New York ISO
Independent System Operator

DRAFT 2023-2032 Comprehensive Reliability Plan

A Report from the
New York Independent
System Operator

Draft 1 for August 1, 2023 ESPWG/TPAS

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Executive Summary

[TO BE COMPLETED LATER]

Background

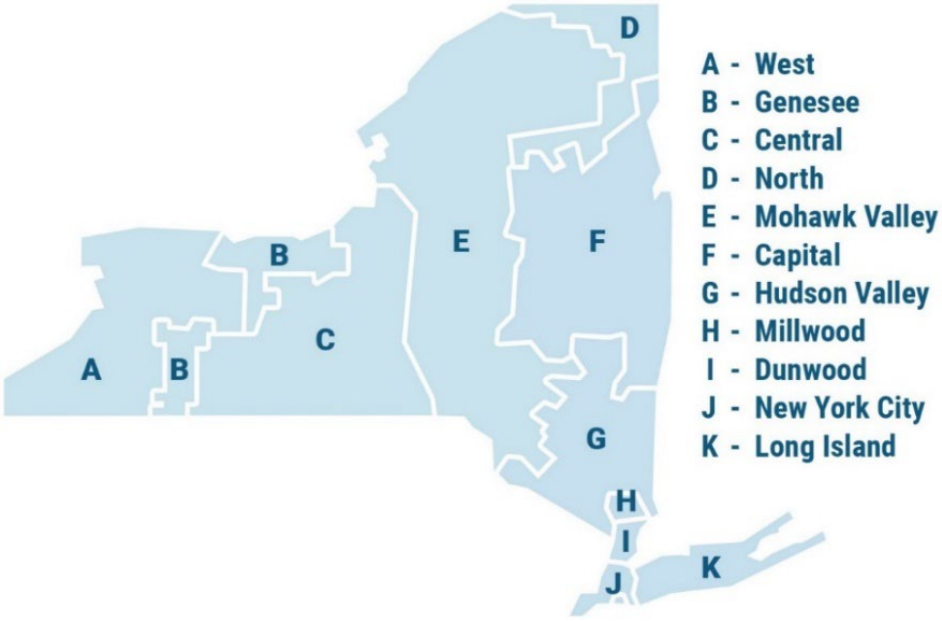
This 2023-2032 Comprehensive Reliability Plan (CRP) completes the NYISO's 2022-2023 cycle of the Reliability Planning Process. The 2022 Reliability Needs Assessment (RNA), approved by the NYISO Board of Directors in November 2022, was the first step of the current cycle. This CRP follows the 2022 RNA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

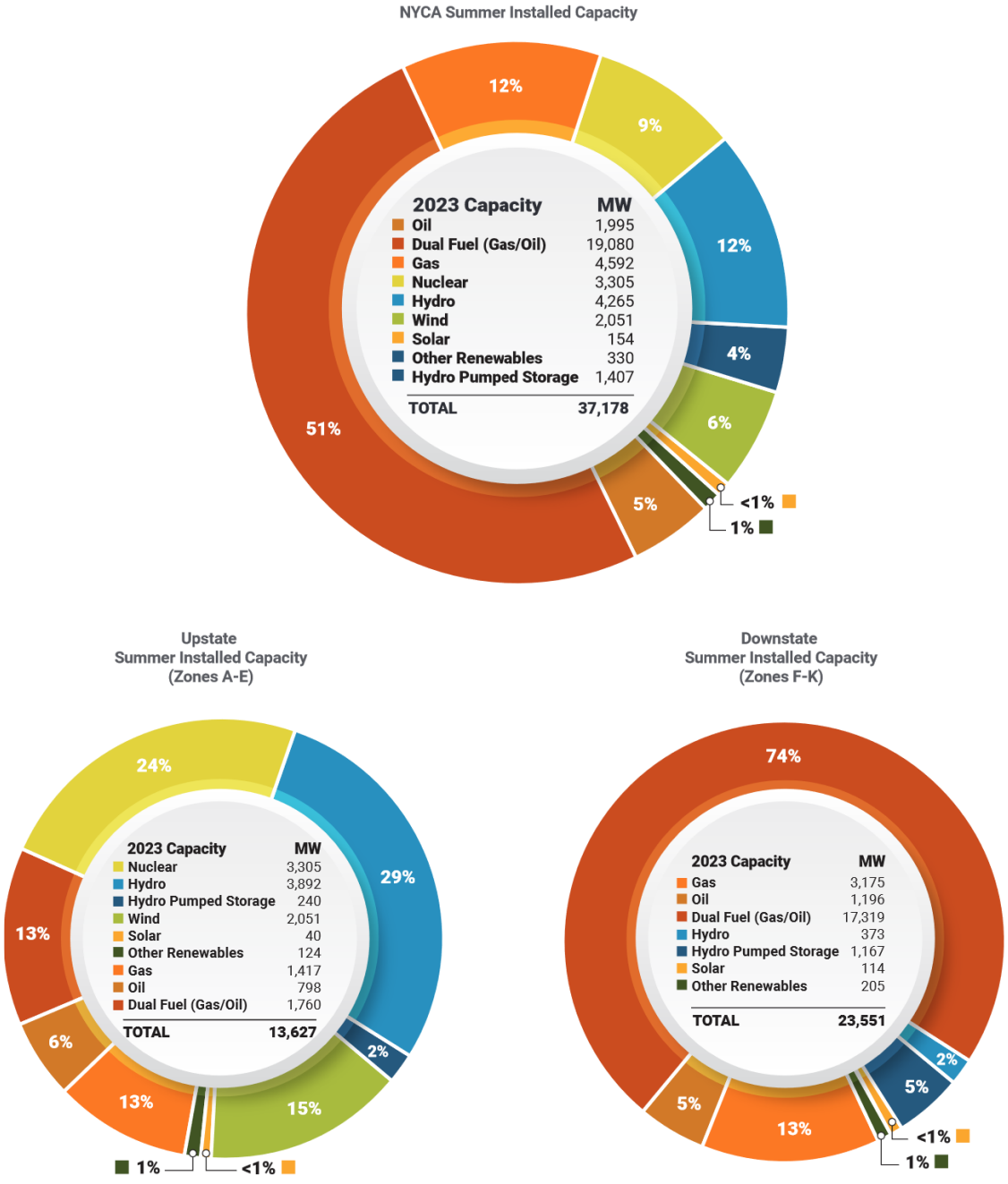
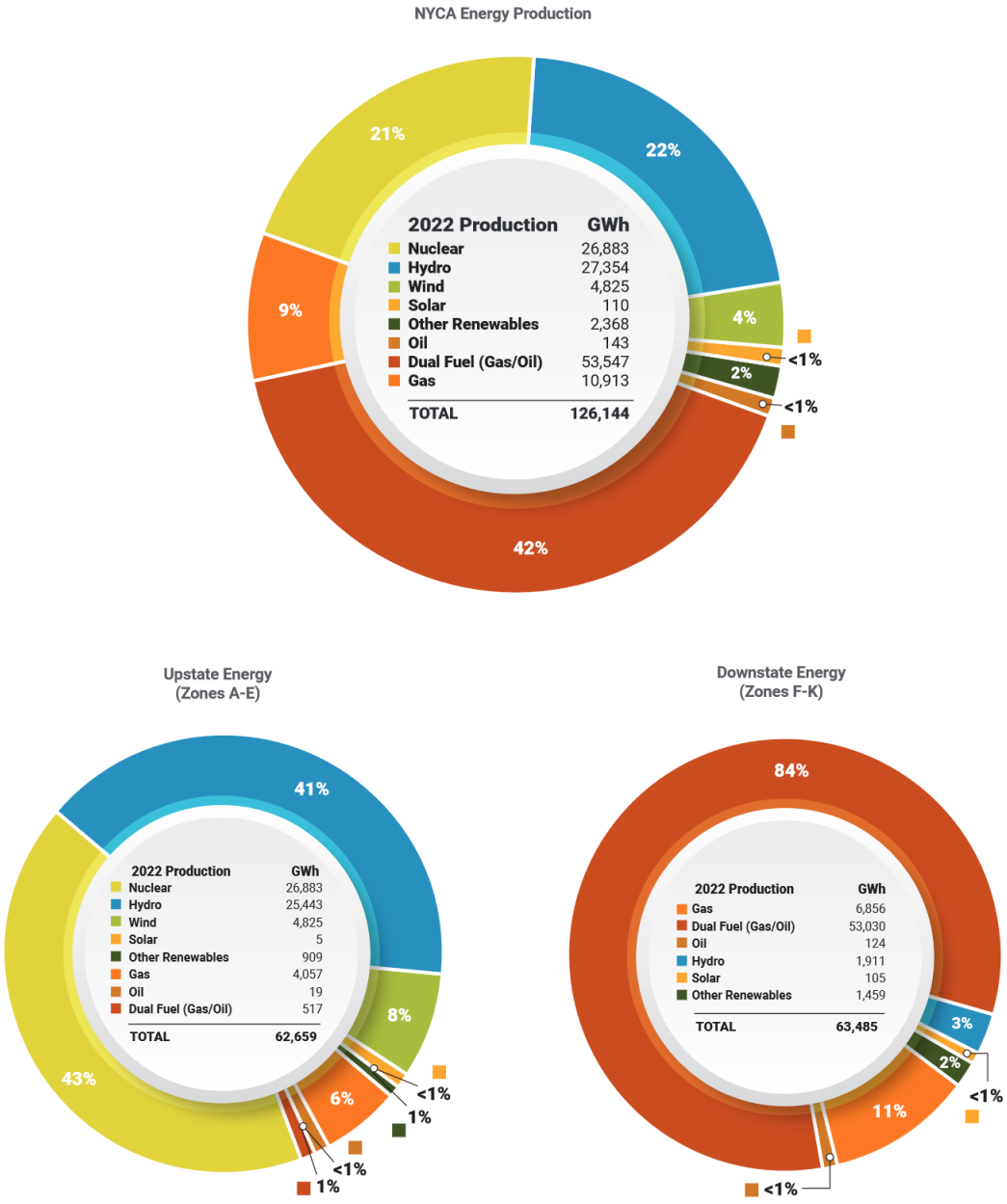


Figure 3: Energy Production by Fuel Source (GWh) – Statewide, Upstate, & Downstate New York: 2022

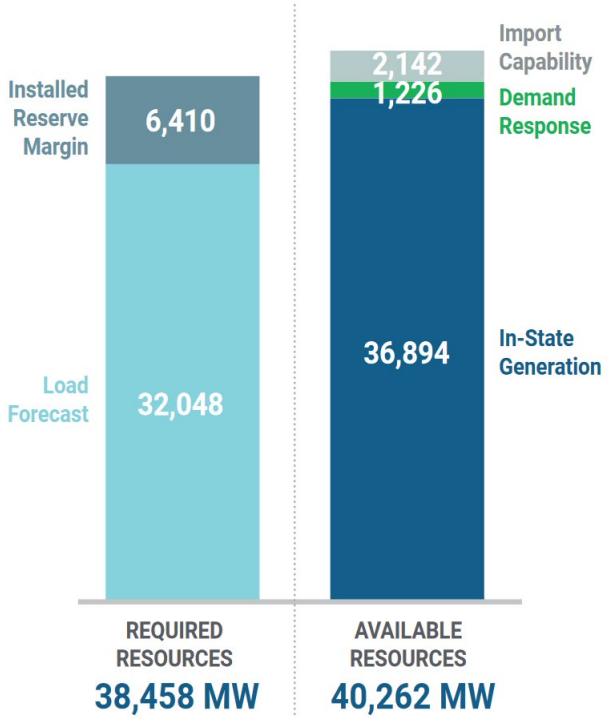


Total generation resource capability in New York for the summer of 2023 is projected to be 40,262 MW, which includes 36,894 MW of generating capability, 1,226 MW of Demand Response, and 2,142 MW of net long-term purchases and sales with neighboring control areas.

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.

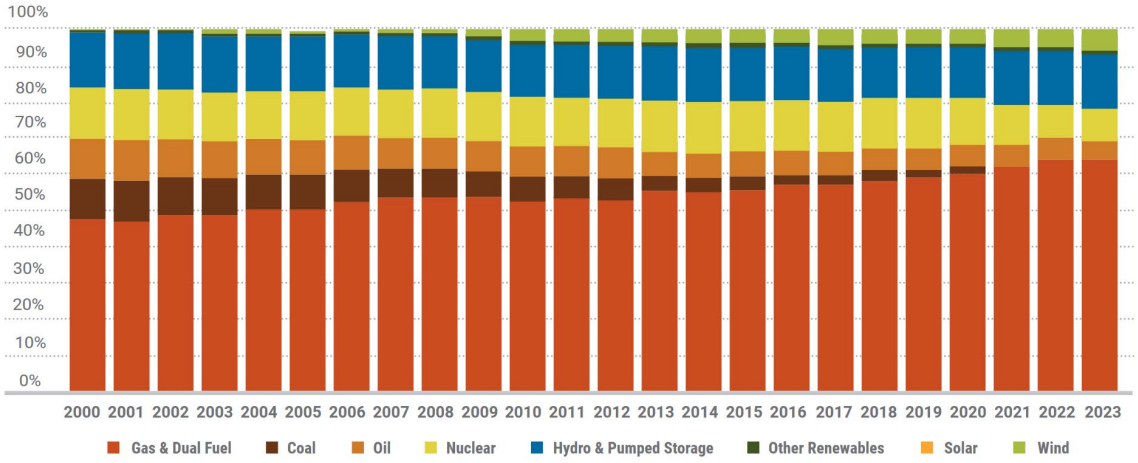
[3] Link to the NYSRC's IRM Reports: https://www.nysrc.org/NYSRC_NYCA_ICR_Reports.html

Figure 4: Statewide Resource Availability: Summer 2023



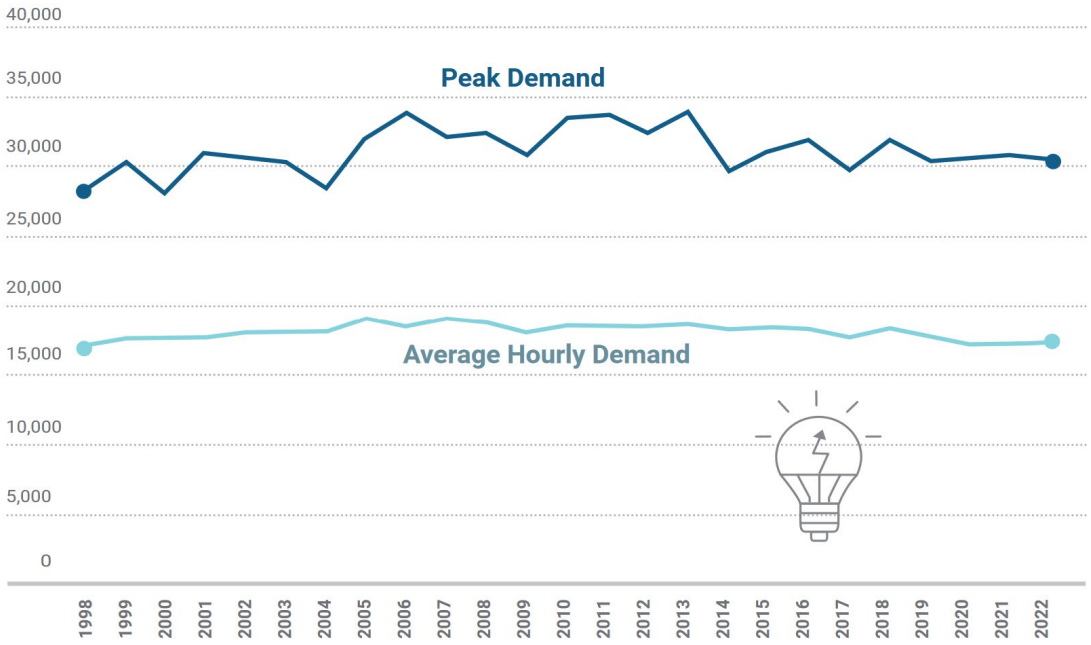
The historical generating capacity fuel mix in New York State 2000-2023 is depicted in the figure xx below.

