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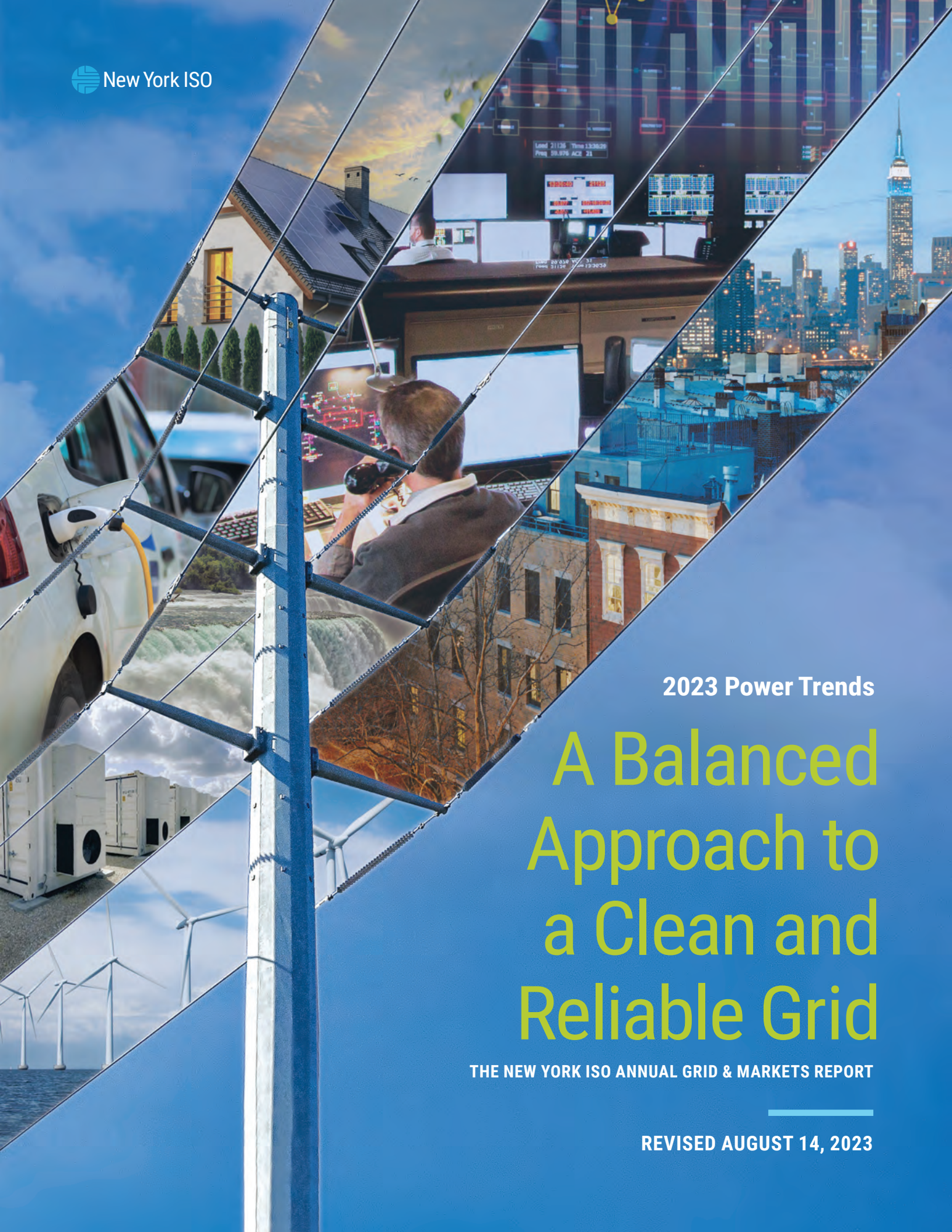


2023 Power Trends

A Balanced Approach to a Clean and Reliable Grid

THE NEW YORK ISO ANNUAL GRID & MARKETS REPORT

REVISED AUGUST 14, 2023

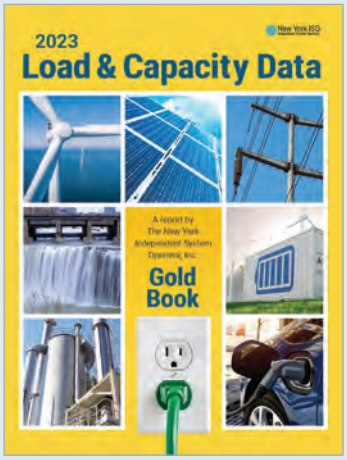
New York ISO

POWER TRENDS 2023 is the NYISO's annual analysis of factors influencing New York State's power grid and wholesale electricity markets. Begun in 2001 as *Power Alert,* the report provides a yearly review of key developments and emerging issues. Originally published June 7, 2023, *Power Trends 2023* was republished on August 14, 2023 to reflect the issuance of the NYISO's Second Quarter 2023 *Short-Term Assessment of Reliability*, selection by the NYISO's Board of Directors of a transmission solution to address the Long Island Public Policy Transmission Need, and the New York State Public Service Commission's recent declaration of a new Public Policy Transmission Need for the injection of offshore wind into New York City.

POWER TRENDS 2023 DATA is from the *2023 Load & Capacity Data* Report (also known as the Gold Book), unless otherwise noted.

Published annually by the NYISO, the *Gold Book* presents New York Control Area system, transmission and generation data and NYISO load forecasts of peak demand, energy requirements, energy efficiency, and emergency demand response; existing and proposed resource capability; and existing and proposed transmission facilities.

The *Gold Book* and other NYISO publications are available on the NYISO website, visit www.nyiso.com



THE NEW YORK INDEPENDENT SYSTEM OPERATOR, INC. (NYISO) is a not-for-profit corporation responsible for operating the state's bulk electricity grid, administering New York's competitive wholesale electricity markets, conducting comprehensive long-term planning for the state's electric power system, and advancing the technological infrastructure of the electric system serving the Empire State.

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From the CEO

On behalf of our team at the New York Independent System Operator, welcome to the 2023 edition of *Power Trends*.

Power Trends is our flagship publication, summarizing and discussing key issues shaping the grid of the future. In *Power Trends* you will learn about our **Mission** of ensuring power system reliability and competitive markets for New York in a clean-energy future. You will also come to understand our **Vision** of working with all stakeholders to build the cleanest, most reliable electric system in the nation.

New York's public policies are increasingly prioritizing clean energy production and a rapid transition away from fossil fuels. As articulated in *Power Trends*, it is imperative that during this time of rapid change we maintain adequate supply necessary to meet a growing demand for electricity. Achieving this balance will be the central challenge to the industry and New York State in the coming years.

The electric system is the backbone of our economy. It preserves the health and safety of all New Yorkers. At the NYISO, we are champions of the essential role the grid provides in our daily lives. Since the NYISO's inception in 1999, preserving electric system reliability has been our top priority in the face of great change, whether it be societal, policy-based, or more frequent extreme weather. As older resources retire and new resources transform the way the system responds, this commitment will remain. The NYISO's recently issued Short-Term Assessment of Reliability report for the second calendar quarter of 2023

demonstrates the importance of maintaining system reliability during the grid in transition. Further, competitive electric markets will continue to provide cost efficiencies and strong investment signals while shifting that investment risk away from the consumer.

All of us at the NYISO are committed to a continued strong partnership with lawmakers, policymakers, market participants and industry stakeholders to address priorities set forth under the Climate Leadership and Community Protection Act (CLCPA). In keeping with our objective as the authoritative source of information on the electric industry, this year's *Power Trends* provides a summary of opportunities for success in this regard. *Power Trends* also presents long-term solutions to address the various challenges facing New York's grid and achievement of the state's climate mandates.

Our promise is always to provide our independent, fact-based perspective and expertise to assist in the reliable transition to a zero-emission power system. We are proud of that work, the role we play in serving New York, and we are excited for the future.

Finally, thank you for reading.

Rich Dewey

Rich Dewey,
President & CEO

Information For Policymakers

Through expert system operations, planning, and wholesale electricity market design, the NYISO is working to identify the reliability needs of the future grid envisioned by New York's nation-leading climate policy goals. We will continue to engage policymakers and our stakeholders to design and implement the operations, planning and market enhancements necessary for the grid in transition, consistent with our mission and vision.

Learn more about the issues currently impacting New York's grid and the NYISO's role in this transition:

Planning For Reliability

- > Grid in Transition
- > Addressing Transmission Needs
- > Interconnection Process
- > Planning Process

Wholesale Electricity Markets

- > Competitive Wholesale Electricity Markets
- > How Markets Can Support Climate Goals
- > Electricity Prices in New York

Our Independence and Transparency

- > History
- > Regulatory and Reliability Organization Oversight
- > Independence

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Executive Summary

The reliability of the electric system is an essential component for a vibrant economy, and necessary to ensure the health and safety for all New Yorkers. At the same time, battling the detrimental effects of climate change is imperative. The NYISO is committed to a carefully planned approach to enable a reliable grid transition. We are also committed to meeting state and federal policy objectives.

State climate and energy policy objectives are driving rapid and dynamic change to decarbonize New York's electric system, building stock and transportation sector. The New York State power system is operated to the strictest reliability standards in the nation. This places New York at the forefront in balancing the need to address the harmful impacts of climate change, while delivering reliable electric service to consumers.

The pace of change is accelerating with the increased adoption of electric vehicles, and electric heating equipment to replace fossil fuel sources of building heat. In the New York City metropolitan area, data shows a continued rise in economic activity coming out of the pandemic. Across upstate New York, energy intensive microchip manufacturing facilities are developing in several locations. Together, these elements are increasing

Power Trends Key Messages

> Public Policies are driving rapid change in the electric system in the state, impacting how electricity is produced, transmitted, and consumed.

> As highlighted by the NYISO's recent Short-Term Assessment of Reliability, growth in forecasted electricity demand driven by economic factors and electrification programs, along with generators retiring at a faster pace than new supply and transmission capability is entering service, are leading to reliability needs on the grid as soon as 2025.

> Driven by public polices, new supply, load and transmission projects are seeking to interconnect to the grid at record levels. The NYISO's interconnection process balances developer needs with grid reliability. Efforts are underway to make this process more efficient while protecting grid reliability.

> To achieve the mandates of the CLCPA, new emission-free supply with the necessary reliability services will be needed to replace the capabilities of today's generation. Such new supply is not yet available on a commercial scale

> New wholesale electricity market rules are supporting the grid in transition. These markets are critical for a reliable transition.

The NYISO is committed to a carefully planned, balanced approach to enable a reliable grid transition. We are also committed to meeting state and federal policy objectives.

