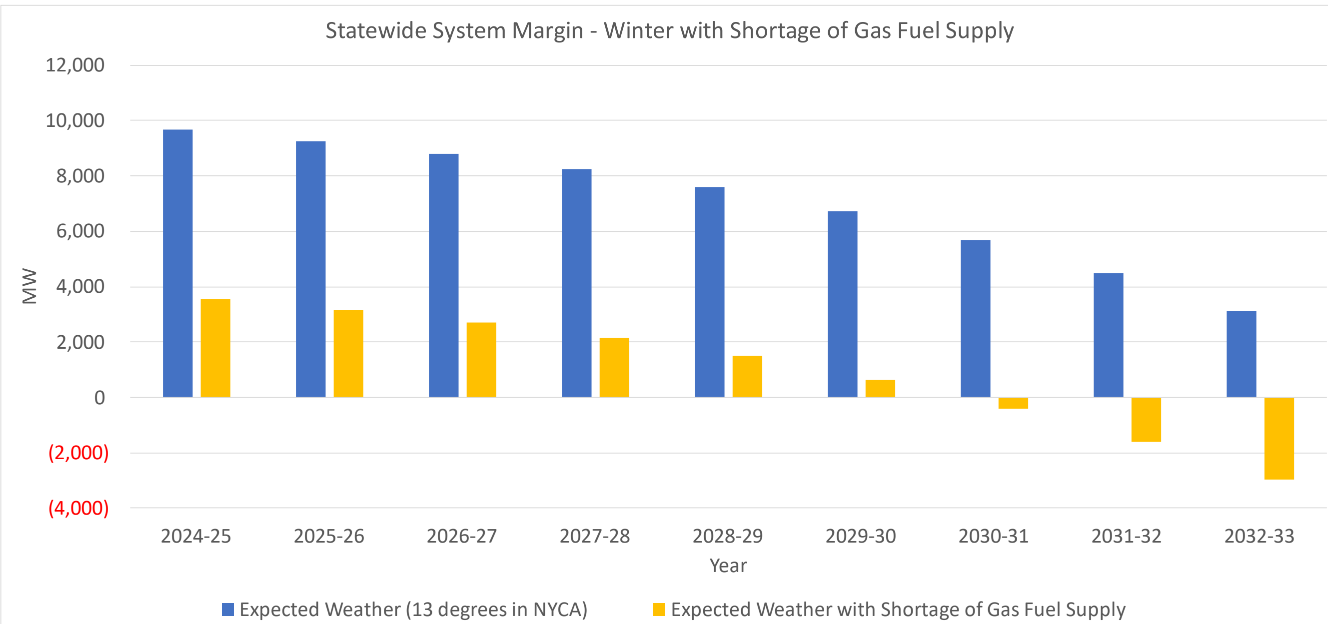
[29] Transmission System Planning Performance Requirements for Extreme Weather, *Notice of Proposed Rulemaking,* Docket No. RM22-10-000 (June 16, 2022).

[30] NYISO comments to RM22-10-000 are available here.

for extreme weather events and other extreme system conditions.[31]

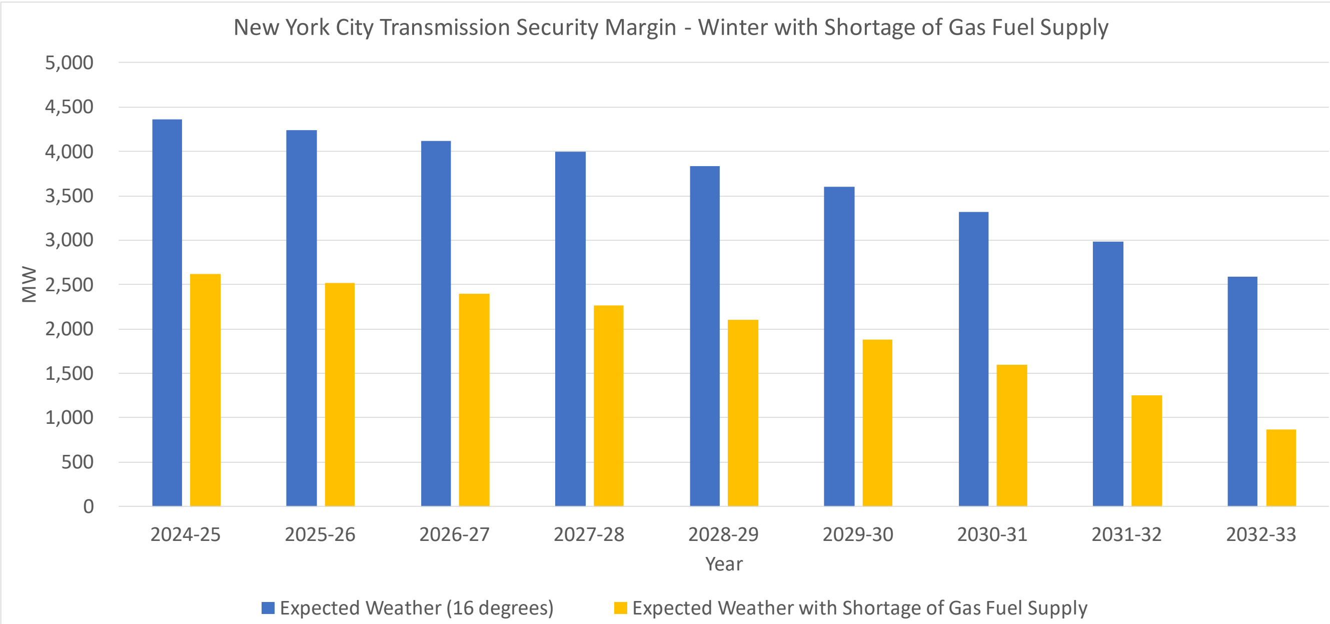
Under the extreme system condition of a gas fuel shortage under baseline expected winter weather the statewide system margin is deficient by winter 2030-31 by 405 MW. In part, this is driven by the large load forecast (589 MW for 2031-32 winter peak). Overall, the observed deficiency worsens to 2,965 MW in winter 2032-33 which would still be observed regardless of the large load forecast. **Figure 34** 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 an extreme cold snap. The Lower Hudson valley and Long Island localities show sufficient margins for all conditions throughout the study period.

Figure 34: Winter Weather Statewide System Margins



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

Figure 35: Winter Weather New York City Transmission Security Margins



Additionally, the 2022 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.