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



Historical average hourly demand versus actual yearly peak demand are 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.

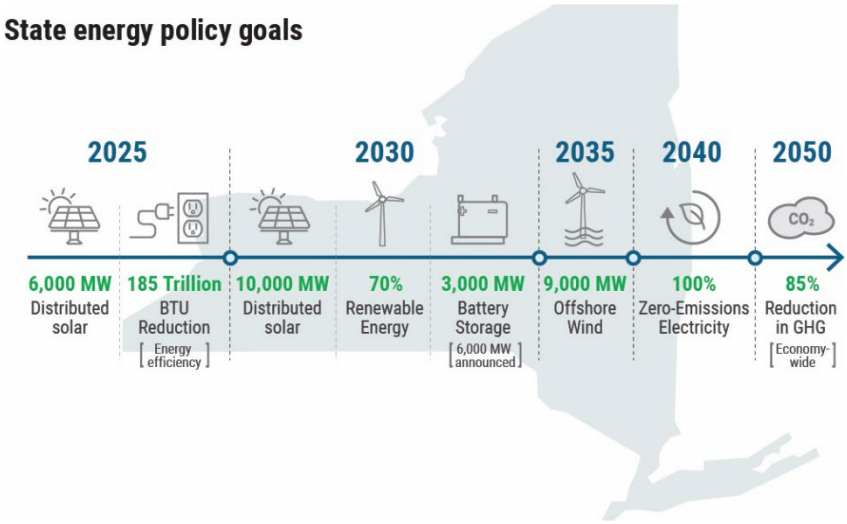
Balancing the grid throughout this transition not only requires maintaining sufficient capacity to meet demand but also requires that new resources entering service replace the capabilities and attributes of the resources leaving the system. Continued dialogue and engagement among market participants, 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.
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.
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.

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]

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.

[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."

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. The clean and renewable energy they produce will contribute to the state's clean energy goals; however, their performance and characteristics must be studied and well understood to reliably integrate such large volumes of resources. Delays in these projects could lead to or frustrate reliability risks.

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 that is intended to maintain electric system reliability in the event of gas supply interruptions.

New York City Local Law 97

The New York City Council passed Local Law 97 in 2019, which mandates that any building 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.

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 publish a plan within two years 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, 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. 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. NYPA must file notice of deactivation with the NYISO for the purpose of ceasing electricity production in a "timeframe sufficient to facilitate the cessation of electricity production."

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.

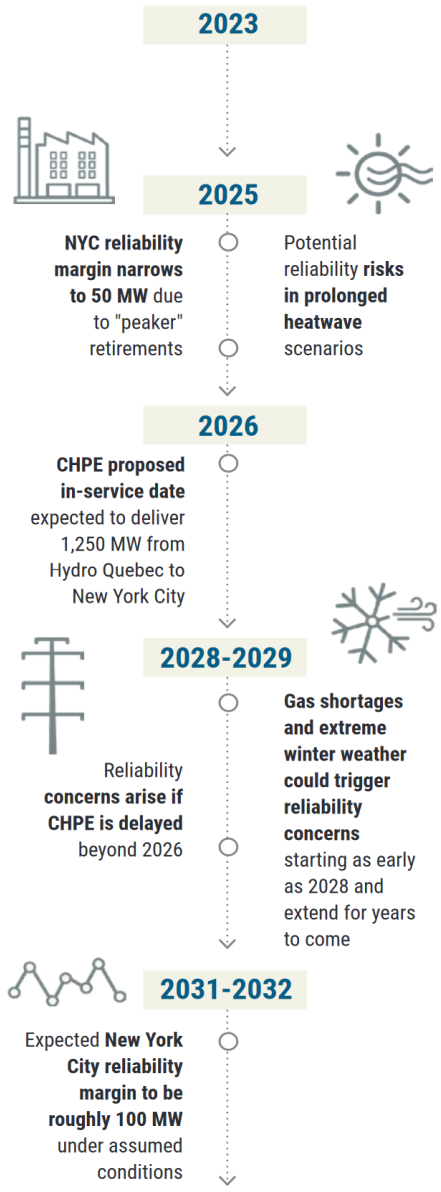
The 2022 RNA also found that reliability margins decrease across the state through time, but the reliability of the New York City area faces the greatest risk due to limited generation and transmission to serve forecasted demand. For the assumed expected summer weather, the New York City grid, as planned, 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

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

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.

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



Short-Term Reliability (2023-2028)

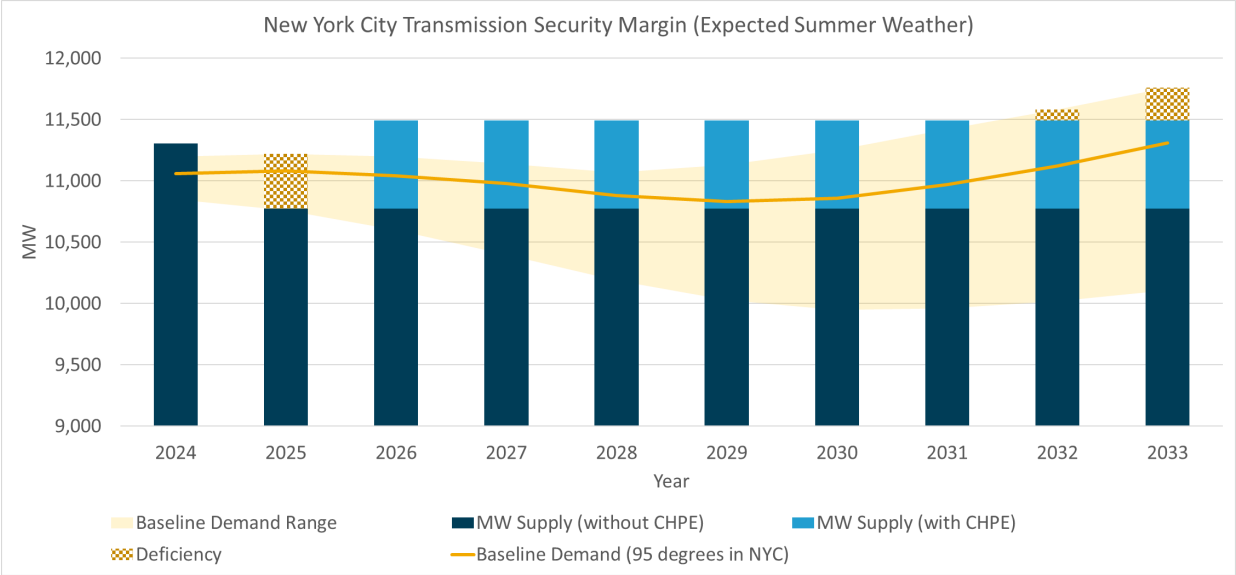
In parallel with the biennial RNA and CRP process, the NYISO uses the quarterly Short-Term Reliability Process (STRP), as prescribed in Attachments Y and FF of the NYISO's Open Access Transmission Tariff, to evaluate the first five years of the planning horizon. This evaluation focuses on needs arising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



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, 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.

The short-term need observed in 2025 is a Near-Term Reliability Need. As a result, solutions will be solicited, evaluated, and addressed in accordance with the NYISO Short-Term Reliability Process. The need arises within the Con Edison Transmission District; therefore, Con Edison is the Responsible Transmission

Owner for developing a regulated solution.[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] *See* OATT Section 38.3.6.

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. 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.

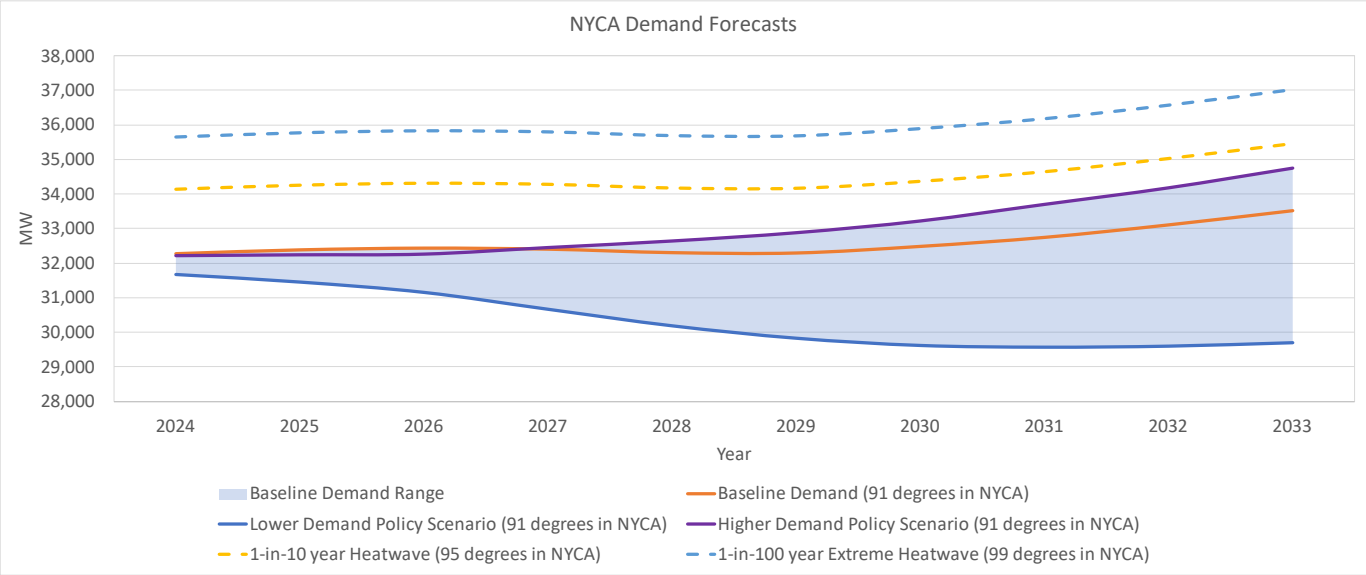
This section summarizes the key future projects and assumptions that have been included as part of this Comprehensive Reliability Plan, and the resultant reliability metrics for the system as planned. As discussed in the next major section of this report (Risk Factors to the Comprehensive Reliability 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. New York is projected to become winter peaking in future decades due to space heating electrification and electric vehicle penetration.

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 7: Statewide Summer Peak Load Forecasts

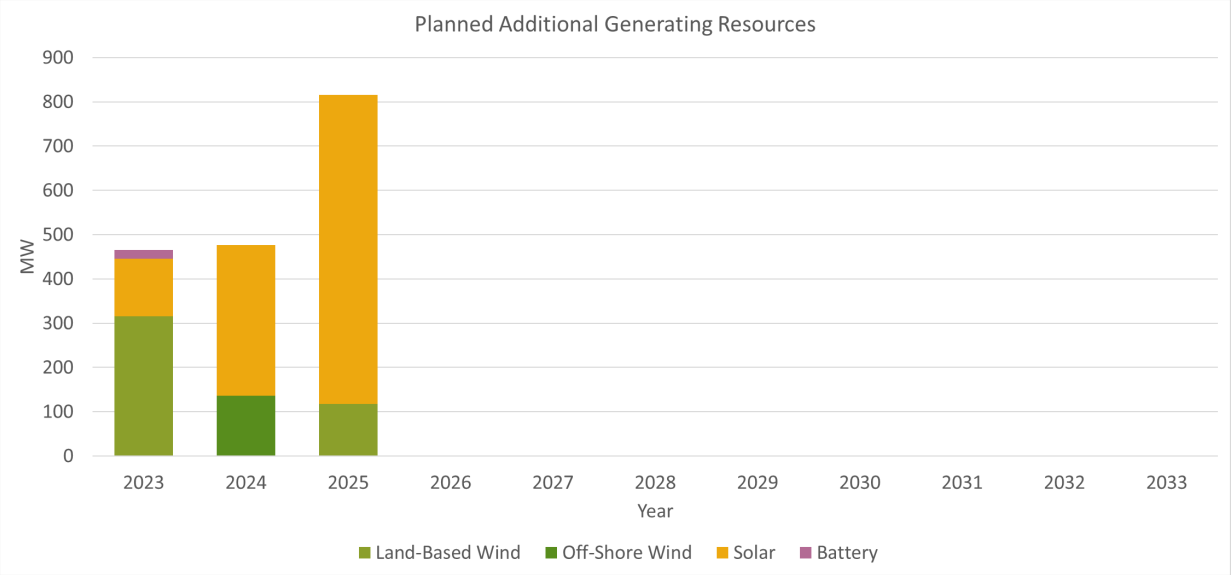


Generation

Figure 8 shows the planned additional generation resources included as part of the CRP. A new generation resource is included in the CRP if the project has reached an advanced stage in the NYISO interconnection process and is making significant progress in construction, project financing, and/or regulatory approvals.[11] These 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.

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

Figure 8: Planned Additional Generating Resources (Nameplate MW)



The base cases for the 2022 RNA included approximately 2,000 MW of generating units assumed unavailable. 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. For instance, some of the Peaker units are assumed out of service in the May through October ozone season 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

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

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 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 processed under the STRP. 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.

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).