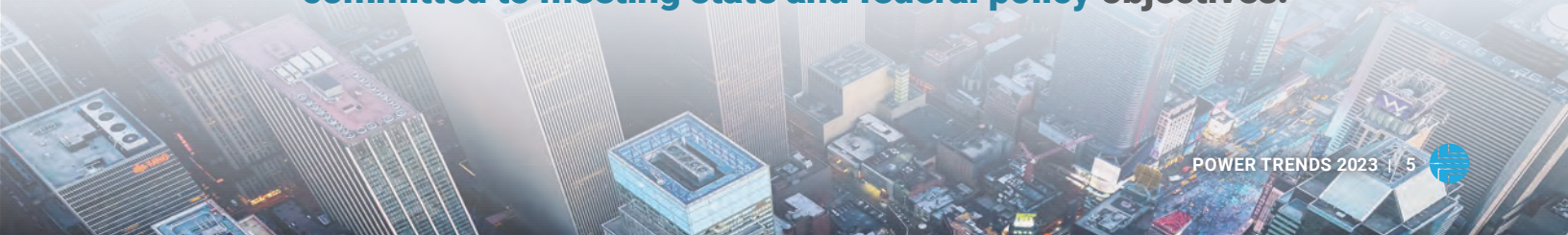
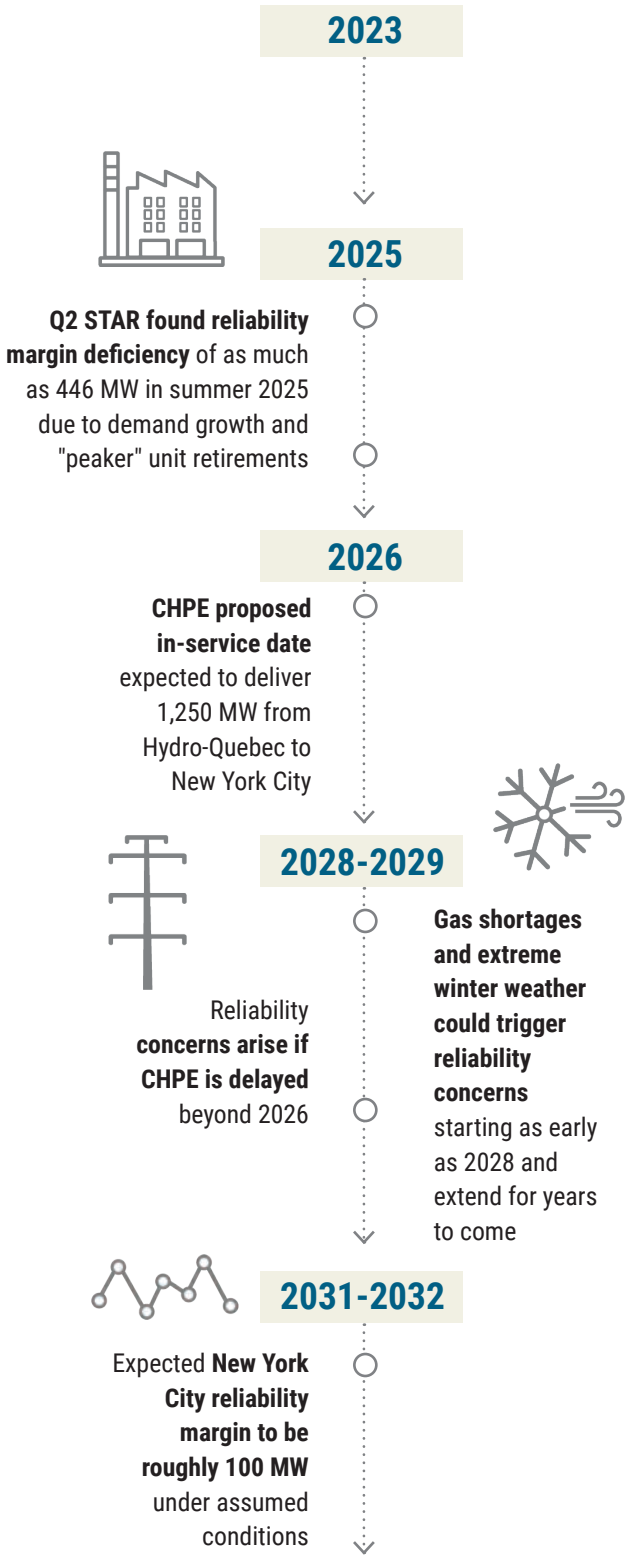


FIGURE 1: **RELIABILITY RISK SCENARIOS TIMELINE**



demand for electricity. **However, pursuant to public policies, fossil fuel generation is retiring faster than renewable resources are entering service, leading to declining reliability margins across the state, but most acutely in the New York City area.**

State policies, specifically the Climate Leadership and Community Protection Act (CLCPA), require an emission-free electric system by 2040. As the independent grid operator in New York, our mission is to ensure a reliable electric grid during the transition to the new clean energy technologies that will support the economy and the health and safety of New Yorkers. To achieve this, new clean energy supply will need to interconnect to the grid at a pace commensurate with the departure of existing supply. **Just as importantly, new supply in total must provide reliability services comparable to departing supply so that, in aggregate, the grid remains reliable and resilient through this transition and beyond.**

The NYISO evaluates the reliability implications of this transition on a regular basis, conducting a variety of studies that help determine if reliability could be at risk in the future. Our *Reliability Needs Assessment* (RNA) and *Comprehensive Reliability Plan* (CRP) and quarterly *Short-Term Assessment of Reliability* (STAR) analyses regularly assess the state of change on the grid and determine what new resources and transmission upgrades may be needed to maintain reliability.

We also perform quarterly Short-Term Assessments of Reliability (STAR) that look ahead five years to identify risks to reliability. These reports evaluate the state of change on the grid and identify resource capability needed to maintain reliability. **Of note, the NYISO's second quarter 2023 STAR report, issued in July 2023, found a deficit in reliability**

margins for the New York City area beginning in summer 2025. The deficit is as large as 446 MWs. Factors driving the identified reliability need include increased electrification of the transportation and building sectors, continued economic growth following the COVID-19 pandemic, and the unavailability or retirement of select generators under the New York State Department of Environmental Conservation's "Peaker Rule." As of May 2023, the Peaker Rule has resulted in the closure or reduced operation of approximately 950 megawatts of generation in New York City. An additional 500 megawatts of generation is expected to limit or discontinue operations in 2025 in response to these new emissions limitations.

The Peaker Rule includes provisions that allow generation to remain in operation for limited timeframes to address reliability needs arising from their deactivation. These important provisions serve as a model for policymakers to consider when developing new requirements impacting the retirement of existing generation and the associated reliability of the grid.

These studies and others highlight the importance of a balanced and carefully planned transition from the power system of today to the clean-energy grid is essential to avoid the risks to reliability experienced recently in other areas of the United States. According to the NYISO's System and Resource Outlook report, fulfilling the objectives of the CLCPA and other state, federal and local climate policies will require an unprecedented level of investment in new supply and transmission infrastructure at a time when reliability margins are thinning. NYISO's System and Resource Outlook report and New York State estimates indicate that our state will need to triple the amount of clean energy supply currently on the grid by 2040 to achieve the zero-emission electricity supply required by the CLCPA. Economic and technological uncertainties, geopolitical issues, siting and permitting uncertainties, and persistent supply chain constraints affecting the power industry on a global scale are impacting the pace of investment in New York.

The CLCPA mandates decarbonization of the electric system as well as the transportation and building sectors. **Protecting the economy and the health and safety of all New Yorkers also demands that the electric system must remain reliable during the transition**. The NYISO's core mission is to ensure reliability of the grid in New York. Recent electric system outages in other areas of the United States are reminders of the humanitarian and economic crises that arise from extended large-scale outages.

Electric supply from solar and wind resources is intermittent because those resources are dependent upon weather conditions and are unable to increase output to respond to changing system conditions. Energy Storage Resources (ESRs) offer great promise, but the amount of energy they can contribute to the grid, and the length of time they can perform, is limited today. By 2040, to achieve the mandates of the CLCPA, new emission-free generating technologies with the necessary reliability service attributes will be needed to replace the flexible, dispatchable capabilities of fossil fuel generation and sustain production for extended periods of time. Such emission-free technologies, either individually or in aggregate, are not yet available on a commercial scale

In response to the CLCPA and other public policies, the number of transmission and supplier projects seeking to interconnect to the grid in New York has more than quadrupled since 2019. The interconnection process ensures open access for new supply, transmission, and large consumers of electricity, and is an essential element in maintaining the performance and reliability of the grid. The

process is coordinated by the NYISO but requires significant involvement by both the electric utilities and developers. Each party plays an important role in the success of the process. **To address the increase in projects, the NYISO is working with stakeholders to implement improvements to the efficiency of the interconnection study process while maintaining grid reliability.**

Several transmission projects are under construction and expected to be in operation by 2026. These projects are essential to achieving the state's climate and energy goals and expanding the delivery of clean energy to consumers. However, additional transmission investments will be necessary to efficiently integrate offshore wind resources and address transmission constraints throughout the state that otherwise limit the ability to deliver renewable energy to consumers. NERC's 2023 Summer Reliability Assessment identifies reduced supply reserve margins in regions neighboring the NYISO in its risk analysis. These reduced margins potentially limit the ability to import electricity from neighboring regions, putting greater importance on available supply and transmission within New York.

The competitive wholesale electricity markets administered by the NYISO are an important tool to help mitigate the developing risks described above by incentivizing the most cost-effective solutions for consumers. The markets send price signals for new market entry and retention of resources necessary for maintaining reliability at the lowest cost. Future reliability risks and resource needs may be resolved by new supply coming into service, construction of additional transmission facilities, and/or increased energy efficiency and integration of demand response resources. **A balanced approach to the retirement and addition of resources is essential for grid reliability, economic efficiency, and the environment.**

Managing the grid reliably through this transition is the NYISO's mission.

The NYISO's wholesale electricity markets continue to lead the way toward a cleaner, resilient, and efficient electricity grid. In 2022, the Federal Regulatory Energy Commission (FERC) accepted the NYISO's groundbreaking proposal to enhance capacity markets for investment in new clean energy technologies. These reforms serve as a new national model for wholesale electricity market design, addressing the issue of federal versus state oversight of capacity markets while also strengthening reliability and economic efficiency. Additional market enhancements are underway to help meet the requirements of public policy, strengthen the grid, and position the competitive markets for future technologies.

Managing the grid reliably through this transition is the NYISO's mission. The NYISO's expertise in operating the power system in the state is essential for a reliable grid in transition. The NYISO's independent, fact-based planning studies will continue to inform market participants, developers, and policymakers on the implications of public policies, technological advancements, and economic investment conditions impacting the needs of the grid and the pace of change on the electric system.

Mission

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

Vision

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

A Powerful Purpose

Maintaining
and enhancing regional reliability

Operating
open and fair wholesale electricity markets

Planning
the bulk power system for the future

Providing
factual information to policymakers, stakeholders and investors

Regulatory & Reliability Organization Oversight

The NYISO serves New Yorkers under the oversight of the **Federal Energy Regulatory Commission,** the **New York Public Service Commission,** the **North American Electric Reliability Corp.,** the **New York State Reliability Council,** and the **Northeast Power Coordinating Council.**

Shared Governance

This process **engages suppliers, transmission owners, consumers, environmental and environmental justice interests, and state organizations** to facilitate the development of the rules and processes for a reliable and economically-efficient grid in New York.