Emergency Assistance from Neighboring Regions

The 2022 RNA included information related with the impact on the results of emergency assistance from external areas. As shown in the

Figure 36 at step 7, the New York loss of load expectation (LOLE) before the external areas support exceeded the 0.1 event-days/year criterion: this demonstrates that without emergency assistance from neighboring regions, there would not be sufficient resources to serve demand within New York. There are several modeling methods currently employed to limit New York's reliance on external areas, such as: neighboring areas are set to be at a high LOLE between a 0.1 - 0.15 event-days/year range, the top three summer peak load days of the external areas are modeled as coincident with the NYCA top three peak load days; the emergency operating procedures steps from external areas are removed; the load forecast uncertainty multiplier is applied to neighboring systems; and the same historical load years are used for external areas and NY capturing coincidence in shapes. Additionally, the NYISO applies a statewide limitation of 3,500 MW on emergency assistance. A sensitivity was performed in the 2022 RNA to identify at what limit of emergency assistance would result in a resource deficiency in 2032. When the emergency assistance statewide limit is reduced from 3,500 MW to 1,200 MW, the NYCA LOLE changed from 0.02 days/year to 0.1 days/year (at criterion).

Additional efforts to evaluate how to further limit reliance on external areas are in progress with the NYSRC.

Figure 36: 2022 RNA 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**

Note:

- **The results in bold font** (Step 9) represent the NYCA LOLE that is compared against the 0.1 event-days/year criterion.

Extreme Weather

The dangers of severe weather impacting the grid have been exemplified around the country in the past year, with Texas experiencing a brutal polar vortex in February and California facing problems from extreme heat last summer. New York is not immune from such extreme weather, which could lead to greater electrical demand and more forced generator outages than currently accounted for in the baseline forecasts. Prior to each summer and winter, the NYISO presents a capacity assessment to gauge the margins available for the upcoming season in consideration of such plausible system conditions.[32]

In consideration of these risk factors, the New York grid may be deficient in future years such that the transmission system could not fully serve the demand. **Figure 37** shows the transmission security margin in New York City for an expected summer peak conditions along with 1-in-10-year heatwave (90/10) and 1-in-100-year extreme heatwave scenarios. The baseline analysis of normal weather and limited generation outages shows a positive but narrowing transmission security margin across the ten-year period. As shown in **Figure 37**, the New York City transmission security margin is deficient by 555 MW under a

[32] Summer 2023 Capacity Assessment, April Operating Committee Meeting (here)

heatwave. When CHPE is planned to come into service in 2026, the margin improves and is sufficient through 2032. Under an extreme heatwave, the margin is deficient for all years with the largest deficiency observed in 2025 at 1,060 MW. This projection could improve as more resources and transmission are added to New York City. Similarly, these risk factors result in the narrowing of the transmission security margin in Long Island and deficient margins statewide, as shown in **Figure 38** and **Figure 39**. Under winter cold snaps or extreme cold snaps, the observed statewide system margins are sufficient. However, if these are paired with a shortage of gas fuel supply, the system may be as deficient as early as winter 2027-28 with a deficiency of 338 MW in winter 2027-28 (*see* **Figure 40**). Within the Lower Hudson Valley and Long Island localities, the transmission security margins are sufficient under a cold snap or extreme cold snap even with a shortage of gas fuel supply. The New York City winter transmission security margin under a cold snap is sufficient for all years; however, an extreme cold snap would result in a deficiency of 88 MW in winter 2032-33.

Figure 37: New York City Summer Transmission Security Margin with Extreme Weather