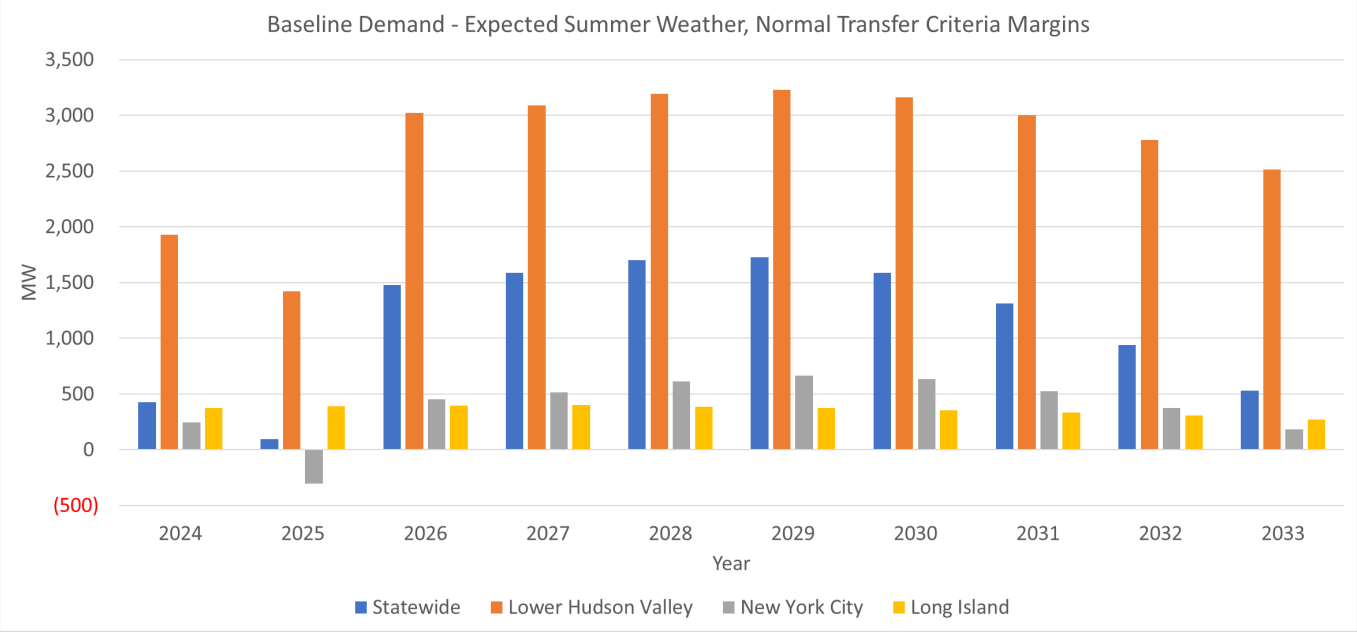
In the 2022 RNA, the NYISO did not identify a reliability need. However, the NYISO did identify that the reliability margins within New York City would not be sufficient if, among other reasons, the forecasted demand increased by as little as 60 MW in 2025. Comparing the baseline summer coincident peak 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

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

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 9 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 (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 9: Summary of Expected Summer Weather, Normal Transfer Criteria Margins



The 345 kV transmission system along with specific portions of the 138 kV transmission system in the Con Edison Transmission District are designed to criteria to address the occurrence of two non-simultaneous contingencies and a return to normal (N-1-1-0). Design criteria N-1-1-0 combinations include

various combinations of the loss of generation and transmission facilities. As the system changes, the limiting contingency combination may also change. For summers 2023, 2024, and 2025, the 345 kV transmission system is most limiting for the combined loss of Ravenswood 3 followed by the loss of the Mott Haven – Rainey 345 kV (Q12) transmission line (N-1-1-0). Starting in summer 2026, the limiting contingency combination changes to the loss of CHPE followed by the loss of Ravenswood 3.

Under the baseline forecast for coincident summer peak demand and the above-reference contingencies, the NYISO identified in the 2023 Quarter 2 STAR that the New York City transmission security margin would be deficient by 306 MW in 2025 for a duration of 7 hours. However, accounting for uncertainties in key demand forecast assumptions, the higher bound of expected demand under baseline weather conditions (95 degrees Fahrenheit) in 2025 results in a deficiency of 446 MW over 9 hours. The deficiency would be significantly greater if New York City experiences a heatwave (98 degrees Fahrenheit) or an extreme heatwave (102 degrees Fahrenheit).

As recognized in the 2023 Quarter 2 STAR 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 were considered in the 2023 Quarter 2 STAR transmission security margin calculations by incorporating the lower and higher bounds as a range of forecasted conditions during expected weather, specified in the Gold Book as the policy scenario forecasts. 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. **Figure 10** shows the range of baseline forecast utilizing the lower and higher demand policy scenarios within New York City along with the demand for heatwave and extreme heatwave conditions. **Figure 11** also provides a summary of the difference between the lower and higher demand policy scenarios as compared to the baseline demand forecast published in the 2023 Gold Book.

Figure 10: New York City Demand Forecasts

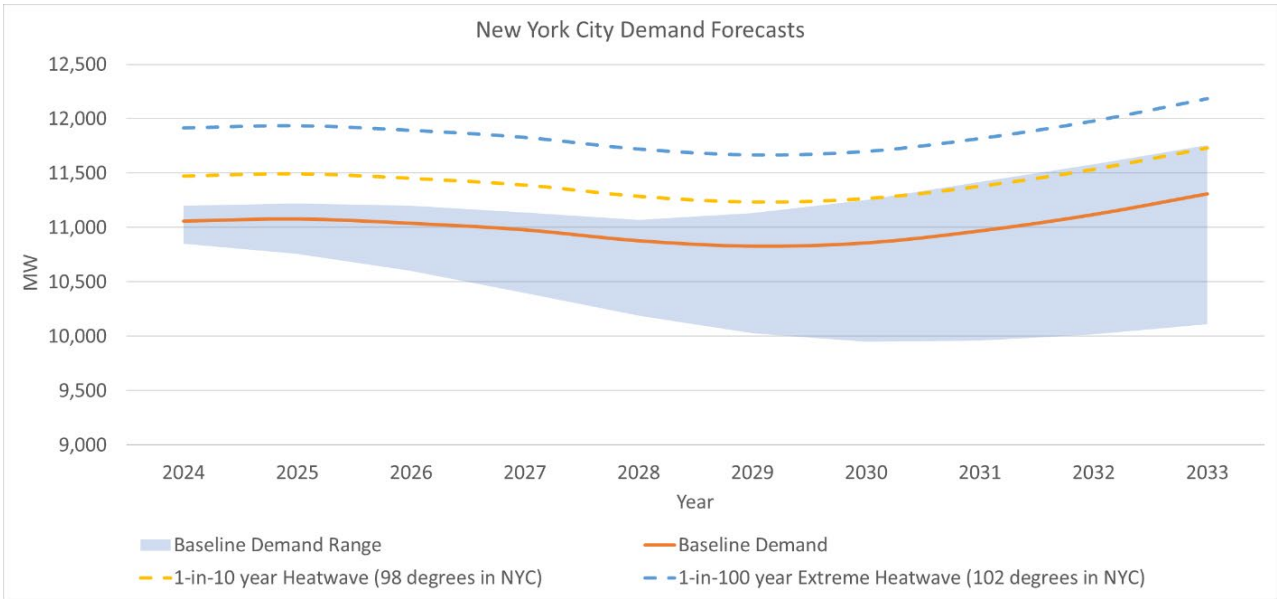
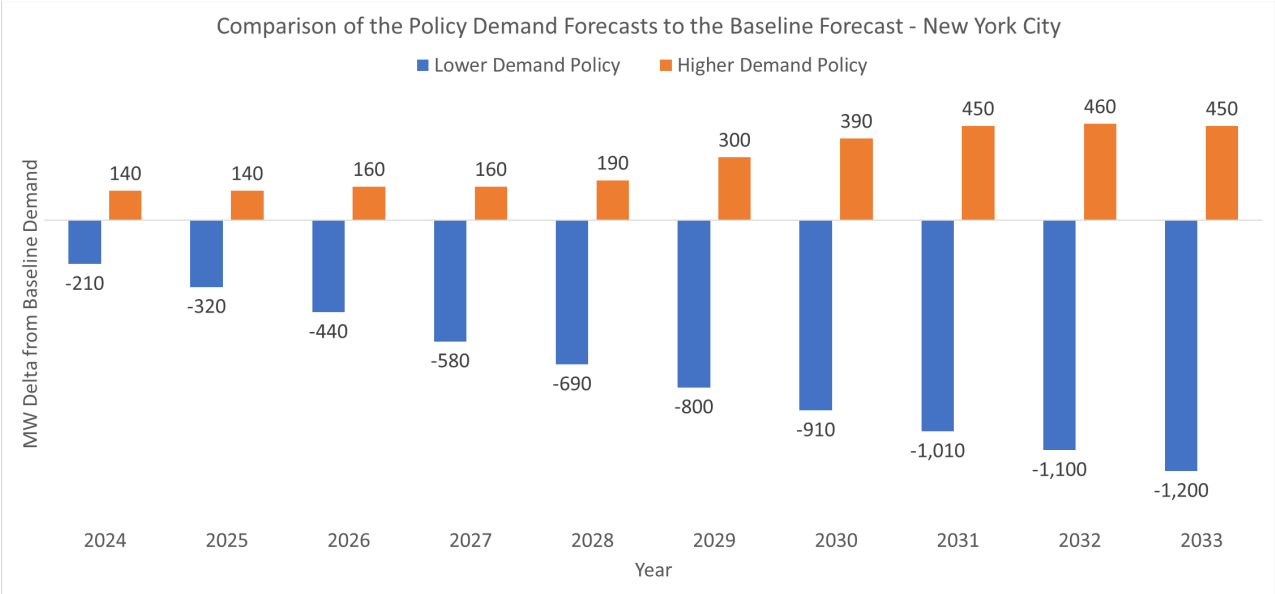


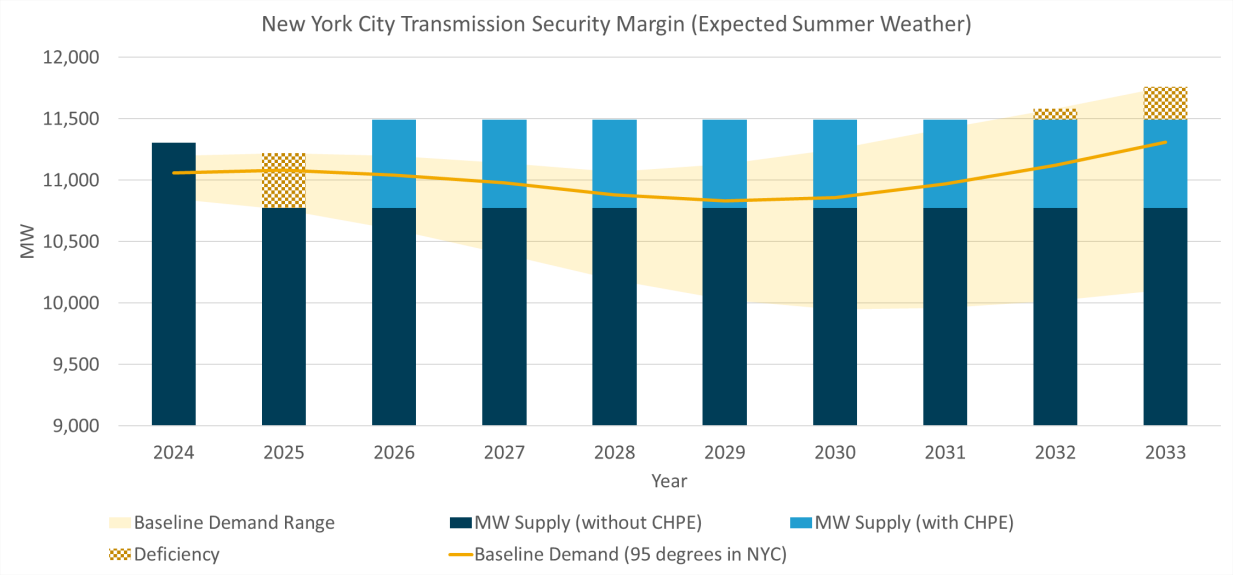
Figure 11: Impact of Lower and Higher Demand Policy Scenarios on Baseline New York City Demand Forecast



As shown in **Figure 11**, for the lower policy scenario, the summer peak demand in 2025 is 320 MW lower than that of the baseline forecast, resulting in the potential for a sufficient transmission security margin of 14 MW (see **Figure 13**). For the higher policy scenario, the summer peak demand forecast in 2025 is 140 MW higher than the baseline forecast (see **Figure 11**) resulting in a transmission security margin deficiency of 446 MW. As shown in Figure 14 the deficiency of 446 MW is anticipated to last nine hours.

Regardless of the demand forecast, the New York City transmission security margin improves in 2026 with the anticipated addition of the CHPE project. However, the margin gradually erodes following the addition of the CHPE project as the baseline demand grows in New York City. For the higher demand policy scenario by 2032, the margin is deficient by 88 MW and grows to a deficiency of 268 MW by 2033.

Figure 12: New York City Transmission Security Margin (Expected Weather, With and Without CHPE)



Beyond 2025, the reliability margins within New York City may also 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. For the baseline or higher policy scenario demand forecasts, the reliability margins continue to be deficient for the ten-year planning horizon without the CHPE project in service or other offsetting changes or solutions. 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. Depending on the solutions received in response to the NYISO's solicitation for solutions to address this reliability need through the Short-Term Reliability Process, some generation affected by the DEC Peaker Rule may need to remain in service until the CHPE project or other permanent solutions are completed to maintain a reliable grid.