Independence

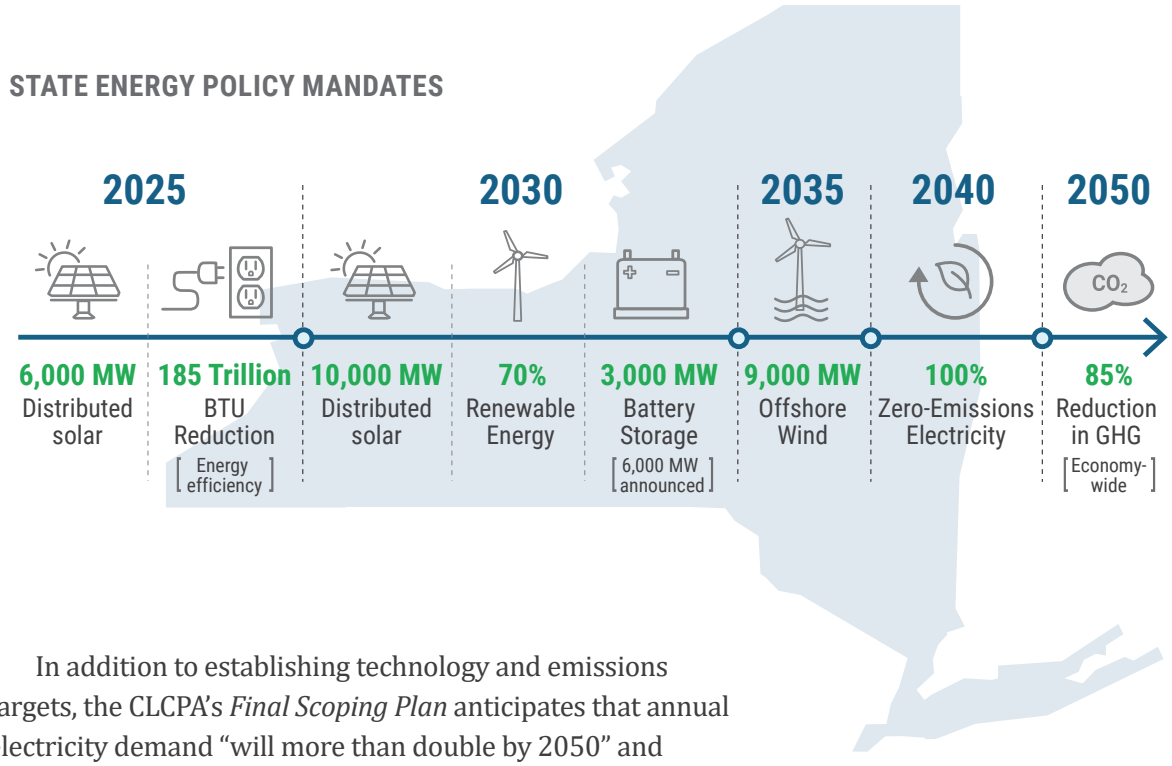
The NYISO is transparent, open, and independent of its stakeholders. We are a registered 501(c)3 not-for-profit corporation. NYISO and its directors, executives ad employees are prohibited from having financial interests in any company participating in New York wholesale competitive electricity markets.

New York's Electricity Landscape

New York's renewable energy and environmental requirements are driving profound changes on the electric system. State and local requirements have created what are arguably the most ambitious energy and environmental policies in the nation. The questions of how to maintain system reliability and cost efficiency as we progress towards the state's objectives are central issues for the NYISO, our stakeholders, and policymakers.

Each second, every day, the NYISO operates the New York power system to the strictest reliability standards in the nation. The NYISO's markets, operations, and planning responsibilities are regulated by the FERC and, in certain aspects, by the New York State Public Service Commission (NYPSC). Reliability standards and rules established by the North American Electric Reliability Corporation (NERC) and the Northeast Power Coordinating Council (NPCC) shape our operations, planning, and cybersecurity rules and practices. Given the unique aspects of the New York power system, and New York City's importance as an economic center for the nation, the New York State Reliability Council (NYSRC) was created to establish state-specific reliability rules.

Each second, every day, the NYISO operates the New York power system to the strictest reliability standards in the nation.



In addition to establishing technology and emissions targets, the CLCPA's *Final Scoping Plan* anticipates that annual electricity demand "will more than double by 2050" and calls for enhancements to the electric grid to "improve the efficiency, delivery, and reliability of electricity, facilitate the integration of renewable energy, and prioritize clean resources consistent with the Climate Act." This combination of mandates for clean energy production and significant added demand on the grid is creating challenges and complications for balancing load with supply.

Adding to the challenge is pressure to eliminate fossil fuel generating resources from the grid, which has the net effect of causing generation to exit the grid faster than new resources can be added. The most pressing example of these forces is the New York State Department of Environmental Conservation's "Peaker Rule." Adopted at the end of 2019, the Peaker Rule is impacting approximately 3,300 megawatts (MW) of dispatchable and flexible electricity generation, primarily downstate. The rule, which imposes stricter nitrogen oxide emission rate caps, takes effect in 2023 and imposes even stricter limits in 2025. This reduction in supply is coming at a time when demand is expected to grow in response to electrification policies and economic conditions.

Importantly, the Peaker Rule includes a reliability consideration that allows for generation to remain in operation for up to four additional years if reliability needs arise from their deactivation.

Planning for the Peaker Rule

> Quarterly, the NYISO and the impacted utilities evaluate the reliability needs from deactivations, load growth, changes to the transmission system, other factors.

> If a reliability need is identified, the NYISO solicits and selects solutions to address the need.

> Following the evaluation, the NYISO will likely need to designate affected peaker plants to remain in service beyond 2025, until other permanent solutions are completed.

Wholesale Electricity Prices

are directly influenced by the cost of the fuels used to produce electricity. Spiking global demand for fossil fuels, lagging supply, and instability caused by war, have combined to bring fossil fuel prices to historic high levels.

> Wholesale electricity prices also rise and fall with power demand. Lower demand for electricity allows a larger proportion of electricity to be generated by more efficient and less costly facilities, resulting in lower wholesale prices. And higher demand results in higher prices.

> The wholesale cost of electricity is often reflected in the "Supply" portion of a typical retail consumer's electricity bill. How wholesale electricity prices influence the "Supply" portion of a retail bill varies between providers, depending on their procurement and cost-hedging strategies. The components of retail electricity bills are regulated by the NYPSC.

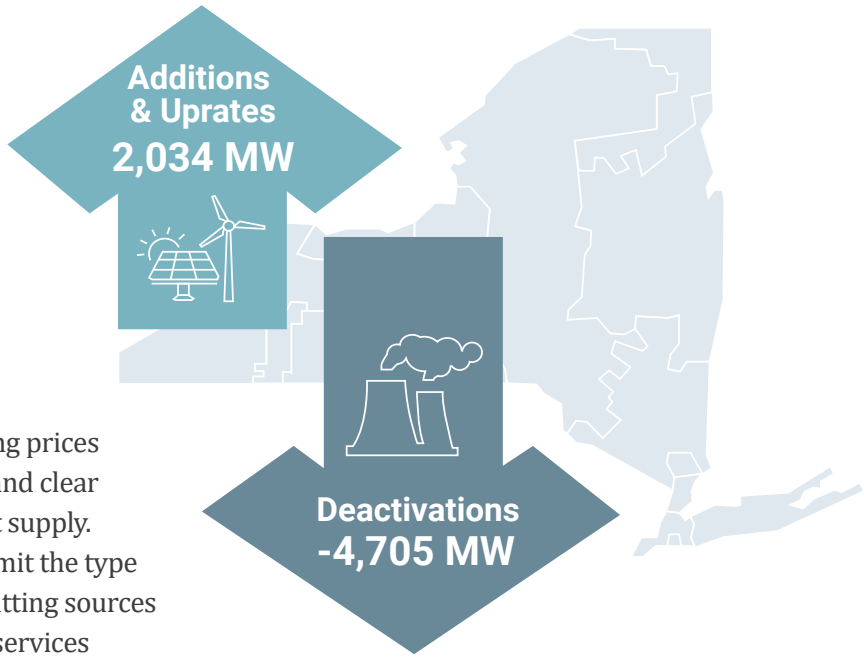
On a quarterly basis, the NYISO and the responsible impacted utilities evaluate whether any reliability needs arise from generator deactivations, load growth, changes to the transmission system, and other factors. Should a reliability need be identified, the NYISO solicits and selects the solutions to address the need. Following the evaluation of any proposed solutions, the NYISO will likely need to designate affected peaker plants to remain in service beyond 2025, until other permanent solutions are completed to maintain a reliable grid.

While the CLCPA and the Peaker Rule were put into place prior to the economic disruptions caused by the COVID pandemic, subsequent geopolitical conflicts have exacerbated supply-chain constraints, price volatility, and inflationary pressures. And while those events could not have been foreseen by policymakers when the CLCPA or the Peaker Rule were put into place, the current investment landscape is driving increased costs and delays in the development of new supply and transmission necessary to decarbonize the grid and support reliability.

Wholesale electricity markets in New York are designed to meet the electricity needs of consumers in the most cost-efficient and reliable manner possible, even when the factors that influence those costs, like fuel, materials, and labor, put upward pressure on prices. Since 1999, when wholesale electricity markets were established in New York, consumers have seen considerable benefits. Market prices serve as a transparent signal to suppliers, consumers, developers, and policymakers of system needs. The NYISO uses a competitive auction structure to establish the wholesale cost of electricity supplied to the grid. The benefit of the NYISO-administered competitive wholesale electricity markets directly benefit customers by procuring electricity services to maintain grid reliability in the most cost-efficient manner available for consumers.

The structure of the NYISO-administered competitive wholesale electricity markets is particularly advantageous for lower emitting energy suppliers with lower fuel costs like wind, hydro, and nuclear because they are more likely to be selected to supply electricity any time they are capable of producing energy. This market design has also historically incentivized existing resources to improve efficiency and reduce costs to increase their chances of being selected by the NYISO market to meet demand. As new resources enter the market and existing resources improve their efficiency, competitive forces effectively push less-efficient, higher-cost resources out of the market. In this manner, wholesale competitive markets provide a structure for continuous improvement in overall efficiency, which benefits consumers, achieves lower emissions and supports reliability.

FIGURE 2: **ADDITIONS, UPRATES, & DEACTIVATIONS SINCE APPROVAL OF THE CLCPA (NAMEPLATE CAPACITY)**



Wholesale electricity prices rise and fall reflecting the balance of supply and demand. With generator deactivations accelerating in response to public policies, the thinning margin between supply and demand is driving prices upward. This has served as a strong and clear signal for investment in new, efficient supply. The CLCPA and other state policies limit the type of supply that can be built to non-emitting sources that do not offer the same reliability services provided by the departing resources.

In addition, in the absence of the ability to reinvest in existing generation, aging units that will continue to operate and be depended on for reliability throughout the transition of the grid may be more prone to mechanical failures.

As the NYISO communicated in its STAR report for the second calendar quarter of 2023, reliability margins are projected to decrease to a level in violation of applicable reliability rules by summer 2025. The NYISO is obligated under its federally regulated tariffs to pursue solutions to resolve this reliability issue. Timing is an essential component of the NYISO's evaluation. If proposed solutions are not viable or sufficient to meet the identified 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's Peaker Rule to remain in operation until a permanent solution is in place. The DEC's Peaker Rule anticipated this scenario when it authorized the NYISO to designate certain units to temporarily remain in operation beyond 2025 on an as-needed basis for reliability. The peaker plants located in New York City protect system reliability but are located in environmental justice communities that have limited access to cleaner electric supply from other areas of the state due to transmission system limitations.

Sustaining reliability in these communities throughout the transition towards cleaner resources will be critical to achieving a just transition of the electric system as envisioned by the CLCPA. **Achieving state policy mandates reliably while also protecting communities from the risk of power outages is a NYISO priority.**

Environmental Justice and A Just Transition

> Meeting the environmental justice objectives of the CLCPA is critical to the state's policies. A just transition must consider reliability and the toll on public health, safety, and welfare if reliability is not maintained. Balancing reliability with the need for a cleaner power system will be key to realizing a successful transition.

> Expanding our understanding of environmental justice concerns will be necessary as we plan the system, enhance wholesale electricity markets, and integrate clean energy. To this end, the NYISO is expanding the expertise provided by our long-standing Environmental Advisory Council to provide insight into the state's social justice challenges.

Planning for the Future Grid

The NYISO's planning processes are an essential element of the NYISO's mission of ensuring power system reliability and competitive markets for New York in a clean energy future. The NYISO's planning processes serve this mission by identifying future system needs and enabling investment to meet those needs long before there is an impact to consumers. The NYISO's planning function has taken on even greater complexity as reliability is increasingly impacted by public policy mandates, advancing technology and more frequent extreme weather.