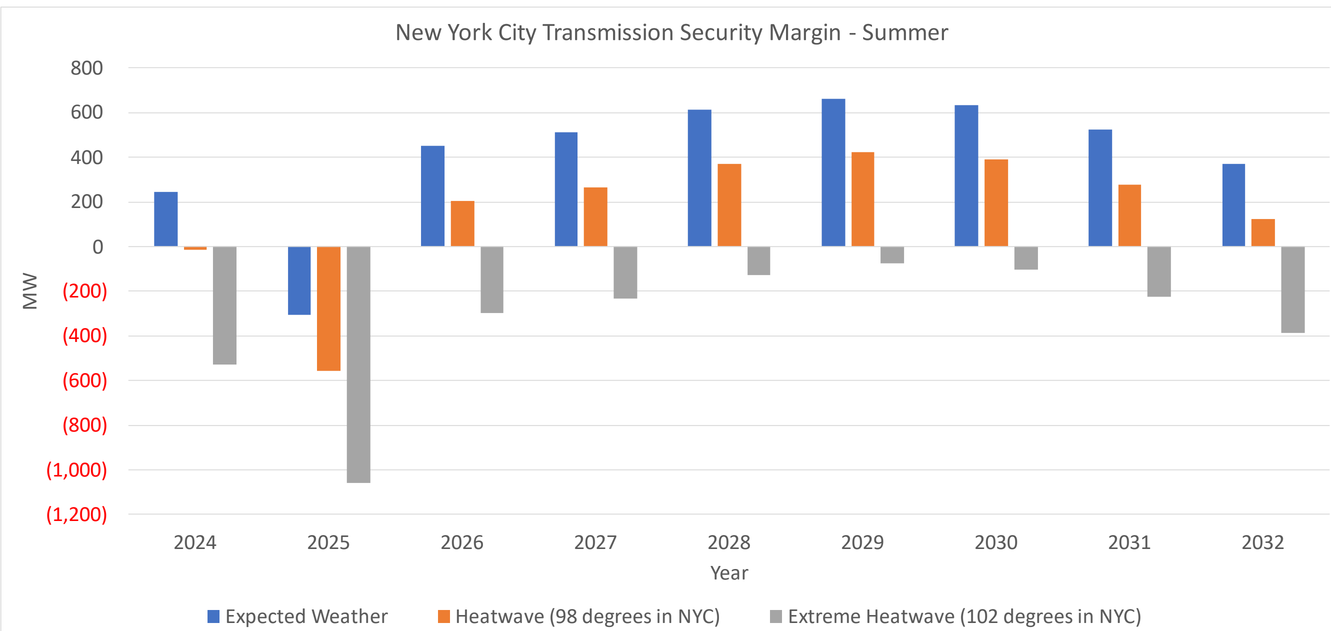


Figure 38: Long Island Summer Transmission Security Margin with Extreme Weather

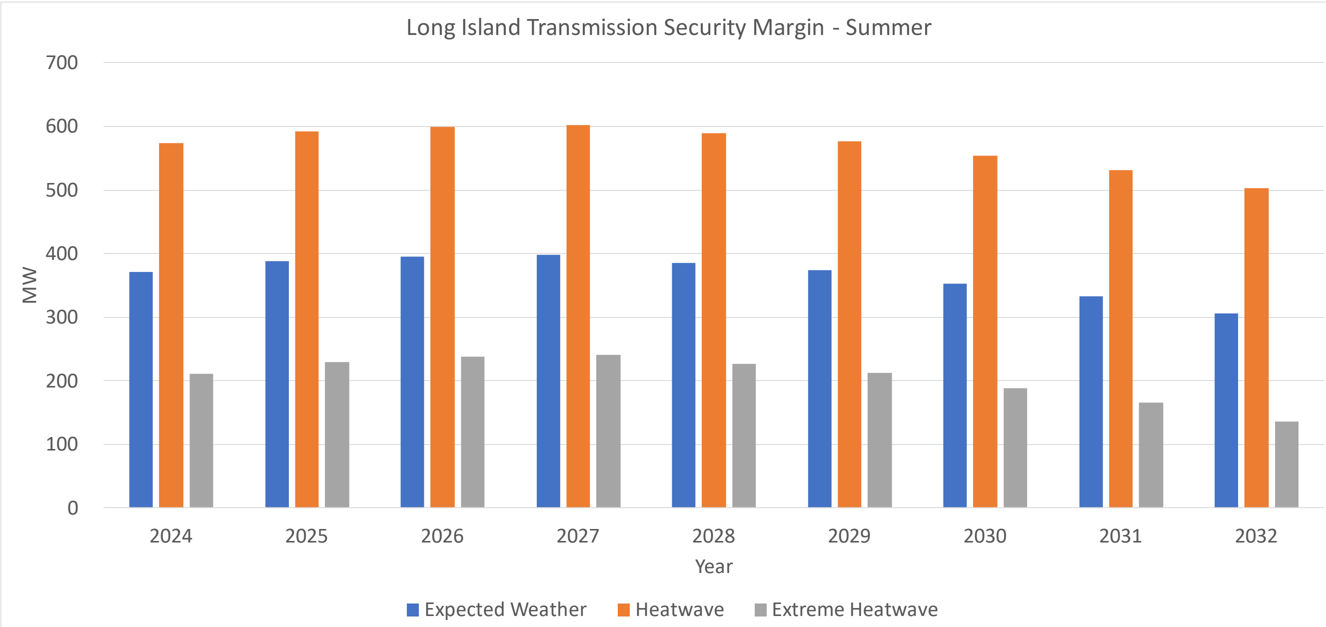


Figure 39: Statewide System Summer Margin with Extreme Weather

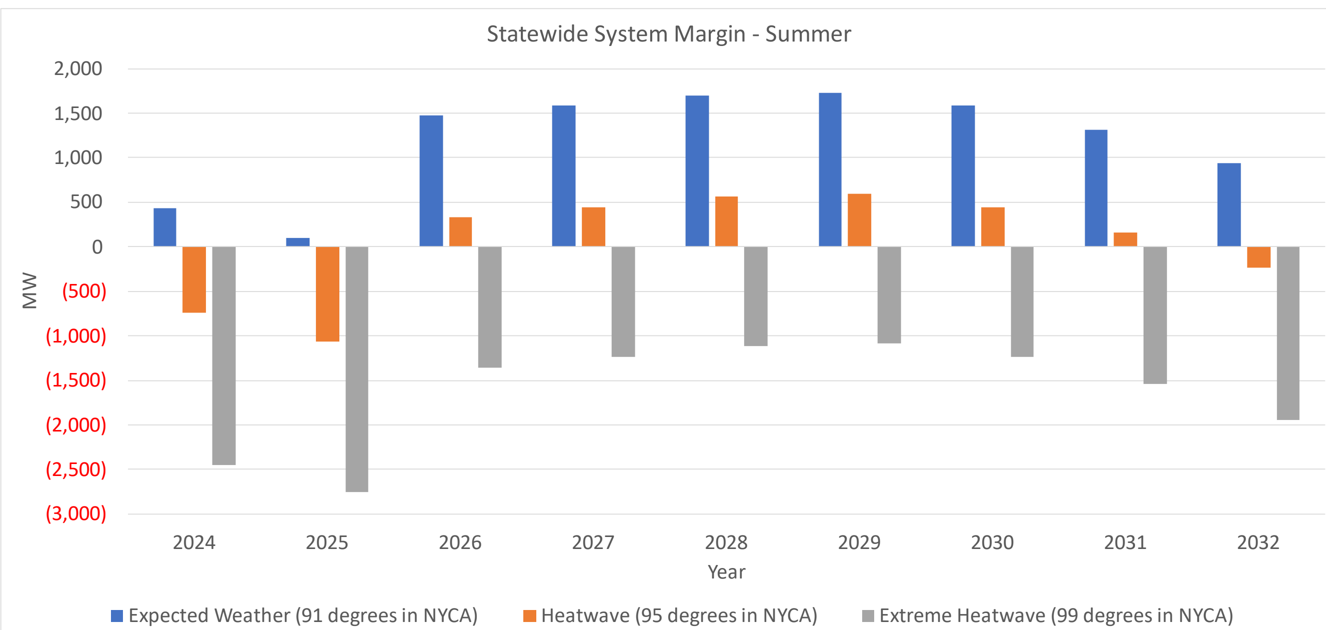
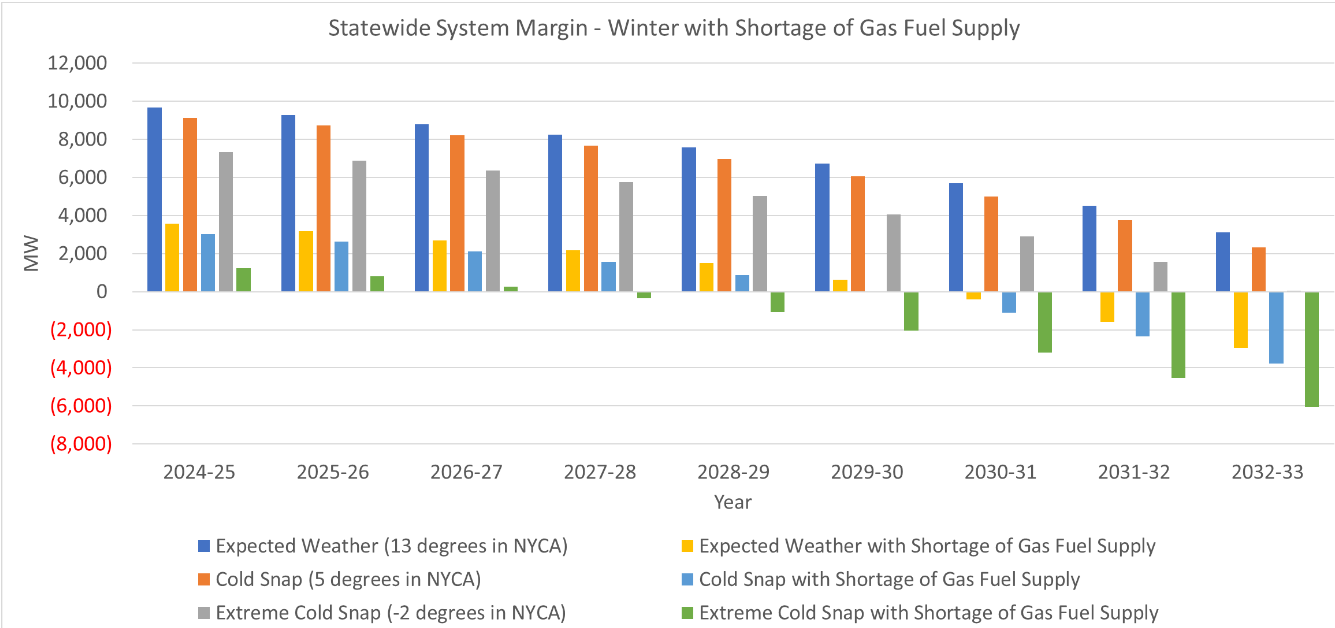


Figure 40: Statewide System Winter Margin with Extreme Weather and Gas Fuel Shortage



The NYISO has been working with the NYSRC under their Extreme Weather Working Group initiative to identify if anything else should be captured to further account for extreme weather conditions.