Figure 13: New York City Transmission Security Margins for Expected Weather (With and Without CHPE)

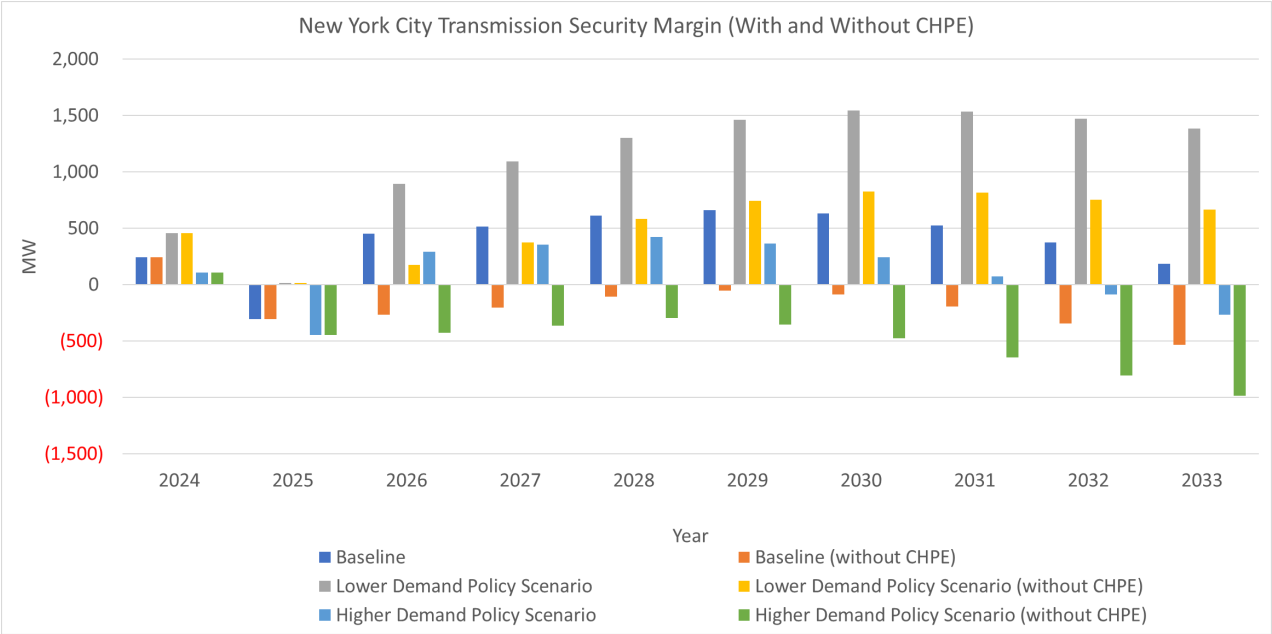
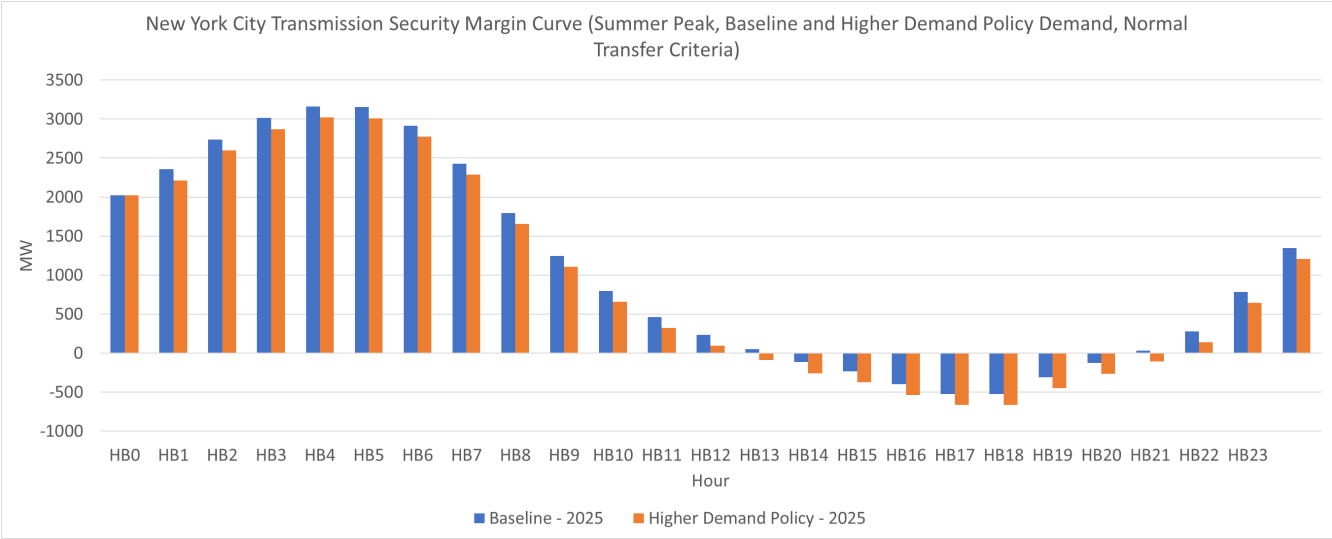
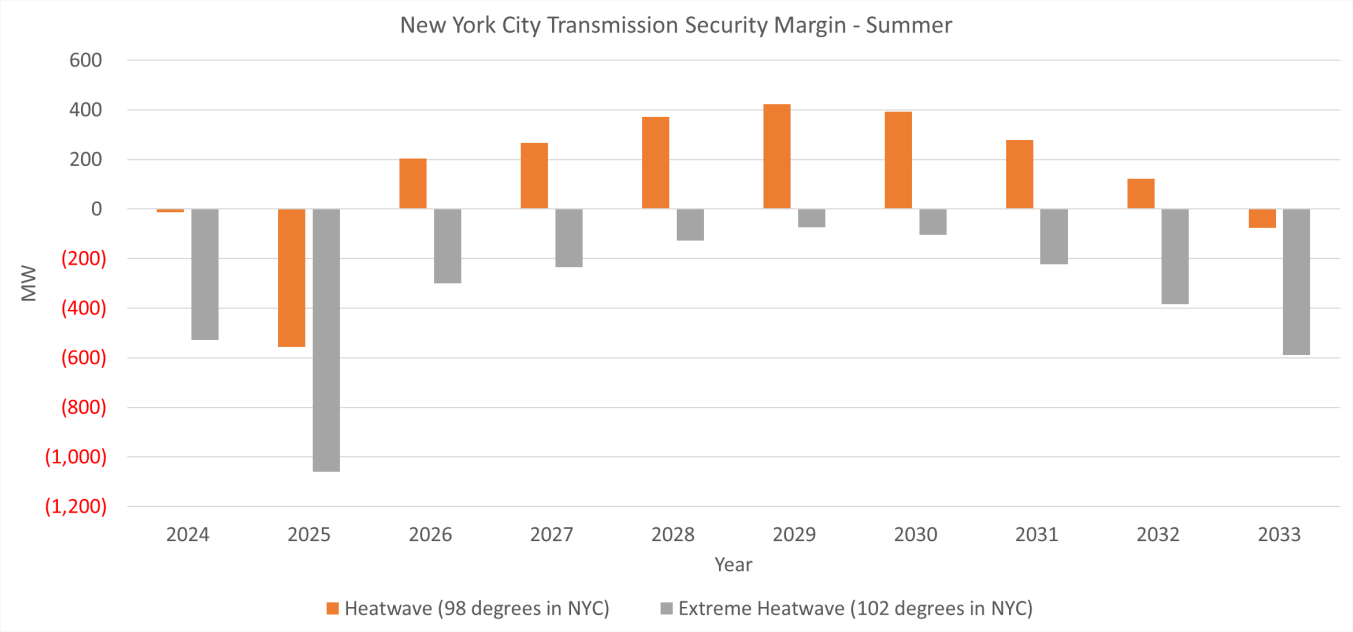


Figure 14: New York City Transmission Security Margin Hourly Curve



Potential heatwaves of various degrees also pose risks throughout the next ten years, especially in 2025, with a deficiency of 555 MW during a heatwave. As shown in Figure 15, with the CHPE project in service by 2026 the transmission security margin under a heatwave is sufficient through 2032. By 2033, under a heatwave the margin is again deficient by 75 MW. Under an extreme heatwave the margin is deficient for all years with the largest deficiency observed in 2025 at 1,060 MW. 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 15: New York City Transmission Security Margin for Heatwaves and Extreme Heatwaves



Within the Lower Hudson Valley, both with and without the CHPE project, the anticipated transmission security margins are sufficient (see **Figure 16**). While heatwaves continue to pose risks to reliability, within the Lower Hudson Valley the margins remain sufficient under this system condition (see **Figure 17**). Similarly, within the Long Island locality, the transmission security margin is sufficient for all study years as well as under heatwave conditions (see **Figure 18** and **Figure 19**).

Figure 16: New York City Transmission Security Margin for Heatwaves and Extreme Heatwaves

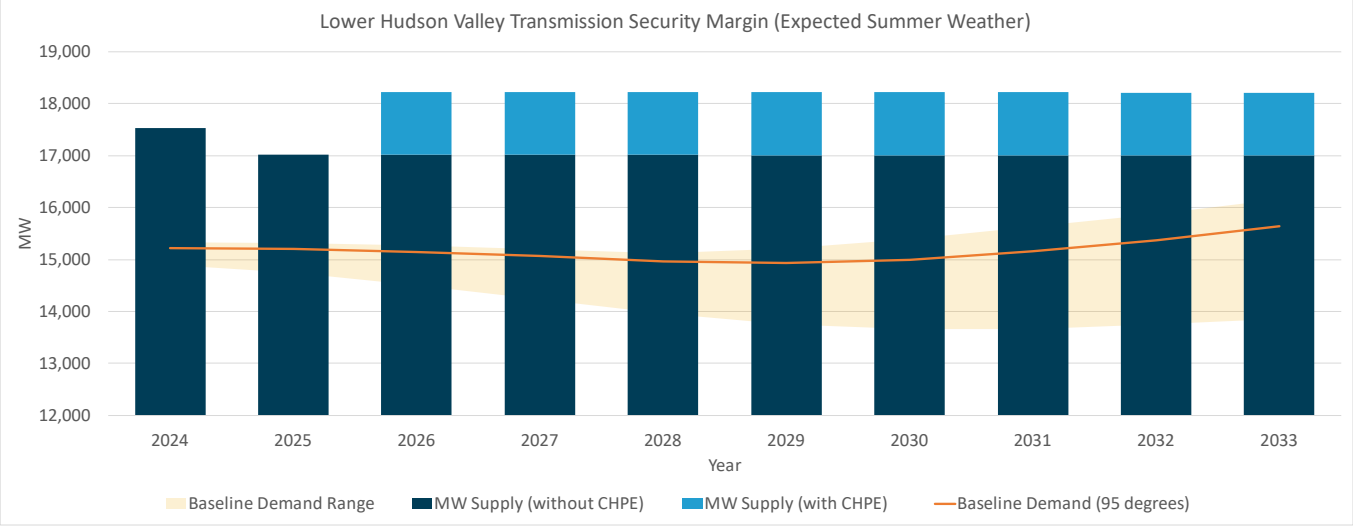


Figure 17: Lower Hudson Valley Transmission Security Margin for Heatwaves and Extreme Heatwaves

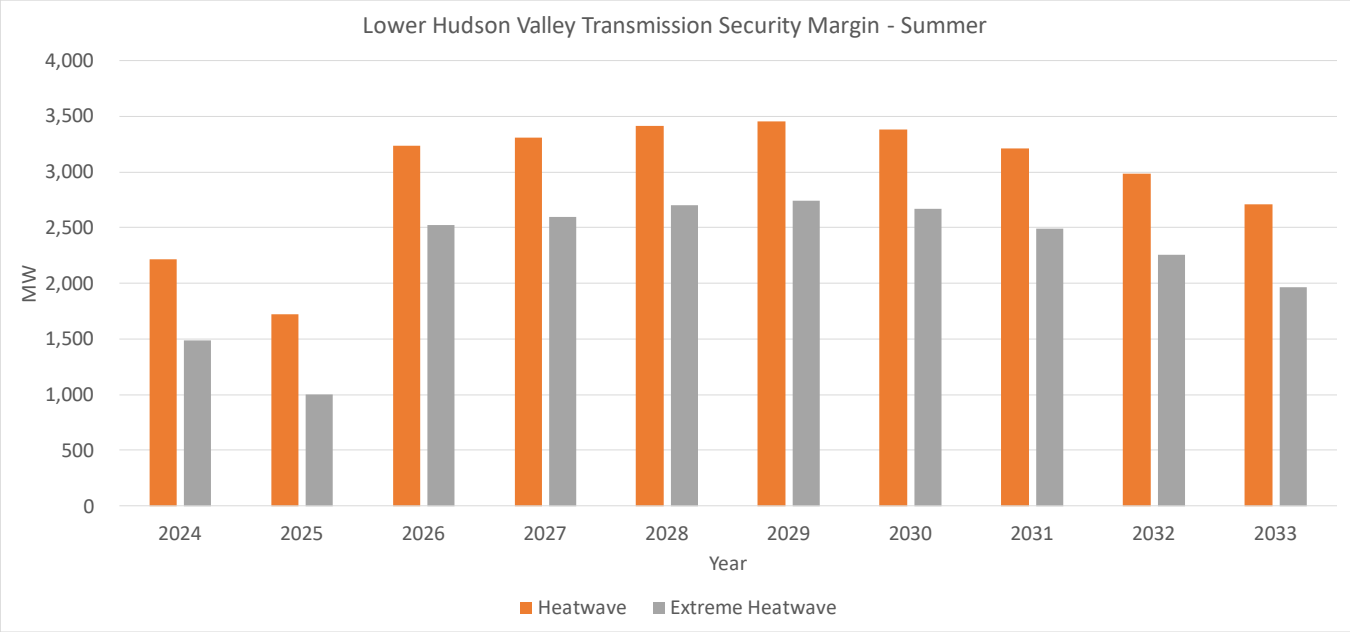


Figure 18: Long Island Transmission Security Margin for Heatwaves and Extreme Heatwaves

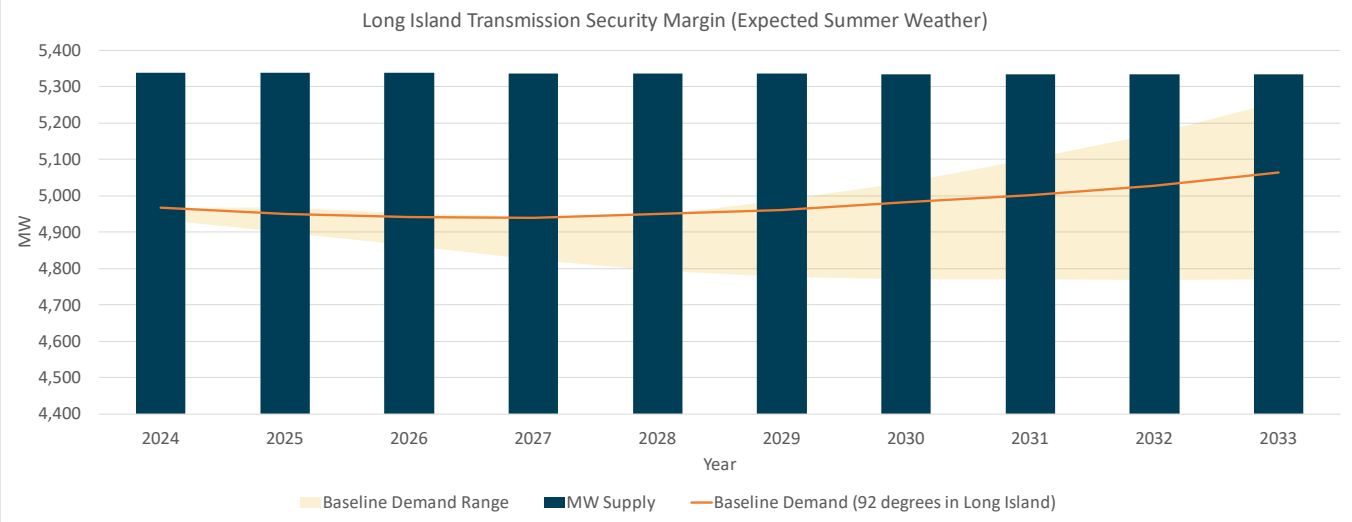
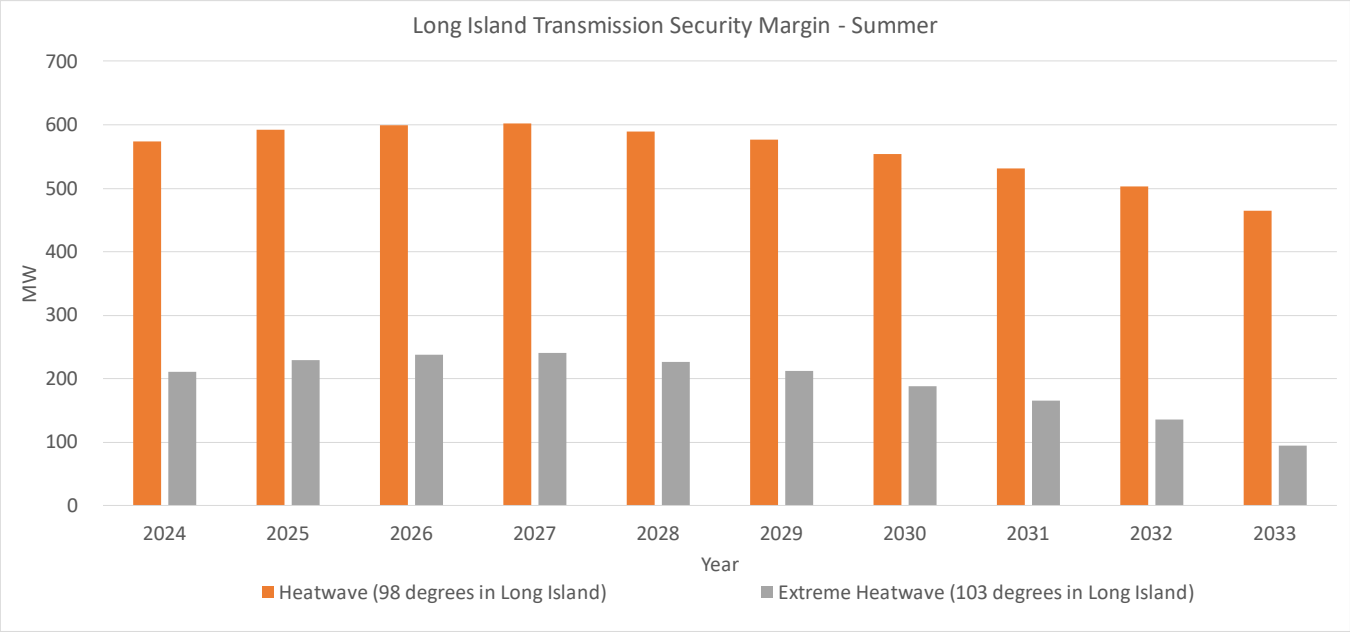