NYISO planners continuously study the electric system to identify and address changes that risk reliability. The NYISO takes a comprehensive approach to studying the grid's reliability, using near-term and longer-range forecasts to monitor changes and identify concerns. The NYISO is required to perform these planning functions consistent with our FERC-regulated tariffs and all applicable reliability standards. These functions include several studies and reports that analyze the system in the near and the long term. NYISO planners evaluate the reliability of the system by assessing available supply, expected demand, and risks such as the effects of extreme weather. Planners also evaluate the system from an economic investment perspective, identifying investment

The NYISO's planning processes serve the mission by identifying future system needs and enabling investment to meet those needs long before there is an impact to consumers.

opportunities that may improve the efficiency of the grid. Further, NYISO planners evaluate transmission expansion needs driven by public policies. If the state formally identifies such policies, the NYISO then solicits and selects projects to address the identified needs.

Forecasting future demand on the power grid often begins by understanding how things like weather and temperature changes can influence demand. For instance, air conditioning is largely responsible for driving summer peak demand, and, increasingly, heating load will drive winter demand. Understanding that relationship is important to prepare the grid to reliably meet peak demand conditions. Decades of experience on how temperatures influence demand from air conditioning helps the NYISO accurately forecast future load, but little data exists on newer technologies like heat pumps and electric vehicles with changes on demand patterns from consumer behavior and adoption rates. Extreme weather associated with climate change is an additional risk factor impacting grid planning efforts.

The CLCPA and new clean energy policies approved in 2023 require significant electrification of the building sector, which has historically relied almost exclusively on fossil fuels for heating needs. In fact, only 10% of New York's homes rely on electricity for heat today. To meet state policy targets, electric heating penetration would need to grow to 90% by 2050.

Electric heat pumps are 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 NYISO continues to conduct a series of important planning initiatives to identify risks and opportunities to transition the grid in a reliable and efficient manner. We have issued a series of reports that reveal a growing need to achieve a careful balance between closing traditional thermal generation and adding new intermittent resources as electrification advances. Those studies and reports address reliability planning, economic planning, and public policy planning processes.

90% **of New York's homes will need to rely on electricity for heating to meet state policy target by 2050.**

Planning, Reports & Studies

> We conduct numerous studies and reports to prepare for New York's future energy needs, as well as provide detailed information to policymakers, stakeholders and investors in the power system.

> **Comprehensive Reliability Report (CRP)**: Integrates all of the planning studies into a ten-year reliability for New York.

> **Reliability Needs Assessment (RNA)**: Evaluates the reliability of the New York bulk electric system considering forecasts of peak power demand, planned upgrades to the transmission system, and changes to the generation mix over the next ten years.

> **System & Resource Outlook (Outlook)**: 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.

> **Short-Term Assessment of Reliability (STARs)**: Conducted every quarter to assess reliability needs within a five-year horizon to determine whether the grid will be able to supply enough power to meet demand.

Reliability Planning Process

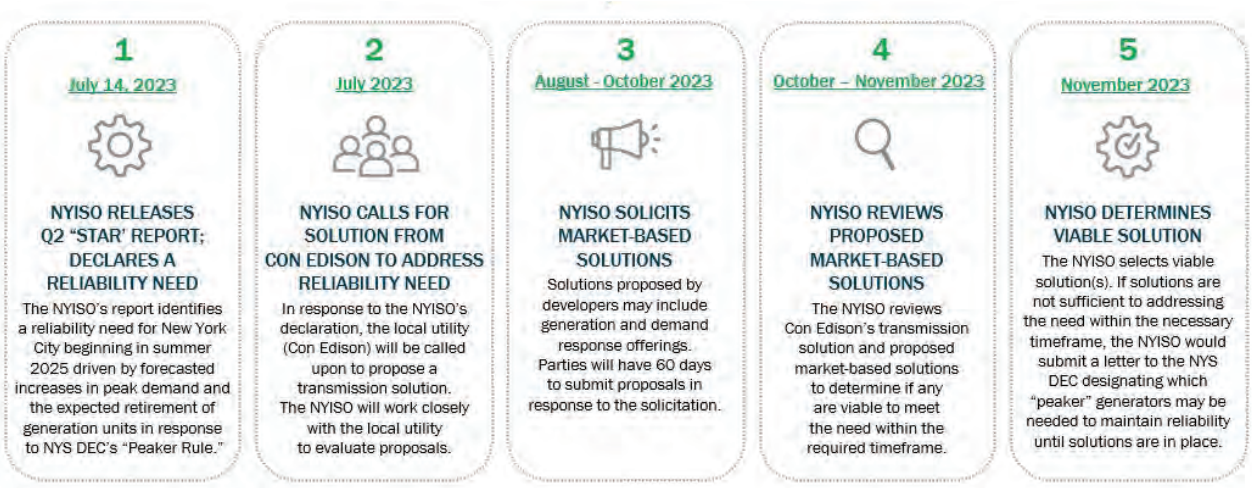
Short-Term Assessment of Reliability (STAR)

Four times each year, we conduct a *Short-Term Assessment of Reliability,* which focuses on identifying reliability needs up to five years into the future. This helps to quickly evaluate changes to the system, such as generator deactivations, changes to the transmission system, or changes in demand that could affect reliability. As we perform our study work and look closely at how the grid is changing in response to policies to reduce fossil fuel dependence, it will be particularly important to monitor the STAR process, as its quarterly reporting enables it to reflect rapid changes in terms of generator supply, transmission capability, and load forecasts.

In July 2023, the NYISO issued its second quarter 2023 STAR report (Q2 STAR). The report identified a reliability need in 2025 of up to 446 MW in New York City to address a deficiency in transmission security. Transmission security represents the ability of the power system to withstand disturbances, such as electric short circuits or the unanticipated loss of a generator or a transmission line, while continuing to reliably supply and deliver electricity.

The recent finding of a reliability need initiates a process administered by the NYISO to bring reliability margins back to acceptable operating levels. The NYISO will begin the process immediately by working with the local utility and the marketplace to identify and evaluate possible solutions to the identified reliability need.

FIGURE 3: **NYISO Q2 STAR RELIABILITY NEED NEXT STEPS**



The Q2 STAR also included a scenario analysis of available supply statewide to meet future anticipated demand growth. This analysis found that such projected demand growth could result in a statewide deficiency of up to 150 MW in 2025. Depending upon the nature of the solution to the reliability need identified in New York City, the solution to the reliability need in New York City may also address the potential statewide reliability margin deficiency. Future reliability studies conducted by the NYISO, including the STAR report for the third calendar quarter of 2023 (Q3 STAR), will continue to evaluate these conditions.

Reliability Needs Assessment (RNA)

For a longer-term view, our *Reliability Needs Assessment* looks ahead 10-years. The RNA looks at both the adequacy of energy resources and limitations of the transmission grid to determine whether the system will be able to supply enough power to meet demand.

The most recent RNA emphasized that already-thinning reliability margins could deteriorate further based on identified risk factors, including the potential for delays in planned infrastructure investments, more extreme weather, or unexpected generator outages or retirements.

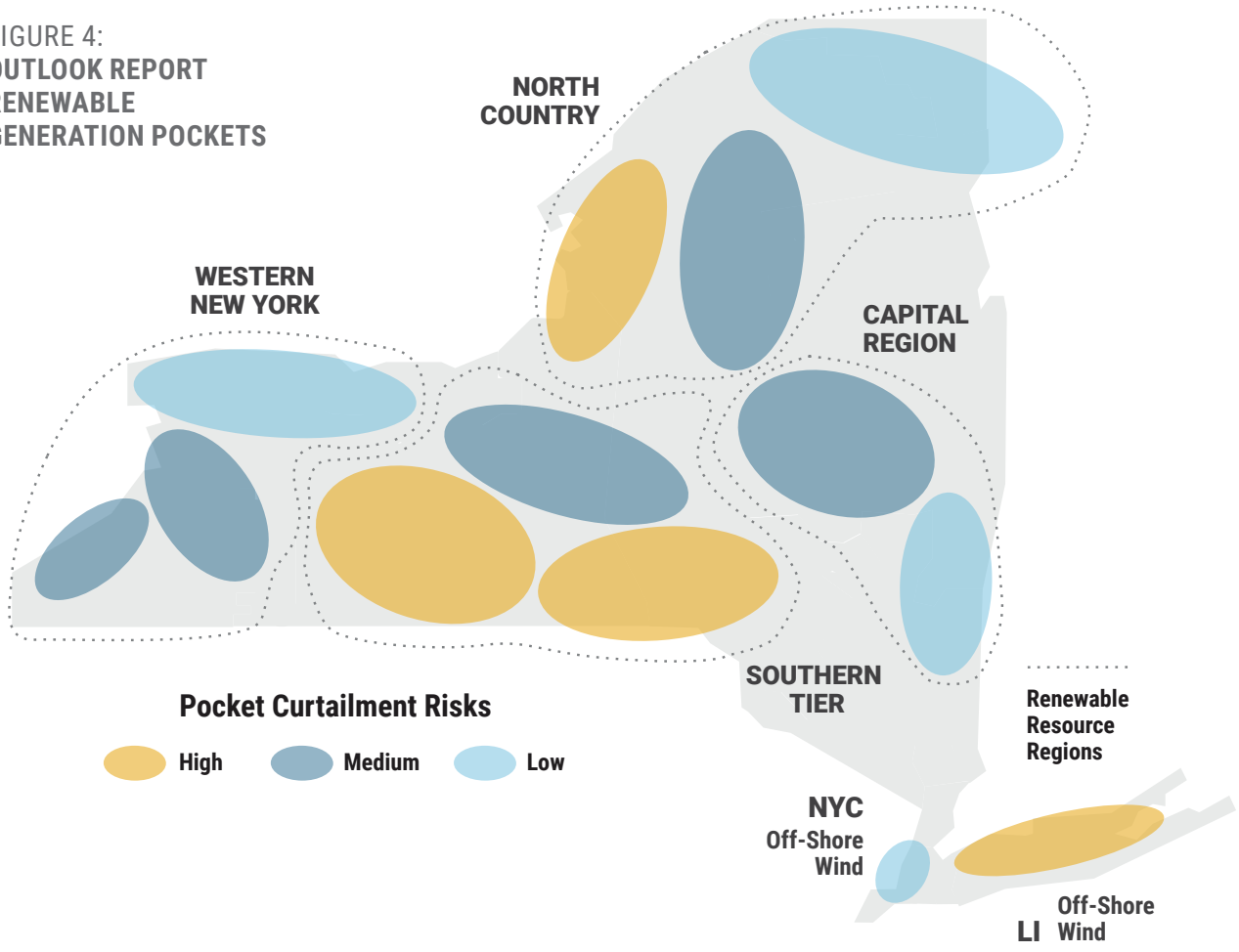
Comprehensive Reliability Plan (CRP)

The CRP integrates STAR reports and the most recent RNA to develop a 10-year reliability analysis and will be completed in late 2023.

System & Resource Outlook

To analyze how changes in supply and demand will affect the grid of the future and understand what types of investments will be needed to enable achievement of state policy, in 2022 the NYISO issued the *2021 – 2040 System & Resource Outlook* (the Outlook). This study includes a 20-year forecast that examines multiple cases and scenarios identifying transmission investment opportunities and project resource mixes for achieving 2030 and 2040 policy mandates while maintaining reliability. *The Outlook* will be updated every two years.