Beyond the CRP – Road to 2040

There have been several significant developments that are shaping how the New York electric grid of the future will develop. Part of the developments are climate related, which will drive temperatures higher and result in higher electricity demand. Other parts are due to state policies in response to climate change. The CLCPA requires an economy-wide approach to addressing climate change and decarbonization.[33] This includes sweeping mandates that 70% of New York electricity consumed shall be produced from renewable resources by 2030 and 100% emissions-free electricity supply by 2040 while promoting electrification in other sectors of the economy. Understanding the impacts due to these two driving developments on the generation, transmission, and load components of the bulk electric system is critical to comprehending and defining the challenges in the coming year.

As part of the 2021-2040 System & Resource Outlook,[34] the NYISO assessed several policy-driven futures to identify potential resource mixes and examine resulting system constraints and operational limitations. The Outlook identified the following key findings:

- Significant new resource development will be required to achieve CLCPA energy targets. The total installed generation capacity to meet policy objectives within New York is projected to range between 111 GW and 124 GW by 2040. At least 95 GW of this capacity will consist of new generation projects and/or modifications to existing plants. Even with these additions, New York still may not be able to fully meet CLCPA compliance criteria and maintain the reliable electricity supply on which New York consumers rely. The sheer scale of resources needed to satisfy system reliability and policy requirements within the next 20 years is unprecedented.
- To achieve an emission-free grid, dispatchable emission-free resources (DEFRs) must be developed and deployed throughout New York. DEFRs that provide sustained on-demand power and system stability will be essential to meeting policy objectives while maintaining a reliable electric grid. While essential to the grid of the future, such DEFR technologies are not commercially viable today. DEFRs will require committed public and private investment in research and development efforts to identify the most efficient and cost-effective technologies with a view towards the development and eventual adoption of commercially viable resources. The development and construction lead times necessary for these technologies may extend beyond policy target dates.

[33] 2019 Laws of New York, ch. 106. The CLCPA requires that seventy percent of energy consumed in New York State be produced by renewable resources by 2030. By 2040, energy consumed must be completely emissions free.

[34] 2021-2040 Outlook Report, published September 2022, which is available at: https://www.nyiso.com/documents/20142/33384099/2021-2040-Outlook-Report.pdf.

- As the energy policies in neighboring regions evolve, New York's imports and exports of energy could vary significantly due to the resulting changes in neighboring grids. New York is fortunate to have strong interconnections with neighboring regions and has enjoyed reliability and economic benefits from such connections. The availability of energy for interchange is predicted to shift fundamentally as policy achievement progresses. Balancing the need to serve demand reliably while achieving New York's emission-free target will require continuous monitoring and collaboration with our neighboring states.

As resources shift from fossil generators to zero emission resources, essential grid services, such as operating reserves, ramping, regulation, voltage support, and black start, must be available to provide New Yorkers with reliable and predictable electric system that consumers require. This means that new resources will need to provide these services before existing resources with these services can exit.

Transmission expansion is also critical to facilitating efficient CLCPA energy target achievement. The current New York transmission system, at both local and bulk levels, is inadequate to achieve currently required policy objectives.

Demand will likely increase, particularly due to electrification in transportation and building heating/cooling. The decarbonization efforts in electric power generation could require fuel conversion from fossil fuel to green hydrogen, which would further increase the demand.

Leveraging these directional observations, the NYISO identified the following factors that could have significant impacts on maintaining reliability, and discusses them in this section:

- Increasing demands and evolving load patterns
- Heavy reliance on intermittent resources, ESR and DER
- System-wide integration of inverter-based resources
- DEFR technology identification and commercialization
- Transmission expansion

Demand: Electrification and Extreme Weather

The power system is undergoing unprecedented changes that exponentially compound the complexity of what it takes to keep the lights on every second of the day. These changes are mainly driven by decarbonization efforts and public policies that affect all sectors. As described in the CLCPA Scoping Plan, New York State will need to achieve a zero-emission electricity system to achieve deep emission reductions in the building and transportation sectors as those sectors become less dependent on fossil fuels. While t overall electric load levels will increase, the size of the increase will be moderated by, for example, more energy-efficient technologies (e.g., cold-climate heat pumps) and additional opportunities for demand management (e.g., electric vehicles (EV)).

Electrification

The CLCPA Scoping Plan[35] projects that by 2030 nearly all new light-duty vehicle sales and almost half of new medium- and heavy-duty vehicle sales will be zero-emission and a substantial portion of personal transportation in urbanized areas will shift to public transportation. By 2050, nearly all vehicles in New York State will have zero tailpipe emissions, and New Yorkers will have substantially greater access to low-carbon modes of transportation, including public transportation. These shifts will significantly increase the demand. At the same time, however, resource decarbonization policies are currently outpacing the installation of new emission-free resources. This leads to significant decreases in system resource margins. Additionally, system planning, coordination, and operation is becoming more complex with the penetration of distributed generation, behind-the-meter solar, and demand side management.

In addition to expanding electric vehicle adoption, public policies also focus efforts on electrifying building heating and cooking appliances. This shift is expected to grow electric demand in winter, eventually making the cold-weather months the highest-demand period of the year. The NYISO is already working to understand how these new technologies will perform and what other system changes may be needed to accommodate the higher demand and changing usage patterns. The 2023 Gold Book baseline energy and coincident peak demand forecasts, which are used in the reliability planning processes to determine actionable reliability needs, already reflect significant increases throughout the forecast period, driven largely by large load project growth in the early forecast years and electrification of space heating and non-weather sensitive appliances and electric vehicle charging in the outer forecast years.

With increased electric demand compounded by the retirement of existing fossil-fuel units, additional resources having a diversity of attributes, as well as transmission will be needed.

Extreme Weather

As the grid moves towards zero-emissions, it is critical to understand how extreme weather events will impact the ability to maintain reliability of the New York electric system. These events can occur in both summer and winter periods and include extended heat waves and cold snaps, with impacts on the availability of fossil and renewable resources and peak demands. The NYISO currently develops and distributes 90/10 and 99/1 forecasts as one metric of extreme weather impacts in its annual Gold Book. It

[35] NY State Scoping Plan, which is available at: https://climate.ny.gov/resources/scoping-plan/.

is also engaged in efforts to collect historic data on solar, terrestrial and offshore winds to assess output patterns for these intermittent resources and estimate potential correlations in derates to better calibrate the reliability models.