Figure 19: Long Island Transmission Security Margin for Heatwaves and Extreme Heatwaves



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. The 2023 Quarter 3 STAR, which is currently underway, includes these load interconnection and forecast changes.

Figure 20: Additional 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

The anticipated increases to the demand forecast reduce the available margins in all years. With the increased demand forecast in 2025, the 2023 Quarter 2 STAR scenario projected that the statewide system margin would be deficient by 145 MW. Based on the overall trend of the demand forecast, the 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 21**). In the near-term with the additional large loads included in the demand forecast, the margin remains deficient at 145 MW in summer 2025. As shown in **Figure 22**, with the addition of the CHPE project, the margin remains sufficient through year 2030. However, the margin becomes deficient by 261 MW in 2031, which worsens to 1,324 MW in 2033.

Figure 21: Statewide System Margin without Additional Large Loads

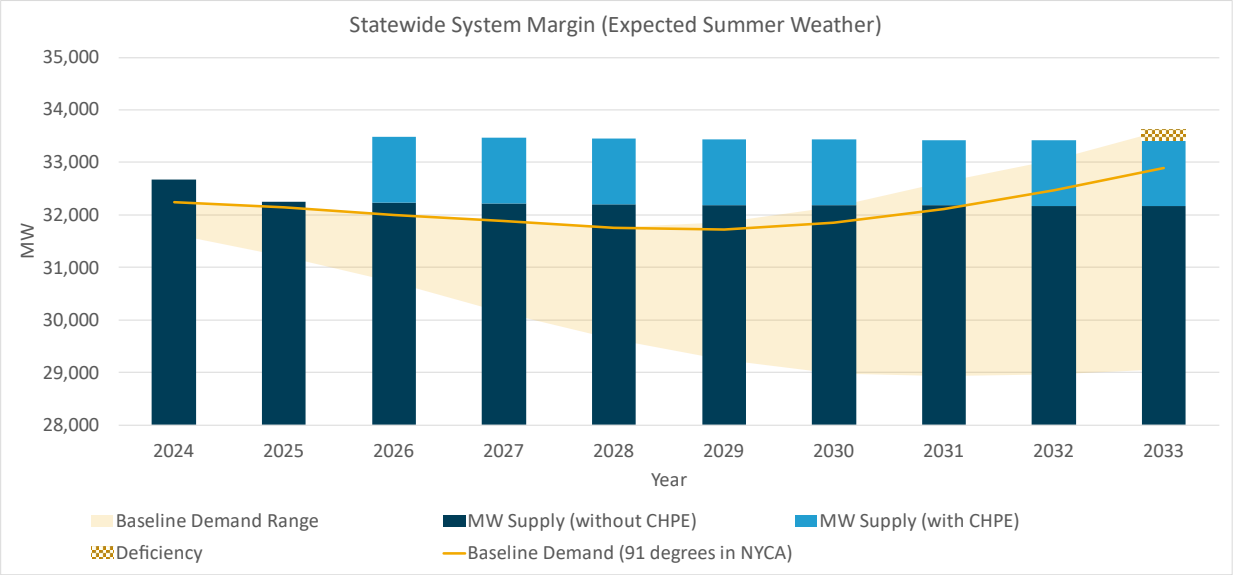
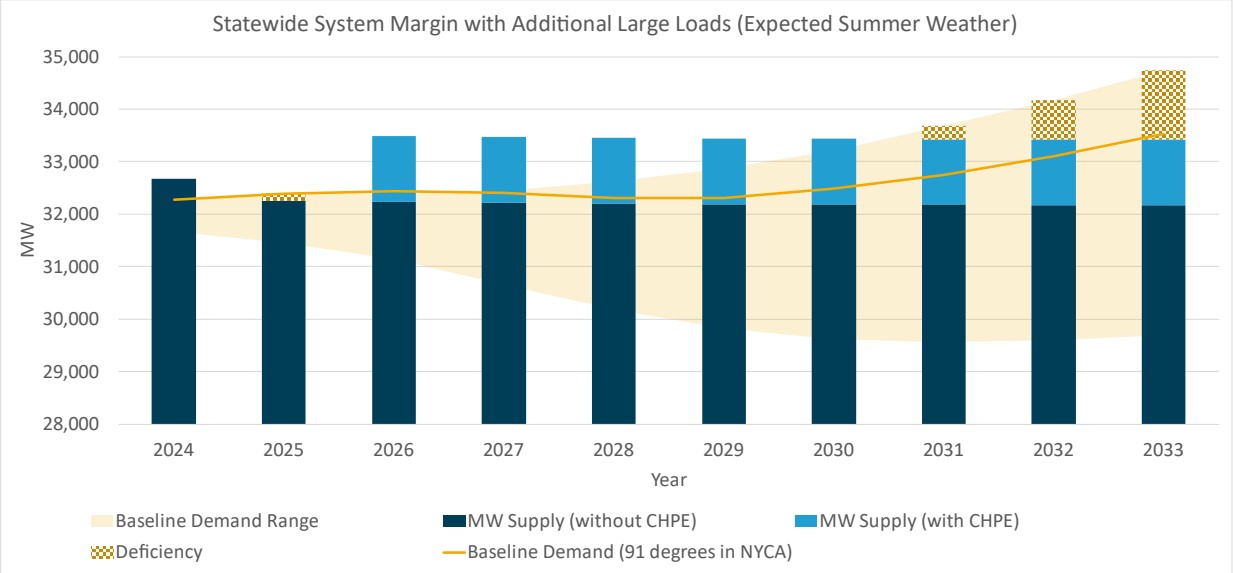


Figure 22: Statewide System Margin with Additional Large Loads



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 23: 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:

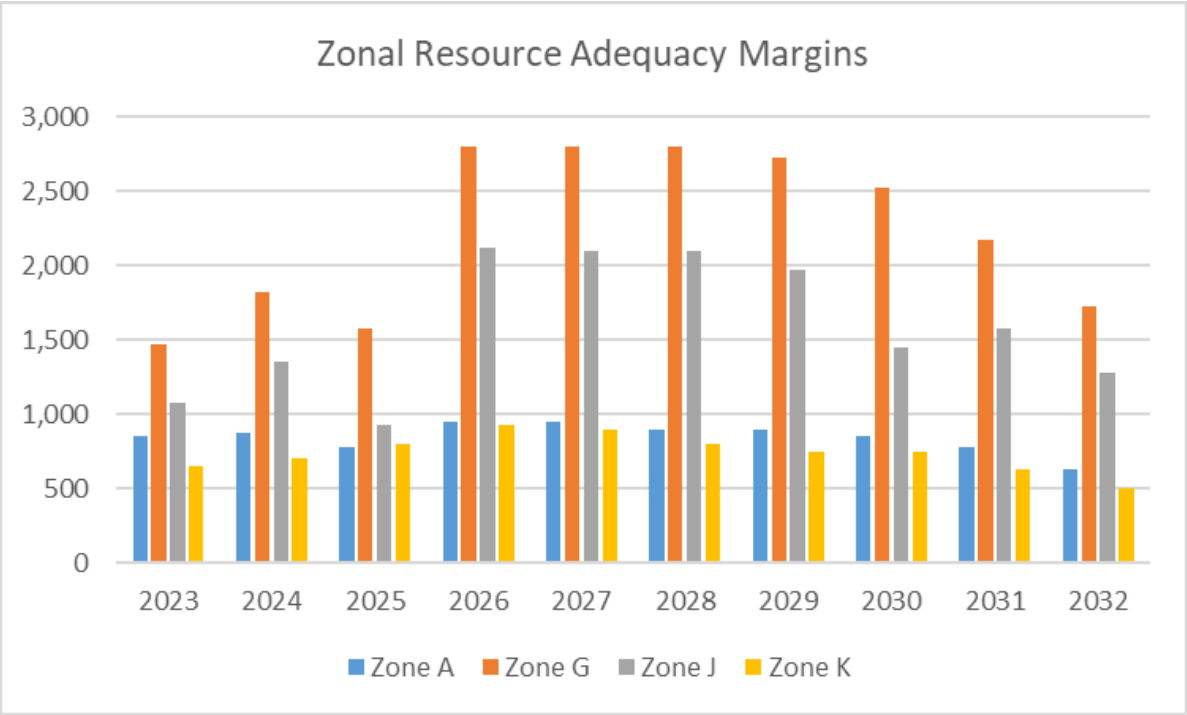
- LOLE: Loss of load expectation (days per year). The criterion is that the LOLE not exceed one day in 10 years, or LOLE < 0.1 days/year.
- LOLH: Loss of load hours (hours per year).
- EUE: Expected unserved energy (megawatt-hours per year).

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 24, 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 that 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 24: 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 25**, and the zonal resource margin analysis (ZRAM) is summarized in **Figure 26.**

Figure 25: NYISO Load Zone Map

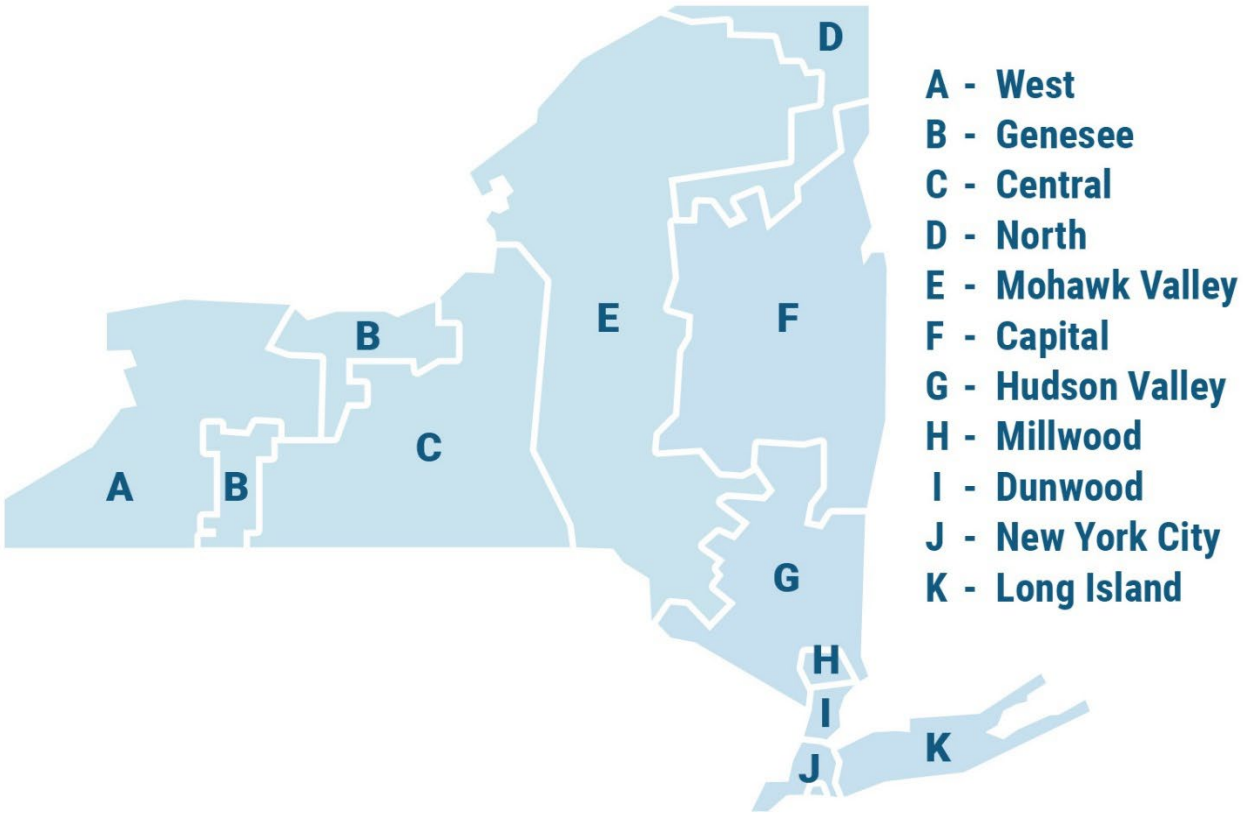


Figure 26: 2022 RNA Zonal Resource Adequacy Margins (MW)

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

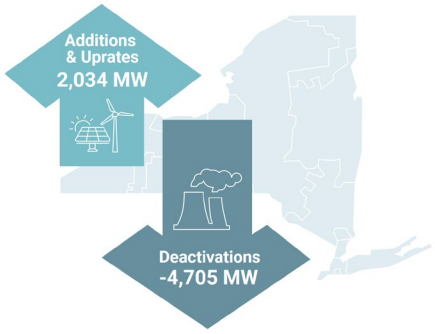
The Reliability Planning Process findings reflect the base case assumptions, which were set in accordance with applicable reliability rules and procedures. There are, however, numerous risk factors that could adversely affect the implementation of the plan and hence system reliability over the planning 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 since the enactment of the CLCPA (nameplate capacity)

Figure 27: 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.