FIGURE 4:
OUTLOOK REPORT RENEWABLE GENERATION POCKETS



The Outlook examines a wide range of potential future system conditions and compares possible pathways to a cleaner resource mix. Under each scenario, *the Outlook* concludes that unprecedented levels of investment in generation will be necessary to reliably deliver sufficient energy to meet future demand. *The Outlook* concludes that by 2040 New York's grid would need the following to reliably meet the goals of the CLCPA and expected peak demand:

- **111-124 GW of generating capacity,** or roughly three times the current capacity connected to the system.
- **27-45 GW of this capacity** must be from non-emitting resources capable of performing like today's fossil fuel-fired generation fleet depending on the scenario. **It is especially important to note that commercially available technologies to provide dispatchable, non-emitting supply do not exist at scale at this time.**

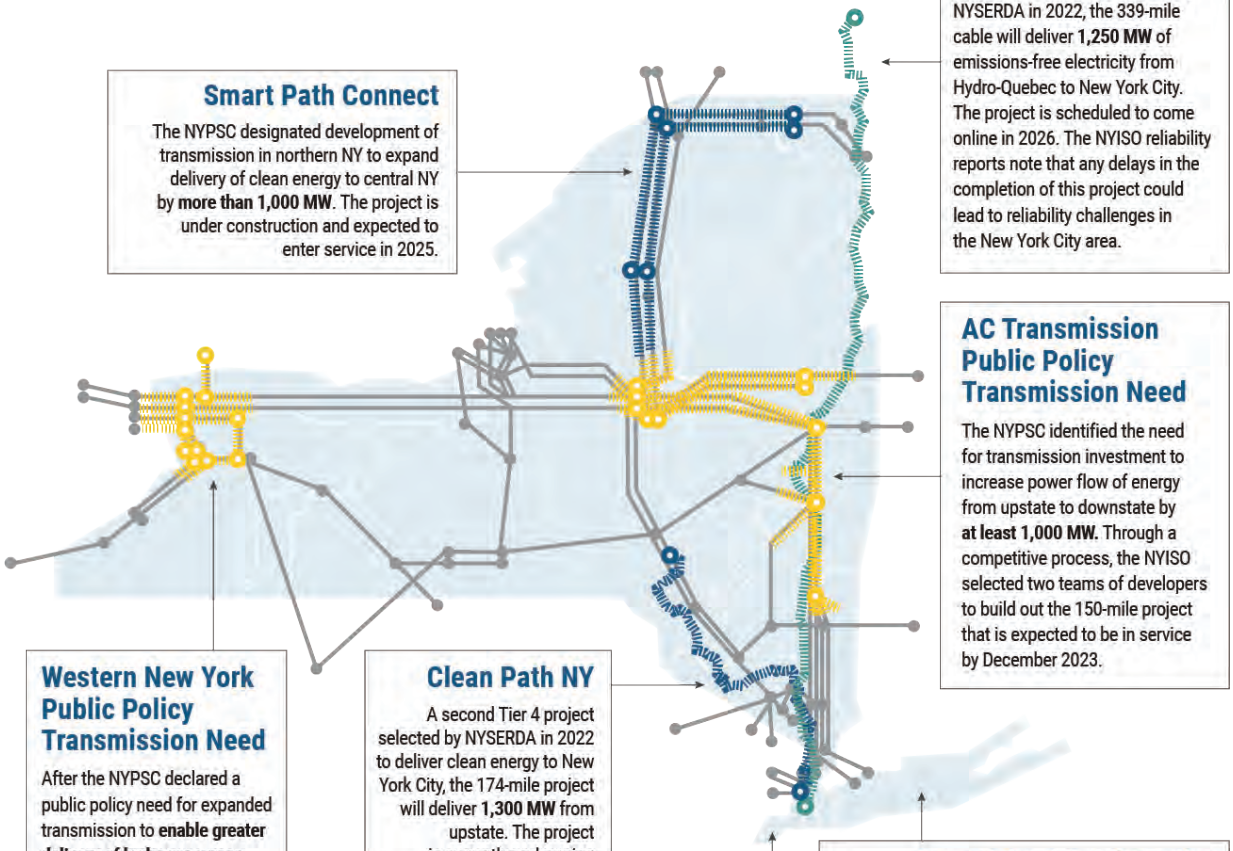
Furthermore, the report finds that extensive transmission investments will be necessary to deliver renewable energy across the state to consumers and address new constraints that appear across the electric system resulting from significant new resource additions. *The Outlook* groups these constraints into "generation pockets" based on their geographical locations, as shown on the map in Figure 4. The findings of *The Outlook* offer insight into where transmission expansion would have the greatest impact on reducing curtailments of renewable energy production so it can be delivered to consumers. Pockets exhibiting high risks for curtailment represent transmission needs that must be addressed to achieve the public policy targets of the CLCPA. The NYISO plans to begin development the next iteration of *the Outlook* in 2023.

Public Policy Transmission Planning

In addition to the reliability planning studies and *the Outlook*, the NYISO also works with the state and stakeholders to identify transmission expansion needs driven by public policies. **New York has seen the most significant investment in new transmission in decades through the NYISO's Public Policy Transmission Planning Process.** While the process has been a great success, the NYISO has called for significant additional transmission investment through its Public Policy Transmission Planning Process to support the achievement of public policy requirements.

New York has seen the most significant investment in new transmission in decades through the NYISO's Public Policy Transmission Planning Process.

FIGURE 5: **NEW TRANSMISSION PROJECTS IN NEW YORK STATE**



A public policy requirement is a federal or state law or regulation, including a NYPSC rulemaking order, which identifies the need for additional transmission capability in the state. Once the NYPSC identifies a specific public policy need, the NYISO requests proposals and evaluates the viability and sufficiency of proposed solutions, selecting the more efficient or cost-effective transmission solution.

In recent years, the NYPSC has identified five transmission investment needs being driven by state policy. The first, located in western New York, was completed last year and expanded the delivery of emissions free hydropower to consumers across the state. Two additional projects are under construction in the Mohawk and Hudson Valley regions and, upon completion, will deliver more than 1,000 MW of additional power from upstate generators to downstate consumers. Together, these three projects represent the largest investment in transmission infrastructure in New York State in more than 30 years.

The fourth transmission need identified by the NYPSC sought transmission facilities to export at least 3,000 MW of future offshore wind energy from Long Island to New York City and the rest of the state. The NYISO issued a solicitation for projects to address this need, and the NYISO's Board of Directors selected, in June 2023, a transmission solution submitted by Propel NY, a joint venture between the New York Power Authority and New York Transco LLC. The selected transmission project will provide transmission capability to deliver at least 3,000 megawatts from offshore wind projects — advancing the state closer to its goal of 9,000 MW of offshore wind energy by 2035.

> **Renewable Energy Credits (RECs)**
> A mechanism to link the environmental attributes associated with certain forms of renewable energy generators with the energy produced by those generators. One REC equates to one MWh of energy generated from eligible renewable energy resources. In New York State, NYSERDA procures RECs from eligible resources to incentivize development of renewable resources and measure compliance with the renewable energy goals.

In June 2023, the NYPSC identified a fifth transmission need driven by a public policy requirement to coordinate the delivery of offshore wind resource production into New York City. The NYPSC directed that proposed solutions to address the identified need must demonstrate their ability to be in service by January 1, 2033, to support the CLCPA's timeframe for offshore wind. The NYISO will be working with stakeholders and interested parties, including hosting technical conferences, through the end of 2023 in advance of a solicitation for solutions to this new public policy transmission need.

There are several additional transmission development efforts underway that are driven by state policies but are not part of the NYISO's Public Policy Transmission Planning Process. For instance, the Smart Path Connect Transmission Project, is under development pursuant to New York State's Accelerated Renewable Energy Growth and Community Benefit Act, which enabled the NYPSC to authorize the development of transmission enhancements to increase delivery of renewable energy from northern New York and Canada to consumers. Further, two Tier 4 transmission projects are under development. In 2020, the NYPSC established a new Tier 4 Renewable Energy Credit (REC) product as part of its Clean Energy Standard for resources that can deliver qualified renewable energy into New York City. Last year, the NYPSC approved two Tier 4 contracts. One represents the Champlain-Hudson Power Express (CHPE) project to deliver Canadian hydropower directly to Queens, and the second is known as Clean Path NY, which proposes to deliver renewable energy from upstate New York directly to New York City. Ground has been broken for the CHPE project, with a projected in-service date in 2026. The Clean Path NY project is in the latter stages of the interconnection process, and is awaiting Article VII certification from the NYPSC, which is a required predicate to commencing construction of the project.

Interconnection Planning

The number of projects seeking to connect to the grid has more than quadrupled since enactment of the CLCPA in 2019.

The NYISO must perform a rigorous analysis of all projects seeking to connect to the transmission system to understand the impact of new resources on the system from a reliability perspective. This is known as the "interconnection study process." Projects seeking to connect to the grid are tracked in an "interconnection queue."

The interconnection process ensures "open access" to the transmission grid for new supply resources seeking to enter operation and is an essential element in maintaining the performance and reliability of the electric system. Studying the impacts of each new proposed facility is a major responsibility, requiring expertise and careful analysis to determine if upgrades are necessary to maintain the reliability and safety of the electric system. The interconnection process is coordinated by the NYISO but requires significant involvement by both the electric utilities and the developers. Each party has an important role to play, and success of the process depends on coordination and timely delivery of information by all participants.

Transparent and robust rules for reliably connecting to the grid provide essential information for developers. Working closely with developers and affected utilities, studies identify necessary system upgrades and estimated costs to allow new resource developers to make informed investment decisions. Costs identified as necessary to maintain reliability are borne by developers and not consumers under the NYISO's interconnection process. **The focus of the process is on balancing the demands of open access to the electric system with grid reliability, at the most efficient cost to consumers.**

When studying the interconnection of new generating resources, each project is studied individually before eventually being grouped into a "Class Year." These studies enable developers to make design changes of their individual projects as they learn about the possible impacts associated with their proposal.

Developers choosing to remain in the queue based on the results of initial interconnection studies enter a "Class Year" where detailed analysis precisely identifies the reliability impact the group of projects have on the grid. The NYISO then assigns the cost of necessary upgrades to each developer to mitigate the impact on reliability of the system. In January 2023, the NYISO completed Class Year studies for 27 new wind, solar, storage, and transmission expansion projects totaling nearly 7,500 MW of clean energy capacity that can proceed towards commercial operations."

500+ **interconnection requests are in the queue today compared to approximately 120 in 2018.**

A Growing Volume of Projects Seeking to Connect to the Grid

> **The NYISO interconnection study process** is evolving to address a greater volume of requests. The state's climate goals, and the substantial influx of new projects means that additional reforms are needed.

> **Interconnection queue:** A queue of transmission and generation projects that have submitted an Interconnection Request to the NYISO to be interconnected to the state's electric system. Depending on the level of proposed capacity, most projects must undergo three studies before interconnecting to the grid: a *Feasibility Study* (unless parties agree to forego it), a *System Reliability Impact Study* (SRIS), and a *Facilities Study.*

> **Class Year:** A group of supply projects seeking to interconnect to the transmission system in similar timeframes, and which have reached similar milestones in their development efforts. These projects are studied to assess the cumulative impact they may have on the system and determine the costs to mitigate those impacts.

In anticipation that state policies would drive an influx of new interconnection requests, the NYISO worked with stakeholders to implement a comprehensive redesign of the interconnection study process in 2019, offering greater flexibility and expedited study options to developers. The NYISO is engaged in a significant effort in 2023 to further improve the interconnection process through what may be wholesale changes to the process to drive efficiencies for new developers seeking to interconnect to the grid.

> **Additional staff has been added to address increasing workloads** and the NYISO has launched a series of customer focus groups, providing for an ongoing exchange of ideas and information with all stakeholders.