The NYISO is part of several efforts to identify extreme weather concerns in order to adapt its planning and operations processes:

- NYSRC has established goals for 2023 and beyond 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, as well as to allow for planning for sudden loss of fuel (*e.g.,* wind, gas) and designing the system for the peak load conditions from extreme weather such as heat waves (*e.g.,* 90/10 forecast)
    - The NYISO is exploring ways to study winter peak load periods including and cold snaps and gas shortage conditions in the resource adequacy models used for both planning and capacity markets evaluations, and how to account for growing forecast uncertainty in the future years due to electrification.
- NPCC, as part of their corporate goals, are engaged in a multi-year effort to address energy sufficiency risks, including those stemming from intermittent resources and extreme weather conditions. NPCC staff, along with the NPCC Areas (including New York), have participated in the EPRI's Resource Adequacy for a Decarbonized Future Project, the U.S. Department of Energy (DOE) Atlantic Offshore Wind Study, and other industry efforts. The industry efforts include, but are not limited to, the Energy Reliability Assessment Working Group and the Energy Systems Integration Group (ESIG) Redefining Resource Adequacy Task Force, as well as a review of various published documents from around industry.
- On June 23, 2023, FERC issued a final rule (order #896) directing NERC, the Commission-certified Electric Reliability Organization, to develop a new Reliability Standard or modifications to Reliability Standard TPL–001–5.1 no later than 18 months of the date of publication of the final rule in the Federal Register to address reliability concerns pertaining to transmission system planning for extreme heat and cold weather events that impact the Reliable Operation of the Bulk Power System. Specifically, FERC directs NERC to develop a new or modified Reliability Standard that requires the following:
    - Development of benchmark planning cases based on prior extreme heat and cold

weather events and/or future meteorological projections;

- Planning for extreme heat and cold events using steady state and transient stability analyses that cover a range of extreme weather scenarios, including the expected resource mix's availability during extreme weather conditions and the broad area impacts of extreme weather; and
- Corrective action plans that include mitigation activities for specified instances where performance requirements during extreme heat and cold events are not met.

Hydrogen Production

The baseline forecast does not include any potential future load increases from low carbon fuel production (*e.g.,* hydrogen production via electrolysis). The potential load growth from hydrogen production in future decades could be significant. For example, the Climate Action Council Integration Analysis scenarios[36] assume that large-scale hydrogen production may be needed in order to meet state decarbonization goals, specifically to address hard to electrify end uses. This potential load growth from electrolysis is included in the higher demand policy scenario forecast, slightly discounted to reflect 100% light duty electric vehicles (EV) sales saturation with no zero-emission vehicle (ZEV) alternatives. The lower demand policy forecast only includes sufficient electrolysis needed to produce hydrogen for non-EV zero emission vehicles (100% ZEV sales beginning in 2035). Electrolysis production is expected to be non-coincident with system peak electricity demand.

The baseline and policy forecasts also generally do not include conversion of the Con Edison district steam system to electricity. Potential impacts on annual energy and seasonal peak demand due to the partial or full electrification of steam generation or steam customers' buildings could be significant. The NYISO continues to monitor prospective changes.[37] The summer peak forecast assumes limited increase in air conditioning demand (switching from the steam system).

Generation: Complete Shift in Technology

The retirement of fossil fueled resources driven by public polices is currently outpacing the development of new renewable energy and other dispatchable, emissions-free resources. As detailed in

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[36] Climate Act Resources: *https://climate.ny.gov/Resources/Scoping-Plan*. Integration Analysis Scenario 2 assumes over 40,000 GWh of annual electricity usage in 2050 for in-state hydrogen production.

[37] Any near-term impacts due to steam generation electrification or decarbonization demonstration projects are expected to be small, with no anticipated impacts over the next few years. The current winter peak electric forecast assumes no conversion of steam buildings to electric heat. No electrification of steam system boilers or installation of large industrial heat pumps are included in this forecast.

this CRP and the 2023 Q2 STAR, the reliability margins have thinned to concerning levels, highlighting the need for a carefully coordinated and orderly transition to maintain grid reliability and resilience. Additionally, the change in generation technology to principally clean energy resources results in a shift from synchronous machines to inverter-based technology and results in inherently intermittent resources that are highly dependent on weather.

Inverter-Based Technology

Wind, solar, and storage resources are connected to the grid asynchronously through power electronics and are also referred to as inverter-based resources (IBRs). Unlike conventional generators, a number of these technologies, particularly solar and storage resources, are deployed at the distribution level. The operational characteristics and reliability attributes of IBRs are different than conventional synchronous generation. For instance, the performance of these assets during fault conditions is not as robust as that of the current fleet of synchronous generators, which includes hydro, nuclear, and fossil-fueled resources.

The ability of IBRs to function properly often depends on the strength of the grid at or near the interconnection of the resources, and the stability of the grid could weaken as conventional synchronous generation retires. Grid strength is a commonly used term to describe how the system responds to system changes (e.g., changes in load and equipment switching). In a "strong" system, the voltage and frequency are relatively insensitive to changes in current injection from the IBR. IBRs connecting to a portion of the system rich in synchronous generation that is electrically close or relatively large are likely connecting to a strong portion of the system. IBRs connected to a "weak" portion of the grid may be subject to instability, adverse control interactions, and other issues. Through assessments of short-circuit ratios and voltage flicker described in this report, the NYISO has identified weak portions throughout the New York grid that are likely to experience system performance issues without mitigation measures, such as the implementation of control systems, grid-forming inverters, and synchronous compensators.

NERC has identified the rapid interconnection of IBRs as the most significant driver of grid transformation, and one that poses a high risk to reliability.[38] A total of 13 major events[39] have been reported by NERC where IBRs have demonstrated common mode failures by tripping out of service unexpectedly in response to normally cleared faults. Since a number of these resources connect at the distribution level, they do not meet the facility size or connection voltage thresholds that require them to

[38] NERC Inverter-Based Resource Strategy, Ensuring Reliability of the Bulk Power System with Increased levels of BPS-Connected IBRs, June 2022, which is available here.

[39] NERC major event analysis reports can be found on NERC's website here.

register with NERC and, therefore, may not be explicitly represented in engineering studies. NERC also highlights the observed modeling gaps related to model accuracy and study gaps where the causes for tripping could only be identified in electromagnetic transient (EMT) simulations instead of the positive sequence dynamics simulations.

NERC developed an IBR strategy document that outlines the core tenants of their risk mitigation strategy to ensure reliable operation with the anticipated influx of IBRs.[40] The NERC IBR risk mitigation strategy includes risk analysis, interconnection process improvements, best practices and education, and regulatory enhancements. NERC has also recommended activities such as the development of a post-commissioning performance validation standard. At the federal level, FERC issued a Notice of Proposed Rule Making (NOPR) in November 2022 to direct NERC to develop new or modified reliability standards that address reliability gaps related to IBRs.[41]

Separately, to address these risks, the NYISO in 20222 engaged GE Energy Consulting to develop a strategic roadmap[42] which outlines transmission security reliability risks and recommendations to plan for increasing penetrations of IBRs in the New York grid and shared the findings with the Reliability Council. The three key areas of risk that were highlighted include: (1) areas where the grid is weak, (2) small signal stability, and (3) frequency stability. Without significant mitigation measures, a shift to IBRs may result in flickering lights and disruptions to industrial processes and consumer electronics.