As detailed in the 2023 Quarter 2 STAR, the system is deficient within New York City in year 2025 by 446 MW under the higher demand policy forecast. For the higher demand policy forecast, the transmission security margin is sufficient following the inclusion of the CHPE project in year 2026; however, the transmission security margin becomes deficient again in year 2032 by 88 MW worsening to 268 MW by 2033. Within New York City, a delay in the CHPE project would result in the margin remaining deficient for all years under the baseline load and higher demand policy scenario. With the lower demand policy scenario, the margin is extremely narrow margin in year 2025 and will remain positive, throughout the study period, even if there is a delay in the CHPE project.

Figure 28: Statewide System Margin for Expected Summer Weather

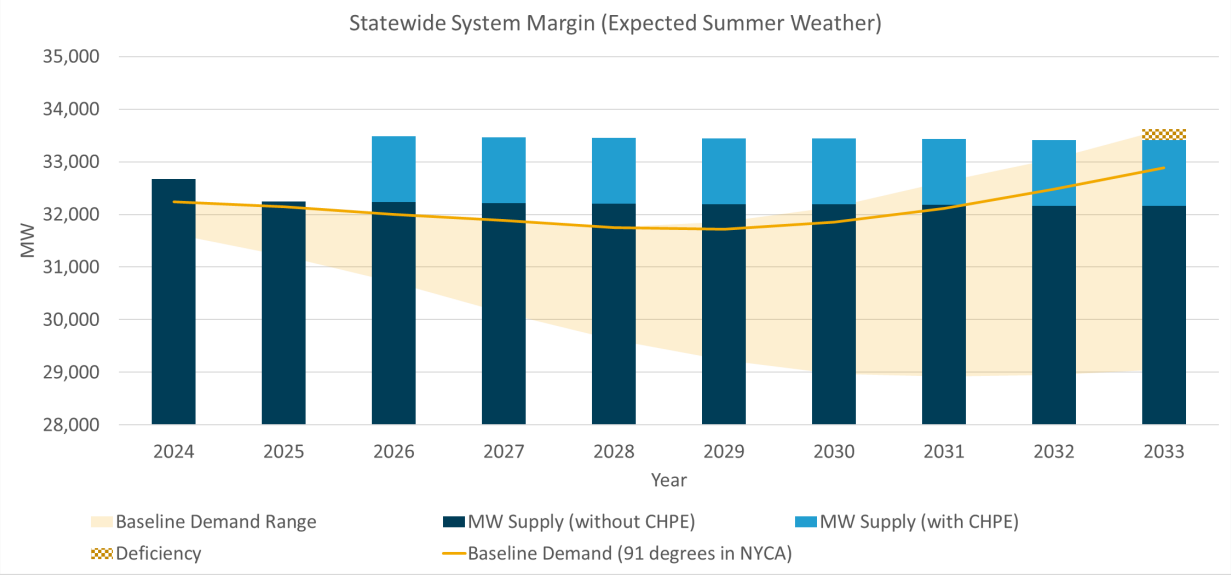
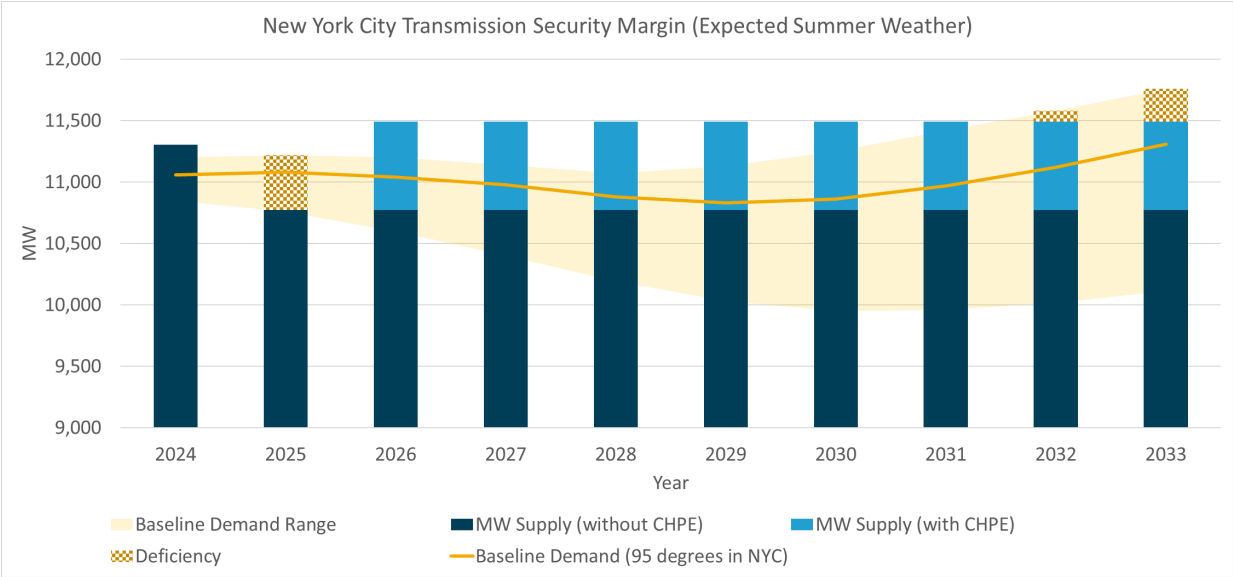


Figure 29: New York City Margin for Expected Summer Weather



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.

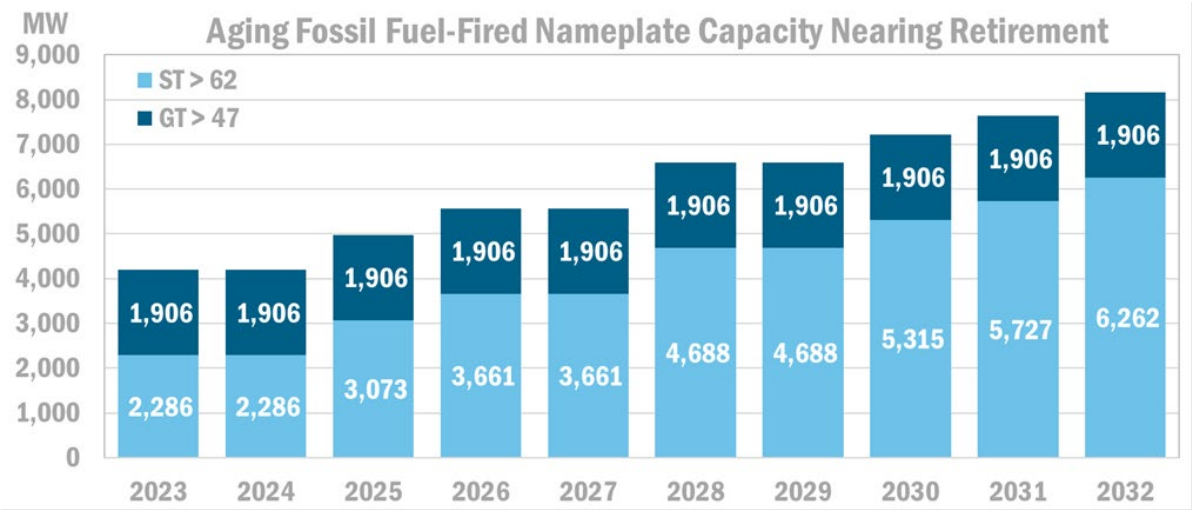
The base cases for those studies included approximately 2,000 MW of generating units assumed unavailable (some of the peaker units are assumed out of service in the May through October ozone season only). Their removal from the existing system representation is due to the units entering a deactivated 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 30**, 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 30: 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 within two years 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, unless those plants are determined 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. NYPA's plan is required to include recommendations to replace the plants with renewable energy systems, wherever appropriate. NYPA must file notice of deactivation with the NYISO for the purpose of ceasing electricity production in a "timeframe sufficient to facilitate the cessation of electricity production." 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

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

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 by 2033.

Figure 31: Units Affected by the May 2023 Legislation

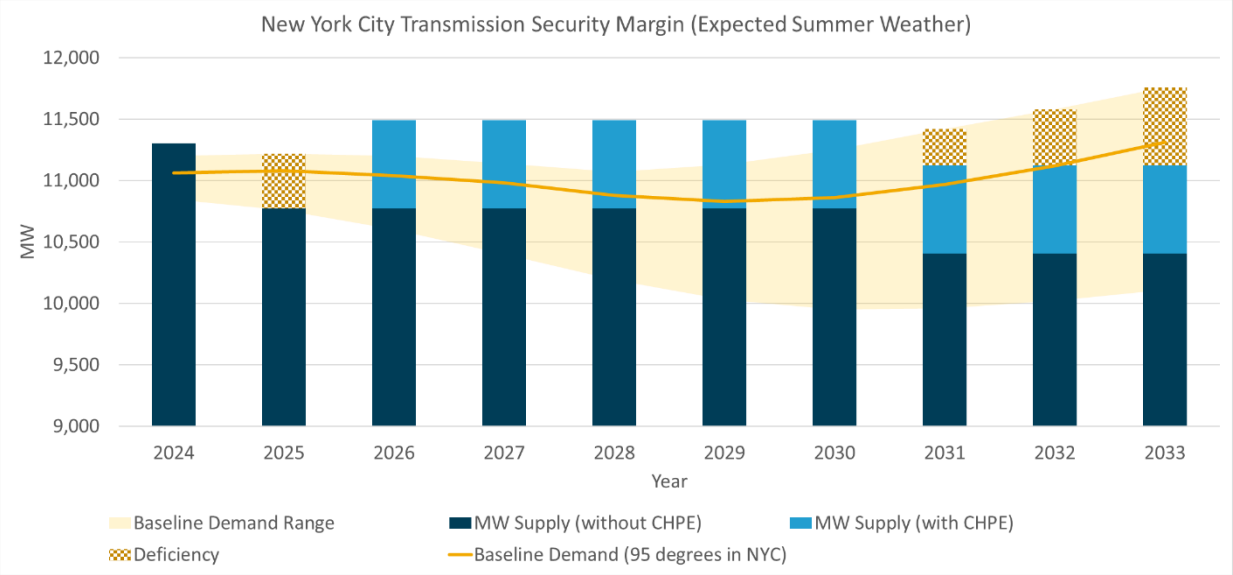
Owner/Operator	Station	Zone	Nameplate (MW)	CRIS (MW) (1)		Capability (MW) (1)		Status Change Date (2)
				Summer	Winter	Summer	Winter	
New York Power Authority	Gowanus 5	J	47.0	45.4	45.4	40.0	40.0	12/1/2030
New York Power Authority	Gowanus 6	J	47.0	46.1	46.1	39.9	39.9	12/1/2030
New York Power Authority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

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)

Figure 32: New York City Transmission Security Margins and the NYPA GTs May 2023 Order



iii) Economic Decisions

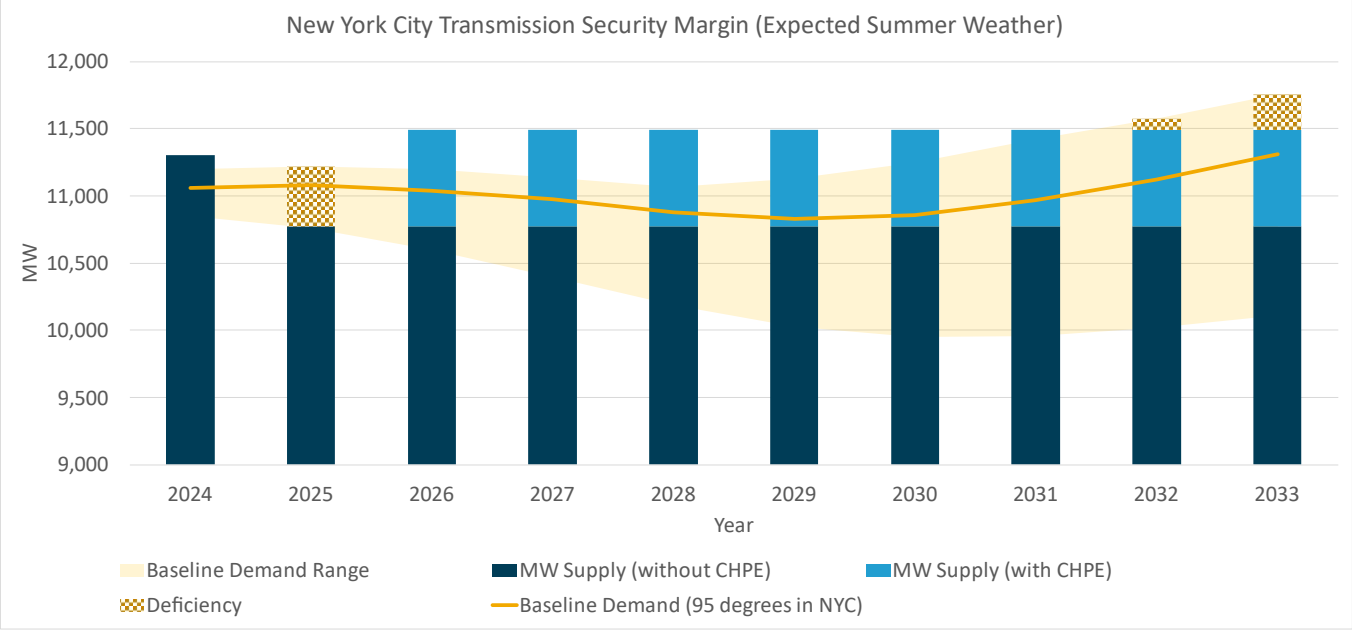
Capacity resources could also decide to offer into markets in other regions and, therefore, some of the capability of those resources may not be available to the NYCA. Accordingly, the NYISO will continue to monitor imports, exports, generation, and other infrastructure.