Multiple factors outside the scope of the NYISO's control can impact whether a project elects to move forward with the interconnection process, including the status of siting and other regulatory matters, investment risks, eligibility for RECs, and supply-chain concerns. These factors can result in developers electing to defer or drop out of a Class Year, even after the final interconnection studies have been completed and interconnection costs have been allocated and accepted. The Class Year process requires a great deal of time and resources by all parties. While flexibility may benefit some developers, it may create inefficiencies for other projects more committed to development.

Going forward, the NYISO and its stakeholders must weigh the benefits of this flexibility against the additional resources, time, and study costs incurred by developers, impacted utilities, and the NYISO. To address the increase in projects seeking to connect to the grid, the NYISO is working with stakeholders to implement improvements to the interconnection study process. Additional engineers and project management staff have been hired in the Planning Department to support existing engineers who are currently shouldering the increased workload. Additional staff will also help manage timelines and customer service functions. Focus groups with developers are ongoing to identify additional areas for enhancements. New technology is being developed that will create efficiencies in managing demands for applicants as well as NYISO staff.

Multiple factors outside the scope of the NYISO's control can impact whether a project elects to move forward with the interconnection process.

New York's Wholesale Markets

Support Reliability and a Clean Energy Transition

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 by resources rewards economic efficiency. Historically, this has resulted in more modern supply coming onto the grid and displacing older, less efficient supply. Since 2000, the power sector's CO_2 emission trate decreased by 42%. Recent increases in the CO_2 emission rate coincide with the phased closure of Indian Point nuclear units 2 and 3 in 2020 and 2021, and corresponding increases in production from fossil resources needed to meet demand and maintain reliability.

Competitive wholesale electricity markets are fundamental to providing consumers reliable, lowest-cost power and an essential mechanism for achieving public policy objectives.

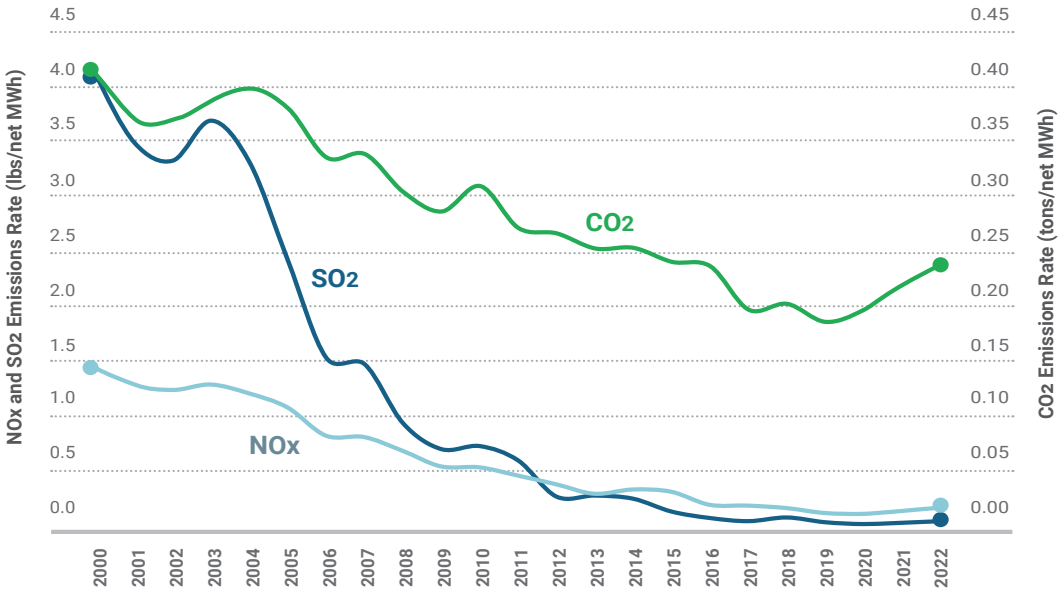
Safeguarding Market Competition

> **The NYISO has a team of engineers and economists that review** market performance to make sure that prices reflect market conditions, such as fuel costs to produce energy. The NYISO can modify market participant offers to reference values if they do not meet competitive market rules that require that offers appropriately reflect market conditions.

> **An independent market monitor evaluates** the performance of the NYISO's markets each day to make sure market outcomes reflect system conditions. The market rules and how they are administered are also subject to review by the independent market monitor to make sure our market design is as efficient as possible.

> **FERC's Office of Enforcement** is active in evaluating markets and how they are administered. FERC can issue penalties to entities that violate market rules.

FIGURE 6: **EMISSIONS RATES FROM ELECTRIC GENERATION IN NEW YORK: 2000-2022**



Sources: U.S. EPA, U.S. EIA, RGGI

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

> **Ancillary Services** are services necessary to support the transmission of capacity and energy from generation resources to consumers, while maintaining the reliable operation of New York's transmission system. These services include Regulation and Operating Reserve, Energy imbalance (using market-based pricing), and the cost-based services of Scheduling, System Control and Dispacth, Voltage Control and Black Start.

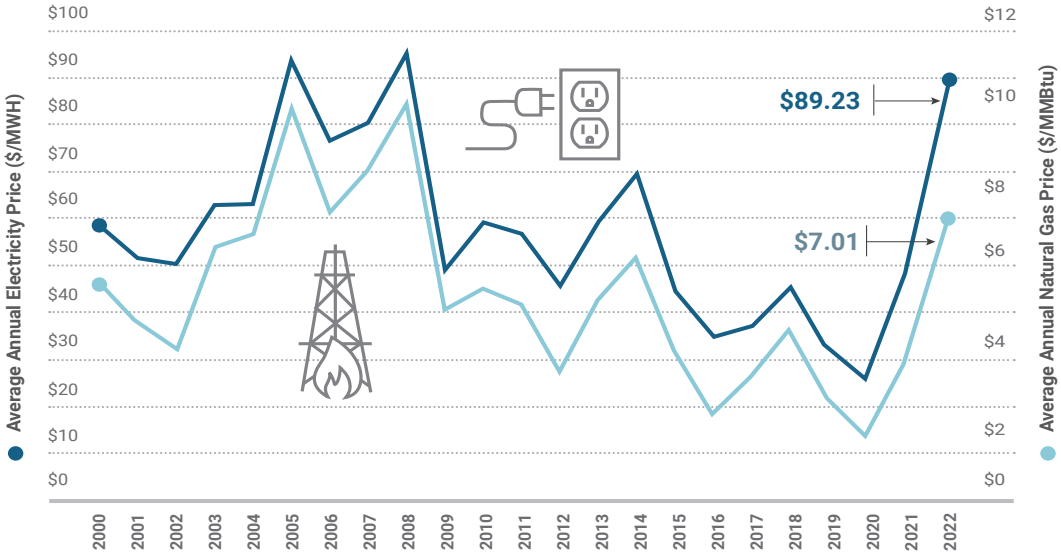
Each day, the NYISO conducts wholesale electricity auctions for market participants to buy and sell electricity. These auctions ensure sufficient electricity is scheduled to match consumer demand, delivering reliable electricity with the least-cost mix of resources available to the grid.

Suppliers with lower costs to provide electricity and ancillary services offer into the market at lower prices. The NYISO calculates market prices by determining the expected demand and evaluating offers from suppliers. These offers are ranked by cost from lowest to highest, with the NYISO's market software selecting the least costly resources first, and then continuing to select supply resources until the total demand is met and reliability maintained. This means that demand also influences prices — lower demand levels result in selecting resources lower in the cost-ranked stack of supplies. Higher demand levels mean higher cost resources need to be selected to meet demand reliably. This auction process results in all selected suppliers receiving the price set by the last supplier needed to meet demand — this is known as the marginal clearing price.

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.

FIGURE 7: **AVERAGE ANNUAL NATURAL GAS AND WHOLESALE ELECTRICITY PRICES IN NEW YORK: 2000-2022**



Wholesale capacity auctions are conducted in much the same way as wholesale electricity markets. The NYISO's monthly capacity spot auctions select the least cost mix of capacity available to meet resource adequacy needs, which are established every year by the NYSRC in setting the Installed Reserve Margin (IRM) for the system. The IRM represents the minimum level of capacity, beyond the forecasted peak demand, which must be procured to serve consumers.

The IRM is established for each 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. The NYSRC has noted in several of its annual Installed Capacity Requirement Technical Study reports that the inclusion of intermittent resources to the grid is a leading factor in establishing higher IRM requirements.

The IRM for the 2023-2024 capability year is 20.0% of the forecasted NYCA peak load, an increase from 19.6% 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 is 38,458 MW.

FIGURE 8: **HISTORIC AVERAGE HOURLY DEMAND VS. ACTUAL YEARLY PEAK DEMAND (MW)**

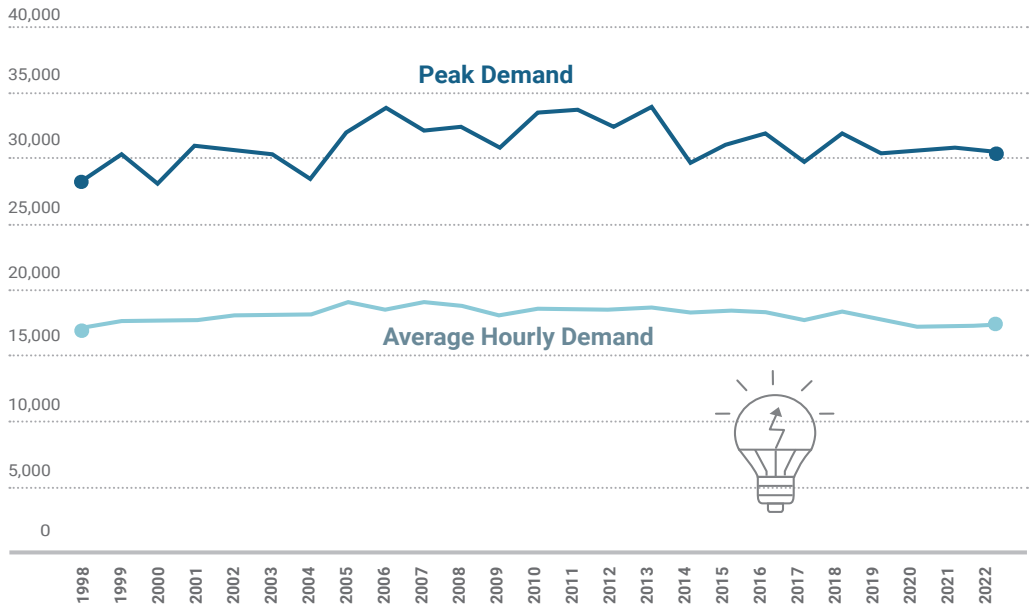
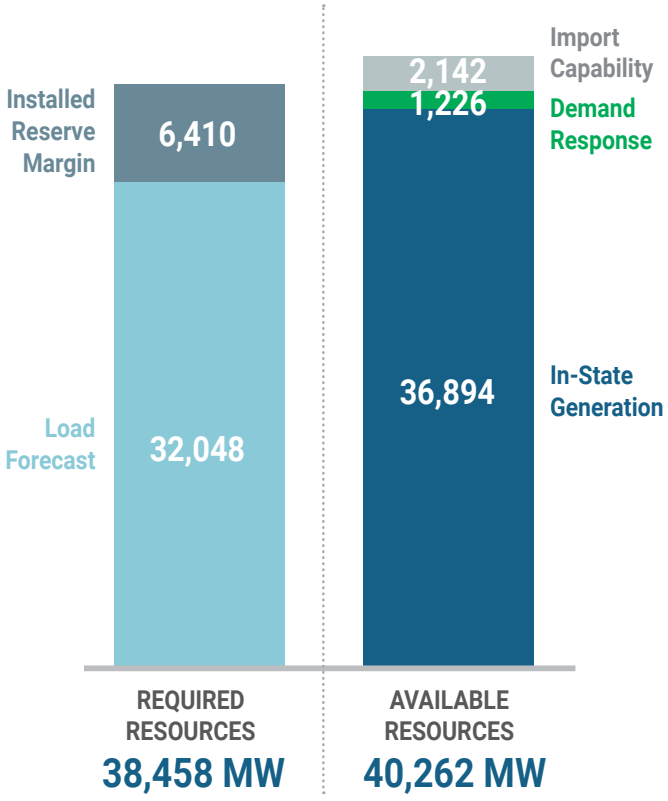