NYSRC also has proposed a reliability rule (PRR-151) to establish minimum interconnection standards for large inverter-based resource generating facilities based on IEEE 2800-2022.[43] This IEEE standard establishes uniform technical minimum requirements for the interconnection, capability, and lifetime performance of IBRs.[44]

In addition to operational risks, NERC has highlighted the potential threat of multiple facilities suffering from a common mode of failure due to an Original Equipment Manufacturer (OEM) compromise. Such an event may occur in instances where non-BES generators use similar OEMs across many assets and lack mitigating cyber security controls. This vulnerability is exacerbated particularly for facilities that allow remote vendor access. In essence, a supply chain compromise could affect a significant number of

[40] NERC Inverter-Based Resource Strategy, Ensuring Reliability of the Bulk Power System with Increased Levels of BPS-Connected IBRs, June 2022, which available here.

[41] Reliability Standards to Address Inverter-Based Resources, Docket No. EM22-12-000 (November 17, 2022), which is available here.

[42] GE Energy Consulting, NYISO IBR Roadmap Project, November 2022 (here).

[43] PRR-151 is posted on the NYSRC website (here)

[44] https://standards.ieee.org/ieee/2800/10453/

generation facilities if the OEM vendor is compromised and a bad actor maliciously leverages authorized remote access. As the first step towards mitigating measure, the approach is to identify OEM similarities across assets and owners that could pose significant BES reliability risks if compromised.

Intermittent Resources: Limited Availability and Dispatchability

Most renewable generation is intermittent, and intermittent resources are not fully dispatchable due to the variability of their "fuel" source. Typically, these resources operate at the maximum output that is feasible given the availability of fuel and are dispatched down during instances of transmission system congestion. To maximize efficiencies, the location of these resources is dictated by where the wind is most constant for wind resources or by where there is sufficient land and high irradiance for solar resources. This results in land-based wind locating in northern and western New York and solar resources locating upstate as well. Offshore wind would connect primarily into New York City and Long Island. The siting of these resources is also influenced by transmission availability.

The variability of meteorological conditions that govern the output from wind and solar resources presents a fundamental challenge to relying solely on those resources to meet electricity demand. Solar resources will have little to no output during the evening and nighttime hours and reduced output due to cloud cover, while wind resources can experience significant and sustained wind lulls. Periods of reduced renewable output will occur for short durations due to cloud cover or changes in wind speed and for prolonged periods across a daily/seasonal cycle. Additionally, weather patterns can impact resources across a broad geographical footprint, limiting the output of resources not just in New York but also in neighboring control areas. The coincidence of these conditions may result in an increased need for sufficient dispatchable and non-energy limited resources to address all conditions and to provide continued reliability.

Dispatchable Emission-Free Resources ("DEFRs"): Attributes for Reliability

The New York power grid is reliant on several electrical attributes to maintain a reliable power grid. One key attribute that is critical to reliability is the ability to balance generation with fluctuating demand. Historically, the majority of the energy and capacity within New York has been provided by dispatchable generating resources with very little provided by intermittent generation resources (*see* **Figure 5**). As such, the New York generating fleet has been collectively able to respond to dispatch signals, run for long periods of time, and use multiple fuel sources. However, wind and solar resources have an intermittent fuel that is dependent on the weather. This may result in these resources not being available to produce energy when needed or for the length of time that it is needed. In addition, the weather conditions that impact these resources may persist over a broad area resulting in reduced output across the fleet as compared to just individual generators.

To address these concerns, a new class of resources, are required to ensure reliability with a larger share of intermittent resources connecting to the grid. DEFRs are a classification of emission-free resources that provide the reliability attributes of synchronous generation and can be dispatched to provide both energy and capacity over long durations, especially when the output of intermittent resources is insufficient to meet demand. This can occur during prolonged wind lulls that impact wind output or extended periods of cloud cover that will reduce solar generation. During these events, continuous operation of DEFRs will be required to compensate for the energy lost from intermittent sources. This capability will become more important as New York integrates larger amounts of solar and wind resources and decommissions fossil-based generation consistent with the CLCPA.

IBRs, such as wind and solar, do not provide the same reliability attributes as synchronous generators that are being decommissioned. To maintain reliability, DEFRs in aggregate must also provide the reliability attributes of the retiring fossil-based generation.

The fleet of resources must collectively maintain a balance of the attributes listed below:

1. **Carbon Free** and dependable fuel source that allow the unit to operate based on system needs;
2. **Dependable Fuel Sources** that allow these resources to be brought online when required;
3. **Non-Energy Limited** and capable of providing energy for multiple hours and days regardless of weather, storage, or fuel constraints;
4. **Dispatchable** to follow instructions to increase or decrease output on a minute-to-minute basis;
5. **Quick-Start** to come online within 15 minutes;
6. **Flexibility** to be dispatched through a wide operating range with a low minimum output;
7. **Fast Ramping** to inject or reduce the energy based on changes to net load which may be driven by changes to load or intermittent generation output;
8. **Multiple starts** so resources can be brought online or switched off multiple times through the day as required based on changes to the generation profile and load;
9. **Inertial Response** and frequency control to maintain power system stability and arrest frequency decline post-fault;
10. **Dynamic Reactive Control** to support grid voltage; and
11. **High Short Circuit Current** contribution to ensure appropriate fault detection and clearance.

These above-mentioned lists of attributes are not exhaustive. As an example, fast frequency response can be provided by resources that can rapidly adjust their output, which can help stabilize system frequency. However, these systems have an inherent time delay required for detection and response, and do not entirely offset the need for inertia. New reliability needs may be identified as the grid continues to evolve.

The essential characteristics or reliability services provided in large part by fossil-based generation do not need to be encapsulated in a singular DEFR or technology. In aggregate, the system needs a collection of these reliability services to be reliable.

Figure 41 illustrates the several potential types of generation technologies and highlights some of the attributes they provide.