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 as shown in Figure 33.[17] Transmission security within Long Island (Zone K) is also maintained through the ten-year period as shown in

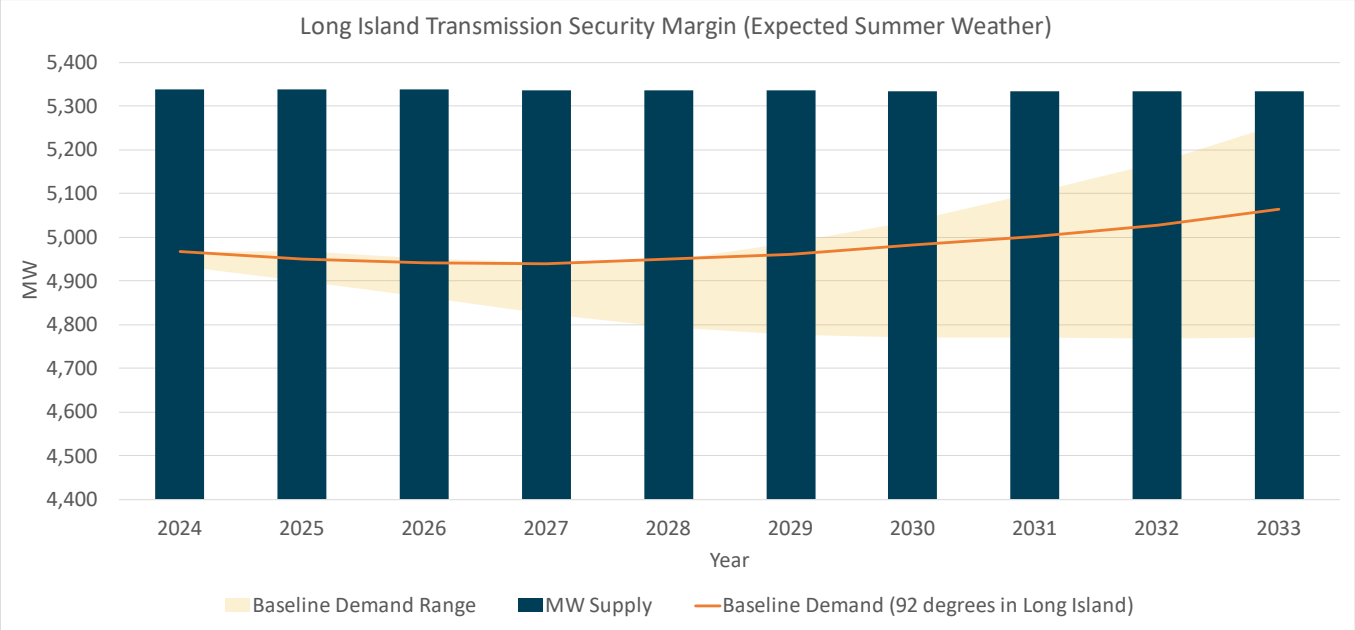
Figure **34**. If forced outages are experienced at the historical rate the Long Island margin would be sufficient through the study period. As detailed in the 2023 Quarter 2 STAR, the New York City transmission security margin is deficient in summer 2024 and then again as early as 2032. These findings 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 unavailability beyond what is already planned increases the risk of further reducing the transmission security margins as studied.

Figure 33: New York City Transmission Security Margin (Summer Baseline Peak Forecast – Normal Operations)



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

Figure 34: Long Island Transmission Security Margin (Summer Baseline Peak Forecast – Normal Operations)



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, 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 section Risk Factors to the Comprehensive Reliability Plan 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 device on the new Knickerbocker to Pleasant Valley 345 kV line is not activated.

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 any further delays to them entering service.

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

Increased Demand, Including Large Loads

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 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.

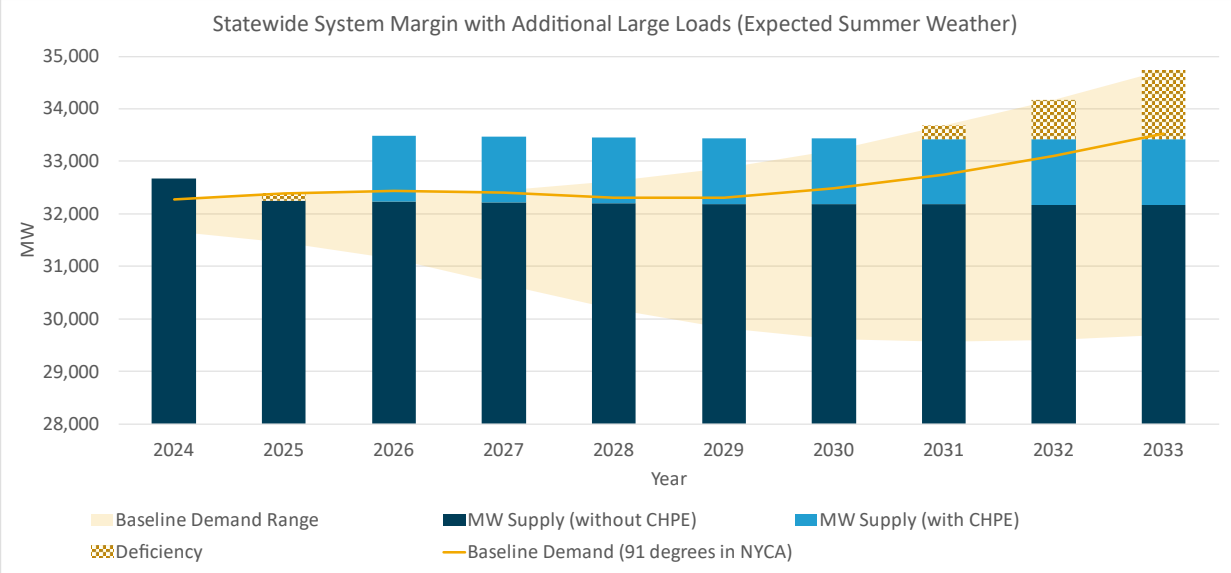
New York is projected to become a winter peaking system in future decades due to electrification, primarily via heat pumps and electric vehicles.

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.

This CRP accounts for several interconnection requests for large load installations in upstate New York; however, additional large loads have been proposed to be evaluated in the NYISO Interconnection process which may exacerbate zonal resource adequacy margins in Zones A, B, C, and D.[19] The NYISO will continue to report on energy usage and peak demand trends in its annual Load and Capacity Data Report (Gold Book) and assess any reliability impacts through its load interconnection process, quarterly STAR studies, and the 2024 Reliability Needs Assessment.

[19] Large load requests included are 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 additional proposed Large Loads in Zones, A, C, and D are currently undergoing the Interconnection process, including the proposed 480 MW Q1536 White Pine Phase 1 by New York Semiconductor Manufacturing LLC in Zone C.

Figure 35: Statewide System Margin with Additional Large Loads

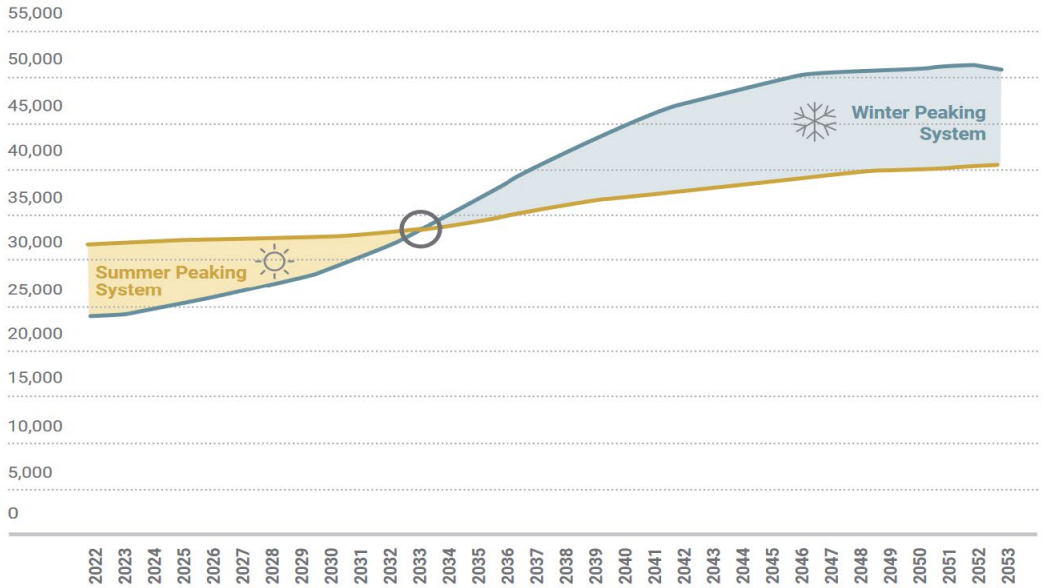


Winter Peaking and Gas Shortage Risks

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. EV charging load is higher on colder days due to reduced battery efficiency and 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 36: Summer and Winter Peak Demand Forecasts (MW)



In the 2022 RNA, the NYISO performed a scenario to assess winter reliability for cold snap and gas supply shortage conditions. With input from NYISO's ongoing fuel & energy security initiatives, approximately 6,300 MW of existing gas-fueled generation was identified as potentially at-risk under gas shortage conditions. Natural gas fired generation in the NYCA is supplied by various networks of major gas pipelines. From a statewide perspective, New York has a relatively diverse mix of generation resources.

The study conditions for evaluating the impact of the gas fuel supply shortages are identified in NPCC Directory #1 and the NYSRC Reliability Rules as an extreme system condition. Extreme system conditions are beyond design criteria conditions and are meant to evaluate the robustness of the system. However, efforts are underway nationally, regionally, and locally to review the established design criteria and conditions in consideration of heatwave, cold snaps, and other system conditions. For instance, FERC issued a Notice of Proposed Rulemaking in 2022 to "address reliability concerns pertaining to transmission system planning for extreme heat or cold weather events that impact the Reliable Operation of the Bulk-Power System."[20] In response to this NOPR, the NYISO supported the Commission's guidance to NERC and the industry at large that will help stakeholders plan for, and develop responses to, extreme heat and cold weather events.[21] Locally, the NYSRC has established goals to identify actions to preserve NYCA reliability for extreme weather events and other extreme system conditions.[22]

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

As shown in **Figure 37**, a cold snap with a statewide daily average temperature of 6 degrees Fahrenheit (1-in-10-year, or 90/10) has sufficient margin throughout the study period. Additionally, an extreme cold snap with a statewide daily average temperature of 0 degrees Fahrenheit (1-in-100-year, or 99/1) also has sufficient margin. However, under the extreme system condition of a gas fuel shortage the statewide system margin is deficient by winter 2031-32. These deficiencies would be exacerbated under cold snap and extreme cold snap conditions.

Figure 38 shows the New York City transmission security margin for similar winter weather conditions, including the gas fuel shortage condition. For New York City, in winter 2032-33 the system is deficient under the shortage of gas fuel supply conditions with a cold snap. The Lower Hudson valley and

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

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

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

Long Island localities show sufficient margins for all conditions throughout the study period.

Figure 37: Winter Weather Statewide System Margins

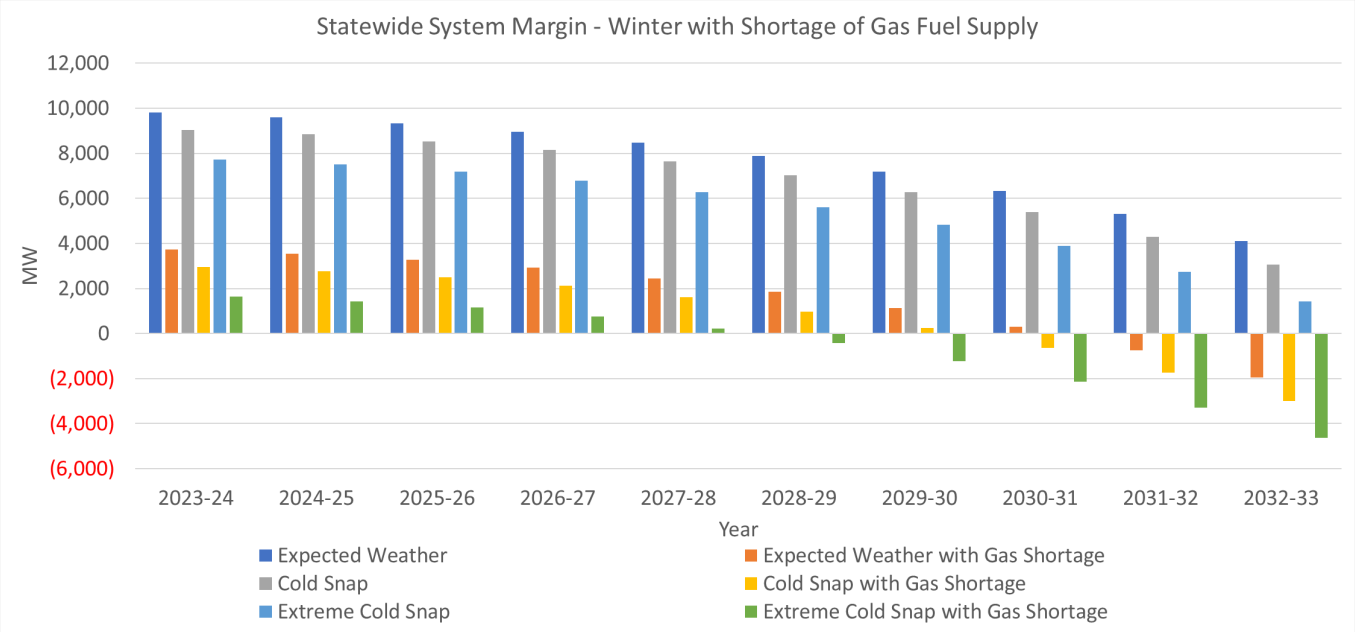
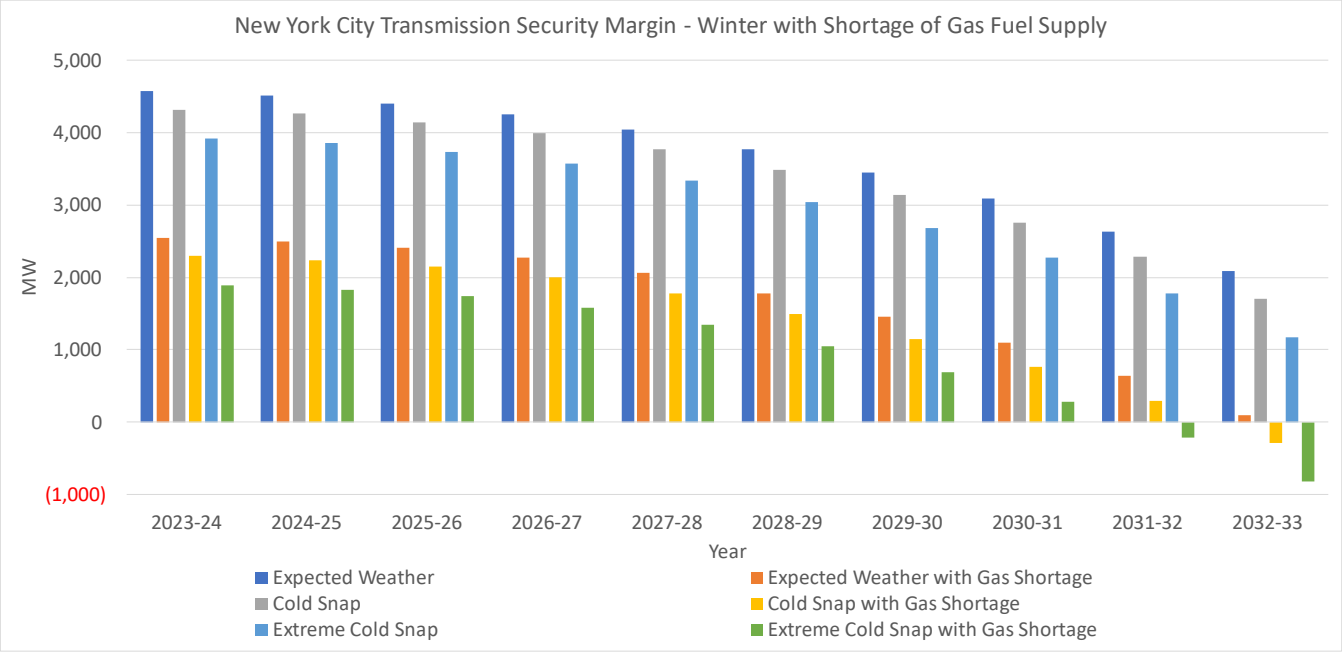


Figure 38: Winter Weather New York City Transmission Security Margins



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.