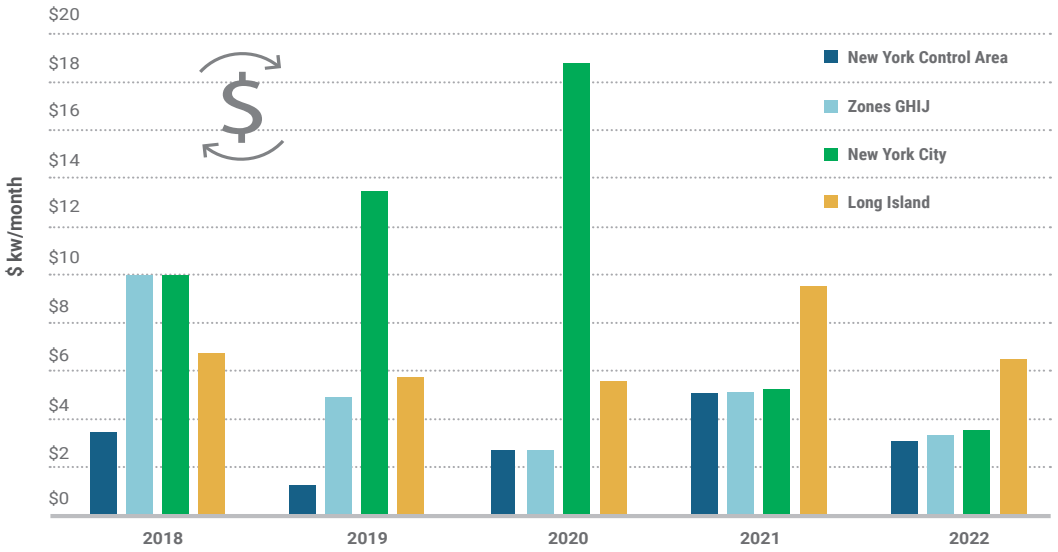
FIGURE 9: **STATEWIDE RESOURCE AVAILABILITY: SUMMER 2023**



Due to transmission limitations that restrict the amount of capacity that can be delivered into certain regions of the state, the NYISO also establishes Locational Capacity Requirements (LCRs) for the Hudson Valley (Zones G-J), New York City (Zone J), and Long Island (Zone K). Without sufficient local generating capacity to serve demand, these regions would face reliability concerns during periods of higher demand. The NYISO's LCRs set the minimum amount of capacity that must be physically located within these regions to support reliability. LCRs for the 2023-24 capability year are 85.4% in the Hudson Valley region, 81.7% in New York City, and 105.2% in the Long Island capacity region. Given the planned reduction in generation capability in response to the Peaker Rule, capacity market prices in New York City are expected to be higher this summer than in recent years, reflective of the tighter margins of capacity available to serve customers.

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.

FIGURE 10: **HISTORIC AVERAGE CAPACITY SPOT AUCTION CLEARING PRICES: 2018-2022**



Winter Storm Elliott: How to Keep the Grid Reliable During Extreme Weather

The Value of Resource Flexibility, Market Operations, and Planning

Winter Storm Elliott rolled through the United States in late December 2022, bringing cold temperatures, strong winds and massive snowfall totals. New York was especially hard hit from December 23rd through December 27th.

Considering the forecasted impacts of Winter Storm Elliott, NYISO Operations began coordinating with the New York Transmission Owners and Generation Owners to restore generation and transmission facilities from maintenance outages. The NYISO also coordinated with regulators and neighboring regions to prepare for the storm, and continued coordination efforts throughout the event.

The storm impacted New York in several different ways. By Friday afternoon, December 23rd, a strong cold front moved from the west across the state causing a rapid drop in temperatures, leading to a change in precipitation from rain to snow and sustained high winds. NYISO load forecasters largely got the forecasts right. While low temperatures on Saturday, December 24th, were slightly below the NYISO's forecast, actual peak loads during the event remained below seasonal forecast conditions due to lower electric demand over the weekend and holiday period.

When the natural gas system became constrained due to demand tied to home and business heating, the dual-fuel capability of generators, particularly in downstate New York, became key to maintaining reliability during the storm. Thanks to accurate load forecasts and the responsible efforts of New York's generators and transmission owners, the bulk electric system performed well across New York during Winter Storm Elliott.

NYISO's Shared Governance

> **What is it:** The NYISO and its stakeholders utilize a shared governance process to establish wholesale market rules and processes associated with grid planning and operations.

> **Members:** Generation Owners, Other Suppliers, Transmission Owners, Public Power & Environmental Parties, End-Use Consumers, Non-Voting Entities

> **Benefits:** Stakeholders have a greater voice in the operation & evolution of the electricity marketplace. Transparent, inclusive, and collaborative process, diverse viewpoints and ideas are exchanged, and the goal is a to develop market rule enhancements which improve efficiency and reflect broad stakeholder support.

Enhancing Wholesale Electricity Market Design

The NYISO's market design must provide proper incentives to new and existing resources that can respond 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 complicate achievement of the CLCPA targets by presenting a hurdle for new entrants necessary to achieve New York State's policy objectives.

150+ shared governance members

200+ stakeholder meetings in 2022

In conjunction with these reforms, the NYISO also pursued capacity accreditation market rules to more accurately reflect capacity market suppliers' contributions to resource adequacy. These new market rules align compensation for capacity suppliers with an 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.

Wholesale Electricity Markets

> **Every 5 minutes, 24/7, 365** days a year electricity is bought and sold through wholesale energy markets.

> **Energy markets:** Provide day-ahead and real-time commitments to meet load.

> **Ancillary services:** Every six seconds resources compete to respond to changing system needs.

> **Capacity markets:** Ensure enough generation is available to meet peak demand and encourage generators to invest in new technology.

> **Effective and competitive wholesale electricity markets** Align investment signals with system needs, support and enhance grid reliability, create a cleaner, more cost-efficient grid, and drive needed energy infrastructure investment to achieve the CLCPA goals.

What to Expect

Next Steps

The grid in New York is undergoing an unprecedented, historic transformation. **The NYISO's involvement in this transition is significant: operating a changing electric system with new intermittent resources, studying, and planning for future changes and designing wholesale markets for a future of newer technologies that will provide flexibility and diversity.** Highly skilled grid operators continue to support reliability and resilience. Through sophisticated modeling and expertise, NYISO grid planners support reliability and enable record levels of new transmission and supply development. The NYISO's wholesale market design continues to lead the way in innovative market rules, supporting reliability and minimizing costs for consumers.

The NYISO's role as an independent, authoritative source of information is essential. As we move towards a zero-emissions grid, it is critical to understand how the growth of intermittent resources and extreme weather will impact the ability to maintain reliability of the New York electric system.

The retirement of fossil fueled resources driven by public polices is currently outpacing the development of new renewable energy and other dispatchable, emissions-free resources. The effect is that reliability margins have thinned to concerning levels, highlighting the need for a carefully coordinated and orderly transition to maintain grid reliability and resilience.

Public policies have also focused efforts on electrifying building heating and cooking appliances, as well as expanding electric vehicle adoption to address climate change. This shift is expected to grow electric demand in winter, eventually making the cold-weather months the highest-demand period of the year. The NYISO is already working to understand how these new technologies will perform and what other system changes may be needed.

For the NYISO, our stakeholders, developers, and policymakers, there are key milestones as the grid transitions which will both influence and reflect the policy, economic, and technological landscape before us.

These include:

- **October 2023:** NYISO issues third quarter Short-Term Assessment of Reliability (STAR) Report which will evaluate the changing mix of supply, transmission capability, and forecasted demand.
- **Third quarter 2023:** NYISO anticipates initiating the solicitation process for the NYPSC's recently identified New York City Public Policy Transmission Need.
- **Third quarter 2023:** NYISO expected to deploy its DER Participation Model software to support market participation of new distributed resources.
- **Fourth quarter 2023:** NYISO expected to deploy the Constraint-Specific Transmission Shortage Pricing project to enhance the reliability signals produced in the NYISO's energy markets.
- **Fourth quarter 2023:** NYISO issues the 2023 Comprehensive Reliability Plan (CRP), which will account for the findings of the 2022 RNA and 2023 STAR evaluations.
- **Fourth quarter 2023:** NYISO issues response to the solicitation for solutions to the New York City reliability need identified in the STAR report issued in July 2023.

As policymakers seek widespread change in how energy is produced and consumed, the NYISO is providing critical data and information on the reliability implications of current and new policies. The NYISO will continue to be actively engaged with stakeholders and policymakers on the path to a reliable and lower emissions grid for New York.

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 expertise of our grid operations is unrivaled, and the importance of the skilled and authoritative system planning work done by the NYISO demonstrates the value of our independence. That success also demonstrates our ability to work across all sectors and interested parties to build consensus that supports reliability, consumer interests, climate policies and new technologies that will help build the grid of the future.

Appendix

NYISO By the Numbers

Demand Trends

FIGURE 11: **ACTUAL & FORECAST LOAD (GWh): 2022-2053**

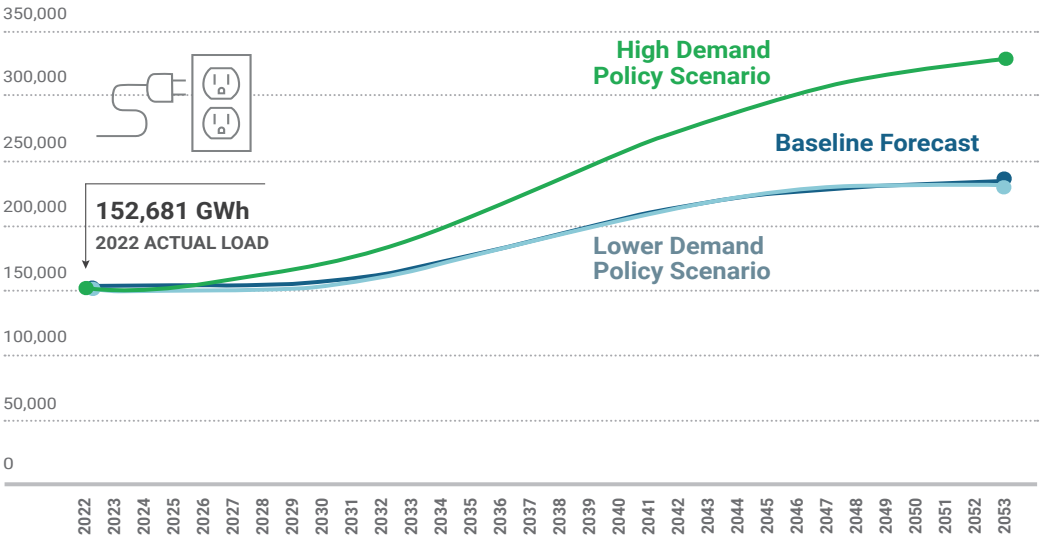


FIGURE 11 | This figure presents three scenario forecasts, a baseline forecast that the NYISO assumes is the most likely outcome based on current observations and assumptions, and two policy scenarios that represent different paths to achieving full compliance with all state policy targets. For example, the Lower Demand Policy Scenario assumes greater deployment of behind-the-meter solar resources and non-plug-in zero-emission vehicles, lowering forecasted demand for electricity. Among other assumptions that could drive future load higher, the Higher Demand Policy Scenario assumes a greater reliance on electric resistance heating as opposed to air-source heat pumps.