Figure 41: Energy and Reliability Attributes of Sample Generation Technologies

		NYCA Summer Capacity (MW)	Energy Attributes						Other Reliability Attributes			
			Carbon Free	Dependable Fuel Source	Energy Limited	Dispatchable	Quick start	Flexible	Multi start	Inertial Response	Dynamic Reactive control	High Short Circuit current
Sample Technology	Fossil	25,667	No	Yes[45]	No	Yes	Yes[46]	Yes	Yes	Yes	Yes	Yes
	Hydro	4,265	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Pumped Hydro	1,407	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Hydrogen Fuel Cell	0	Yes	Yes[47]	No	Yes	Yes	Yes	Yes	No	Yes	No
	Hydrogen Combustion	0	Yes	Yes[60]	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Nuclear	3,305	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
	Modular Nuclear	0	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes
	Battery	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
	Solar	154	Yes	No	Yes	No[48]	Yes	Yes	Yes	No	Yes	No
	Wind	2,051	Yes	No	Yes	No[50]	Yes	Yes	Yes	No	Yes	No
	Synchronous Condenser[49]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	Yes	Yes

[45] Firm fuel contract or dual fuel capable

[46] Simple cycle turbines

[47] Contingent on ability to manufacture and transport hydrogen at scale required for power generation

[48] Resources are energy limited or have intermittent fuel sources which limits their operational capability

[49] Synchronous condensers do not provide energy

The lead time associated with construction and deployment of the different resource types is also an important factor in considering a path forward. Depending on the duration of need, enhancements to various market design aspects may be required including reserves, regulation, ramping, and load forecasting. Looking ahead to 2040, the policy for an emissions-free electricity supply will require the development of new technologies. Substantial zero-emission dispatchable resources will be required to fully replace fossil generation. Long-duration, dispatchable, and emission-free resources will be necessary to maintain reliability and meet the CLCPA. Resources with this combination of attributes are not commercially available at this time but will be critical to future grid reliability.

In May 2023, the PSC issued an order initiating a process to identify technologies that can close the anticipated gap between the capabilities of existing renewable energy technologies and future system reliability needs.[50] The Commission asks stakeholders a series of important questions, including how to define "zero-emissions" for purposes of the zero emissions by 2040 target and whether that definition should include cutting edge technologies such as advanced nuclear, long duration energy storage, green hydrogen, and demand response. The PSC also elicits feedback from stakeholders on how to best design a zero-emissions by 2040 program. Over the next several years, projects undertaken by the NYISO will continue to address the changes needed in the energy and ancillary services, as well as prepare the markets for new resource classes. These efforts will focus on improving signals to drive investment in resources with the characteristics and attributes needed for continued grid reliability.

Transmission: Expansion to Integrate New Resources

Transmission will continue to play a key role in moving power from the renewable resources to the load centers. In response to the declaration of Public Policy Transmission Needs by the PSC, the NYISO has already selected four major public policy transmission projects to enable the delivery of renewable energy to consumers across New York State. The PSC also approved NYPA's request to proceed with development of its proposed Northern New York Transmission Projects, which seek to increase the capacity of certain transmission lines to accommodate incremental delivery of renewable energy from northern New York. In 2021, Governor Kathy Hochul announced two contract awards for the Clean Path NY and Champlain Hudson Power Express projects to increase transmission capability to New York City. In 2022, a project, the Smart Path Connect, proposed by NYPA and National Grid was approved. This project is an upgrade to the transmission backbone system of New York that will improve reliability throughout New York.

[50] PSC Case 15-E-0302, *Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard*, Order Initiating Process Regarding Zero Emissions Target (May 18, 2023), which is available here.

Additionally, in February 2023, the PSC approved the "Phase 2" transmission projects filed by a number of New York Transmission Owners, seeking authority to develop and construct local transmission upgrades whose primary function is to support new renewable generation programs and mitigate generation pockets constraints. Even with the potential benefits provided by these projects, several renewable generation pockets across the whole state would persist that could constrain output from renewable resources, including offshore wind.

In March 2021, the PSC issued an order declaring that offshore wind goals are driving the need for additional transmission facilities to deliver that renewable power from Long Island to the rest of New York State. The NYISO has been evaluating transmission solutions to determine whether they are viable and sufficient to meet the PSC-identified need and whether to select the more cost-effective or efficient project to satisfy the need. In June 2023, the NYISO's Board of Directors selected the "T051" proposed project by New York Transco, LLC and NYPA (under a joint venture "Propel NY"). The project adds three new AC tie lines and a 345 kV backbone across western/central Long Island that will be in service in 2030. The project partially addresses congestion from the Empire Wind 2 proposed offshore wind project. Additionally, the PSC approved in April 2023 the construction of Con Edison's proposed Brooklyn Hub project, including a new 345 kV load serving substation having the goal to address local electric reliability needs in the boroughs of Brooklyn and Queens, as well as could serve as a point of interconnection for up to 1,500 megawatts (MW) of new clean-energy resources, such as offshore wind power. The targeted in-service date for the Brooklyn Hub project is summer 2028.

The NYISO will also be part of the recently adopted Coordinated Grid Planning Process. The New York utilities filed a proposed process proposal with PSC on December 27, 2022, which the PSC approved on August 17, 2023 with modifications and clarifications, in response to a May 2020 order directing them to undertake planning assessments and make investment proposals to facilitate the cost-effective development of renewable and emissions-free resources while maintaining New York's electric grid reliability. The PSC initiated this proceeding to develop an integrated planning process to identify and construct local transmission and distribution infrastructure solutions, in coordination with any necessary bulk transmission infrastructure expansion, throughout New York to support the optimal deployment of these investments.

The Role of Competitive Wholesale Markets

Competitive wholesale electricity markets have successfully facilitated efficiency gains on the grid by reducing fuel consumption and lowering consumer costs. Competitive wholesale electricity markets also shift the risk and cost consequences of resource investment and operational decisions from consumers to electricity suppliers. An added benefit of wholesale markets is that competition among resources rewards economic efficiency. Historically, this has resulted in more modern supply coming onto the grid and displacing older, less efficient supply.

Wholesale markets are also designed to attract and retain enough supply in the most beneficial locations to provide needed reliability services. Within today's system there is a predominance of large-scale controllable resources that can be dispatched by operators to respond to system needs. The NYISO is taking numerous steps to ensure its markets continue to attract investment in resources that are controllable and can respond quickly to changing system conditions that will be necessary to balance the varying supply from wind and solar in the future.

How NYISO's Wholesale Electricity Markets Work

Each day, the NYISO conducts wholesale electricity auctions for market participants to buy and sell electricity. These auctions schedule sufficient electricity generation to match consumer demand, delivering reliable electricity with the least-cost mix of resources available to the grid.

These daily electricity auctions provide for minute-to-minute reliability, with market signals responding to changing conditions and continuously adjusting output levels of suppliers to match the instant needs of the grid.

For these daily auctions to function efficiently, operators need a longer-term view into what supply resources will be available to the grid. The NYISO achieves this certainty through its Installed Capacity (ICAP) market, which promotes reliability by compensating suppliers for committing to be available to the grid whenever needed. The NYISO conducts capacity market auctions on a seasonal and monthly basis to offer suppliers and developers transparent locational pricing signals that reward availability, performance, and the resource's contribution towards reliably serving load.

Taken together, competitive wholesale energy, ancillary services, and capacity markets are fundamental to providing consumers reliable, lowest-cost power and an essential tool for achieving public policy objectives. The NYISO is continuously working with its stakeholders to identify ways to refine and enhance its markets in response to policies and the changing resource mix.