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 RNA showed an improvement in the system reliability if the import and export capabilities into Long Island are increased.

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.[23]

In consideration of these risk factors, the New York grid may cross a "tipping point" in future years such that the transmission system could not fully serve the demand. **Figure 39** shows the transmission security margin in New York City for a variety of plausible conditions. The baseline analysis of normal weather and limited generation outages shows a positive but narrowing transmission security margin across the ten-year period. The conditions evaluated in the 1-in-10-year heatwave (90/10) and 1-in-100-year extreme heatwave scenarios combined with the impact of forced generation outages result in deficiencies to serve demand in New York City in many of the years. **Figure 39** shows that most of these beyond-design conditions, such as a heatwave or generator outages, would result in deficiencies to serve demand in New York City considering the plans included in this Comprehensive Reliability Plan. 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 40** and **Figure 41**.

[23] https://www.nyiso.com/documents/20142/20968296/2021%20Summer%20Capacity%20Assessment%20-%20Updated%20Version.pdf

Figure 39: New York City Transmission Security Margin

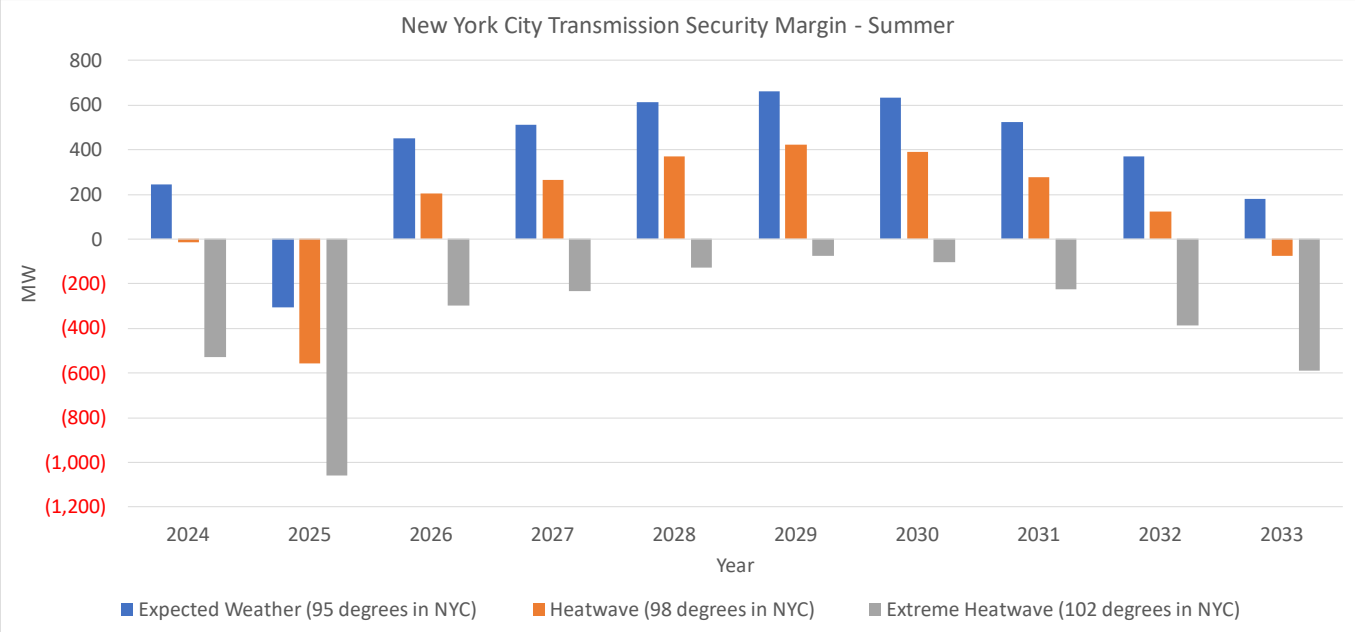


Figure 40: Long Island Transmission Security Margin

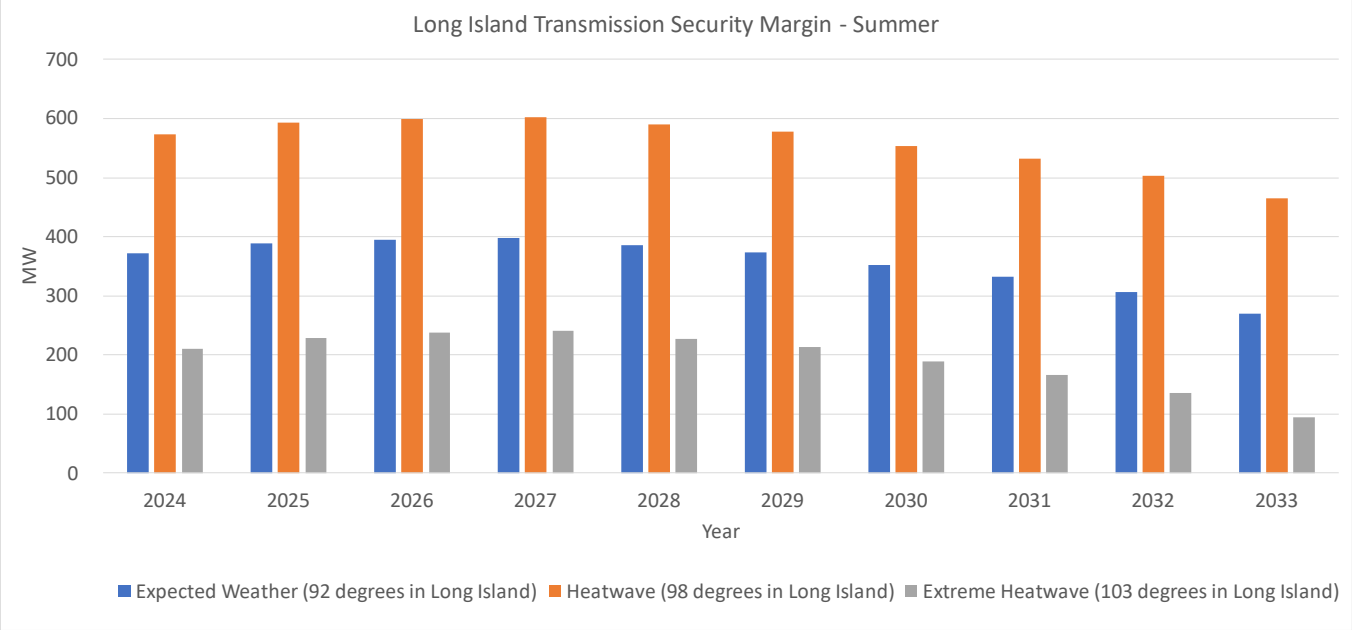
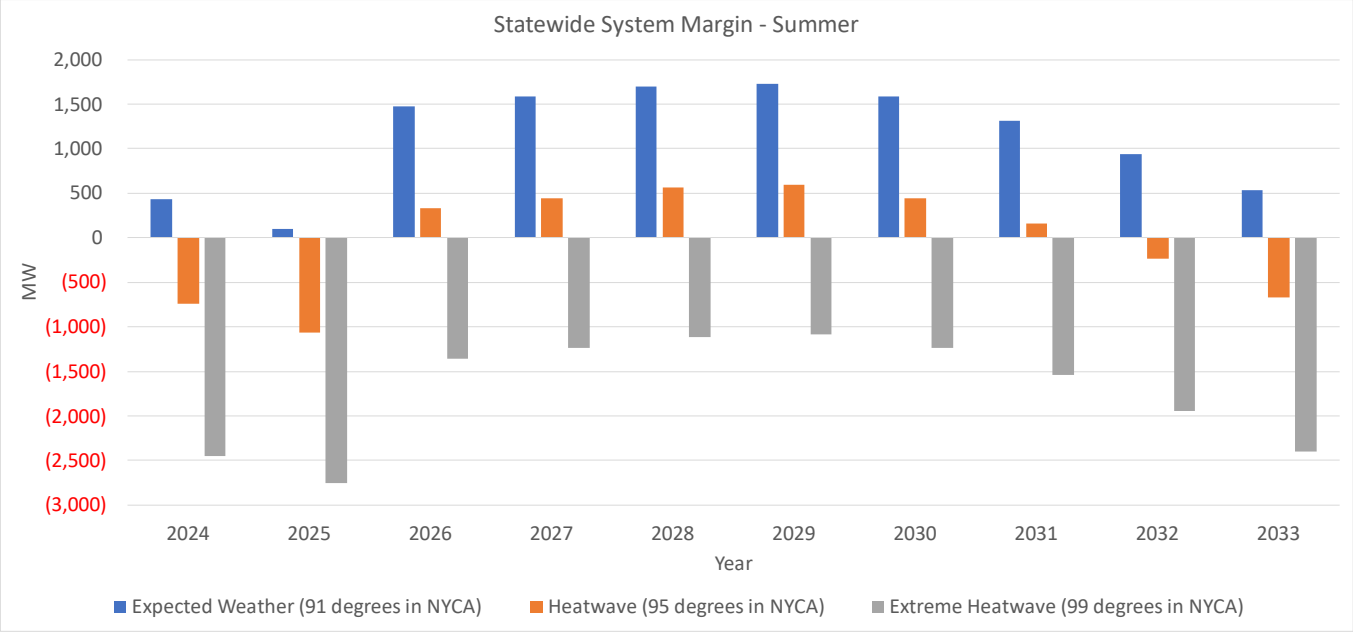


Figure 41: Statewide System Margin



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 changes are climate related, which will drive temperatures higher and result in higher electricity demand. Part of the changes are due to state policies in response to climate change. The CLCPA requires an economy-wide approach to addressing climate change and decarbonization.[24] 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 changes on the generation, transmission, and load components of the bulk electric system is critical to understanding the challenges in the coming year.

As part of the 2021-2040 System & Resource Outlook,[25] 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:

- The pace of renewable project development is unprecedented and requires an increase in the pace of transmission development. Every incremental advancement towards policy achievement matters on the path to a greener and reliable grid in the future, not just at the critical deadline years such as 2030 and 2040. In general, resource and transmission expansion take many years from development to deployment.
- Coordination of project additions and retirements is essential to maintaining reliability and achieving policy. Coordination of renewable energy additions, commercialization, and development of dispatchable technologies, fossil fuel plant operation, and staged fossil fuel plant deactivations over the next 18 years will be essential to facilitate an orderly transition of the grid.
- 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 plants3. Even with these additions, New York still may not be sufficient to fully meet CLCPA compliance criteria4 and maintain the reliable electricity supply on which New York consumers rely5. 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 are

[24] 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.

[25] 2021-2040 Outlook Report, published September 2022: https://www.nyiso.com/documents/20142/33384099/2021-2040-Outlook-Report.pdf.

liable 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.

- 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.
- Transmission limitations prevent full delivery of renewable energy. A minimum of 5 TWh of renewable energy in 2030 and 10 TWh in 2035 is projected to be curtailed due to transmission limitations in renewable pockets. This equates to roughly 5% less renewable energy that can be produced, and thus may not be counted toward the CLCPA targets.
- Transmission expansion is 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. Some renewable generation pockets throughout the State already face curtailments, more curtailments will be experienced in the future and will become more constrained as an increasing number of intermittent generation resources interconnect.
- Four pockets will particularly benefit from transmission expansion: The Finger Lakes, Southern Tier, Watertown, and Long Island. Without investment in transmission, these areas of the New York grid will experience persistent and significant limitations to deliver the renewable power from these pockets to consumers in the upcoming years.
- The challenges identified in the Outlook cannot be solved by any single entity. New York's Climate Action Council has released a draft scoping plan [link] to reduce New York State's carbon footprint across all sectors, make our communities more resilient, and adapt to a changing climate. This plan further supports the state's mission by quantifying the evolving challenges in the electricity sector resulting from widespread beneficial electrification and making recommendations to address those challenges. In addition to much more renewable resources, this plan identifies other key factors for success, such as significant transmission expansion, and efficient peak load management. The full set of comprehensive electric system requirements will need participation among policymakers, generator owners, transmission owners, and consumers. Communication and collaboration between stakeholders are essential to making progress toward achieving policy objectives while maintaining an efficient power market and reliable power grid.

Demand: Electrification and Extreme Weather

[TO BE COMPLETED LATER]

Generation: Complete Shift in Technology

[TO BE COMPLETED LATER]

Intermittent Resources: Limited Availability and Dispatchability

[TO BE COMPLETED LATER]

Most renewable generation is intermittent, and intermittent resources are not fully dispatchable due to the variability of their "fuel" source. 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 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 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. Sufficient resources to address all conditions will be necessary to provide continued reliability.

Inverter-Based Technology

[TO BE COMPLETED LATER]

Most renewable generators will be connected to the grid asynchronously through power electronic devices (i.e., inverter-based resources). The characteristics of inverter-based resources are different than conventional synchronous generation. Without significant mitigation measures, a shift to inverter-based resources may result in flickering lights and disruptions to industrial processes and consumer electronics. The ability of inverter-based resources 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 inverter-based resource. Inverter-based resources 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. Inverter-based resources 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.

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

[TO BE COMPLETED LATER]

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

As the level of renewable resource generation increases, the grid will need sufficient flexible and dispatchable resources to balance variations in wind and solar output. The integration of batteries will help store renewable energy for later use on the grid and is poised to help with the short duration and daily cycles of reduced renewable output. 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 meeting the objectives of 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 NY PSC issued an Order to initiate a process to identify technologies that can close the anticipated gap between the capabilities of existing renewable energy technologies and future system reliability needs. Within the order, 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 order further elicits feedback from stakeholders on how to best design a zero-emissions by 2040 program, consistent with the Climate Act's requirements. Over the next several years, NYISO market projects 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 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 New York Public Service Commission (PSC), the NYISO has already selected three major public policy transmission projects to enable the delivery of renewable energy to consumers across New York State. These projects are scheduled to enter service within the next few years. 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. 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 Transmission Owners' Coordinated Grid Planning Process. The New York Utilities' proposal was filed with PSC on December 27, 2022 to respond 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.