Enhancing Wholesale Electricity Market Design

The NYISO's market design must provide proper incentives to new and existing resources that can respond to and follow dispatch signals in all types of conditions, harnessing competition to minimize consumer costs while maintaining reliable service and assisting with the achievement of policy goals. Further, with many conventional resources slated to retire due to emissions restrictions, markets will also be relied on to sufficiently incentivize investments in new technologies, which may include long-duration storage, hydrogen fueled generators, and other non-emitting, dispatchable technologies.

The NYISO has identified certain key market enhancements to maintain the alignment between emerging reliability needs and market incentives. The NYISO has and is continuing to work with stakeholders to address these market enhancements, which include:

Accreditation of Capacity Resources

To ensure rules intended to preserve competition in the capacity market do not interfere with the state's clean energy policies, the NYISO engaged with stakeholders and policymakers to revise its buyer-side capacity market mitigation (BSM) measures. If these rules did not evolve, they were likely to unduly complicate the achievement of the CLCPA targets by presenting a hurdle for new entrants necessary to achieve New York State's policy objectives.

In conjunction with these reforms, the NYISO also pursued capacity accreditation market rules to more accurately value capacity market suppliers' contributions to resource adequacy. These new market rules align compensation for capacity suppliers with the marginal reliability value of that resource type along with individual resource's expected reliability benefit to consumers. The groundbreaking proposal was accepted by FERC in May 2022. These reforms serve as a new national model for wholesale electricity market design, addressing long-standing tensions between federal and state oversight of capacity markets while also strengthening reliability and economic efficiency.

Further work with stakeholders to enhance wholesale markets in New York continues. The NYISO is developing enhanced capacity ratings for supply resources that reflect the marginal contribution to meeting resource adequacy criterion, accounting for power grid changes, resource availability, performance, and correlated outages.

Enhancing Market Rules for Supply Reserves

Dynamically determining operating reserve needs is a novel approach being explored by the NYISO that would result in more efficient scheduling of operating reserves based on system conditions and transmission system capability. This will allow for appropriate reserves to be procured to support the integration of large amounts of intermittent resources. It will also allow for more reserves to be scheduled in cost-effective regions. Resources capable of providing reliability services when they are needed due to transmission constraints or potential for sudden losses of supply resources will be compensated more commensurate with their locational value.

The NYISO is also working with stakeholders to expand ancillary services products to better support reliable grid operations and assist in balancing the intermittent nature of the anticipated renewable generation fleet. These products will help signal the grid attributes that are expected to become scarcer as fossil fuel generators deactivate.

Capacity Improvements to Support Reliability

The NYISO's capacity market has four pricing zones, which may not capture differences in value of capacity in smaller regions inside these zones due to transmission constraints, both in the import and export direction. Additionally, today's rules only allow for zone creation every four years, coinciding with the Demand Curve Reset. Granular Capacity Market Pricing would enhance the rules for creating zones and the frequency of establishing zones could better align compensation to capacity suppliers with system needs. Establishing appropriate capacity pricing zones to incent needed reliability and recognize the value of capacity suppliers located in different zones could facilitate efficient retention and investment of capacity in regions that provide the highest value while continuing to promote efficient outcomes that benefit consumers.

As the New York State electric system evolves from a power system with primarily summer reliability risk to one with summer and winter reliability risk, the NYISO's Installed Capacity Market structure will need to be reviewed to assess whether price signals, obligations, and incentives provided by the Installed Capacity Market will continue to be effective under this evolution. The Winter Reliability Capacity Enhancements project will perform this review, looking at all aspects of the Installed Capacity Market, including the Installed Capacity Load Forecasts, the requirement setting process, the establishment of Installed Capacity Demand Curves, and participation rules for Installed Capacity Suppliers.

Transmission security margins are declining in southeast New York as noted by the 2022 Reliability Needs Assessment. The declining transmission security margins will make it more likely for TSLs to set the LCRs in southeast New York, as was the case in the New York City and G-J Localities for the 2023/2024 Capability Year. This project also supports State of the Market recommendation 2022-1. The ICAP Market incorporates transmission security limits (TSLs) in its process to establish LCRs. When a TSL binds during the process to establish LCRs, the market is indicating that the transmission limitations are driving the need for ICAP in that Locality rather than strictly resource adequacy needs. A resource can have different contributions to resource adequacy transmission security. Due to the potential differing reliability values, the ICAP Market may not provide efficient compensation when requirements are set by transmission limitations rather than strictly resource adequacy needs.

Competitive Power Markets Role in the Transition

Competitive electricity markets are fundamental to providing consumers reliable, lowest cost power and an essential platform for achieving public policy objectives. The NYISO is leading the way in meeting the challenges before us. The NYISO's leadership in developing innovative market design enhancements demonstrates our focus on innovation. The NYISO will continue to be actively engaged with stakeholders and policymakers on the path to a reliable, affordable, and lower emissions grid for New York.

Conclusions and Recommended Actions

[TO BE COMPLETED LATER]

Future NYISO Studies

Quarterly STAR: The NYISO will administer its quarterly STAR through the Short-Term Reliability Process to capture events such as generator deactivations and other system changes. Through the Short-Term Reliability Process, the NYISO will address every quarter Reliability Needs arising within five years, with an emphasis on needs arising in years one through three. If necessary, the NYISO will seek solutions to address any Reliability Needs identified through that process. For generators affected by the Peaker Rule, the NYISO may designate certain units, in sufficient quantity, to remain in operation for an additional two years (until May 1, 2027) with the potential of an additional two-year extension (to May 1 2029) if a permanent solution that is needed to maintain reliability has been selected but is not yet online. The NYISO would only temporarily retain peakers as a last-step approach if it does not expect solutions to be in place by the time the identified reliability need is expected in 2025. Moreover, the NYISO continuously monitors all planned projects and any changes to the New York State transmission system and may request solutions outside of its normal planning cycle if there appears to be an imminent threat to the reliability of the bulk power transmission system arising from causes other than deactivating generation.

2024 RNA: In the next cycle of the Reliability Planning Process, the 2024 RNA will provide a new reliability assessment of the New York Bulk Power Transmission Facilities for years four through ten of the planning horizon (2028 through 2034). The 2024 RNA, scheduled to be issued by the end of 2024, will be based on updated data, system models and assumptions, and will review the status of the risk factors discussed in this CRP, together with other reliability issues.

2023-2042 System & Resource Outlook: The NYISO is currently undertaking a 20-year System & Resource Outlook, to be issued in 2024. The Outlook will provide a comprehensive overview of system resources and transmission constraints throughout New York, highlighting opportunities for transmission investment driven by economics and public policy.

Together, the Comprehensive Reliability Plan and the System & Resource Outlook are the marquee NYISO planning reports that collectively provide a comprehensive power system outlook to stakeholders, developers, and policymakers.