FIGURE 12: **ACTUAL & FORECAST ANNUAL PEAK DEMAND (MW): 2022-2053**

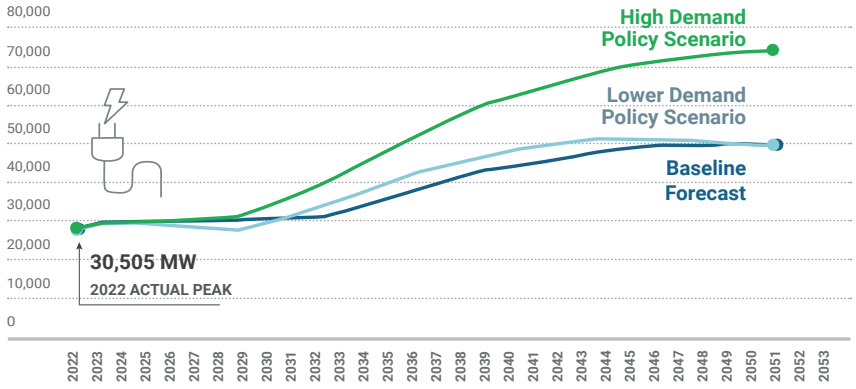


FIGURE 12 | This figure presents three scenario forecasts, a baseline forecast that the NYISO assumes is the most likely outcome based on current observations and assumptions, and two policy scenarios that represent different paths to achieving full compliance with all state policy targets. Key differences between the policy scenarios include the types of technologies adopted to comply with policy requirements as well as the expected adoption of peak-mitigating measures. For example, the Lower Demand Policy Scenario assumes a higher adoption rate of hydrogen-fueled vehicles to support the state's transportation goals and that higher percentages of plug-in electric vehicles practice managed charging to avoid charging during peak demand periods. The Higher Demand Policy Scenario reflects a greater reliance on plug-in vehicles and a greater degree of unmanaged charging that can contribute to higher peaks.

FIGURE 13: **SUMMER & WINTER PEAK DEMAND FORECASTS (MW): 2022-2053**

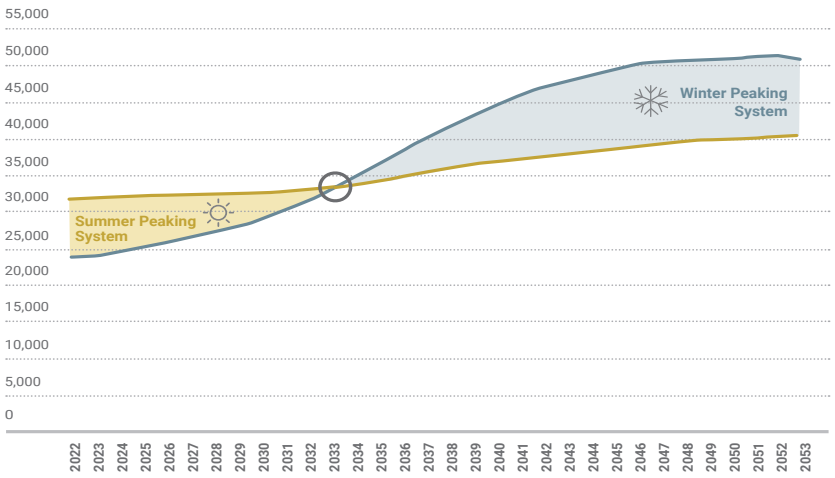


FIGURE 13 | Electrification of the transportation and building sectors will drive winter peak demand higher in the future. In fact, only 10% of New York's homes rely on electricity for heat today. To meet state policy targets, that level would need to grow to 90% by 2050, with electric heat pumps considered 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.

FIGURE 14: **SEASONAL HOURLY DEMAND PATTERNS (MW): 2022**

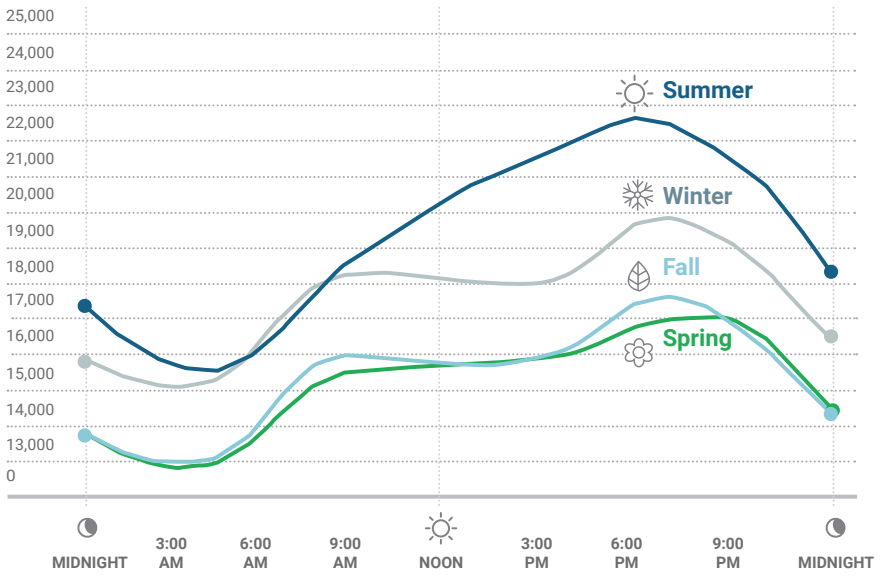


FIGURE 15: **PROJECTED VS. CURRENT SEASONAL LOADS (MW)**

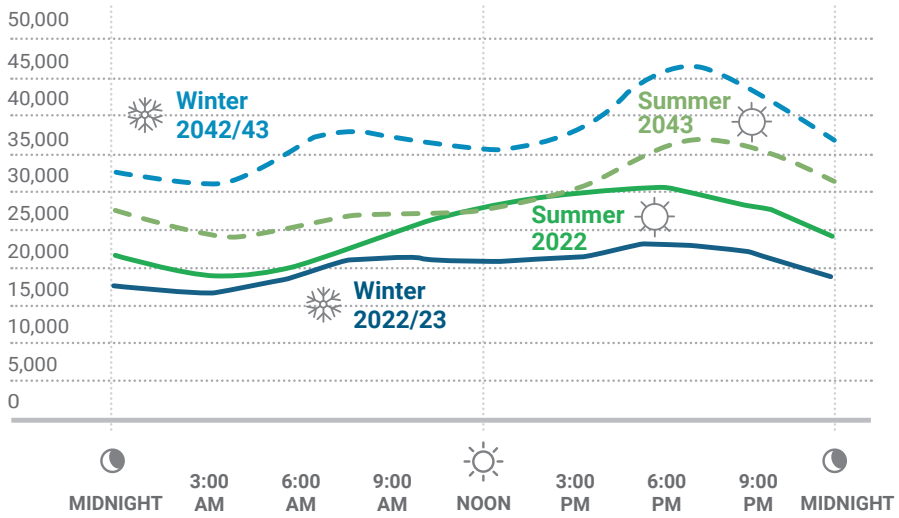
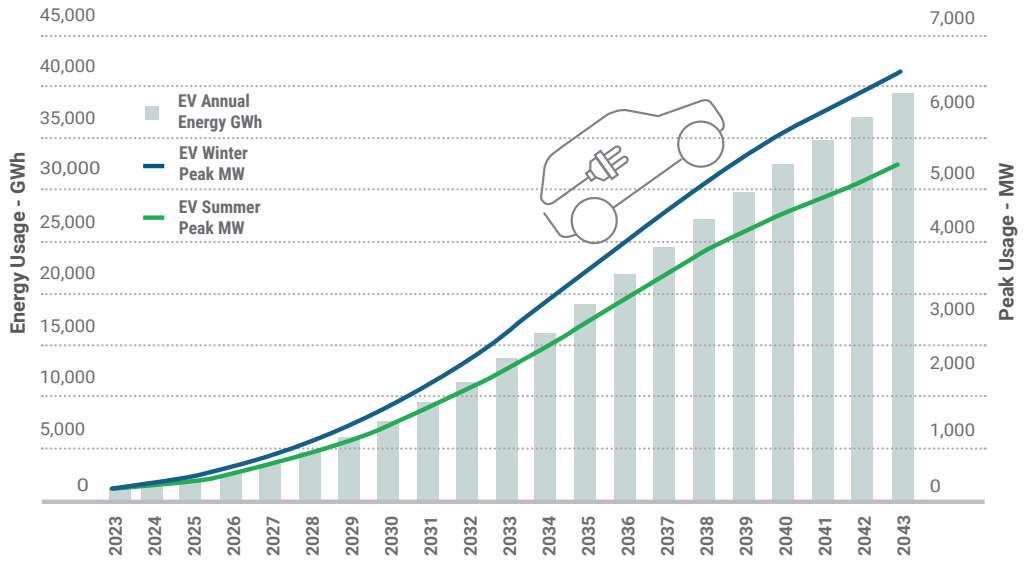


FIGURE 16: **ELECTRIC VEHICLE ENERGY & PEAK IMPACTS: 2023-2043**



Supply Trends

FIGURE 17: **SUMMER & WINTER BEHIND-THE-METER SOLAR PERFORMANCE**

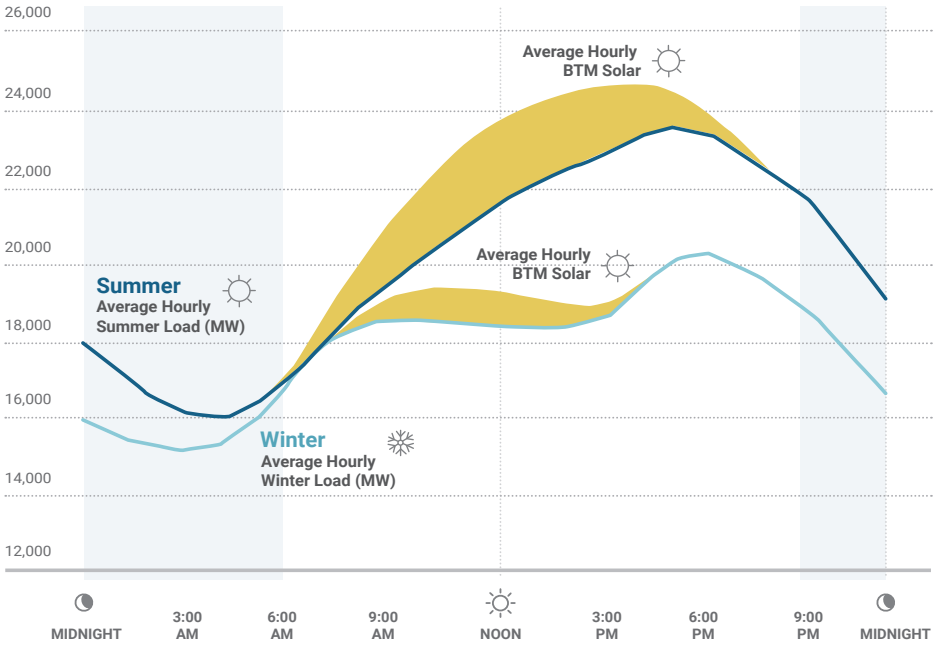


FIGURE 18: **WIND GENERATION & CURTAILMENT (GWh): 2004-2022**

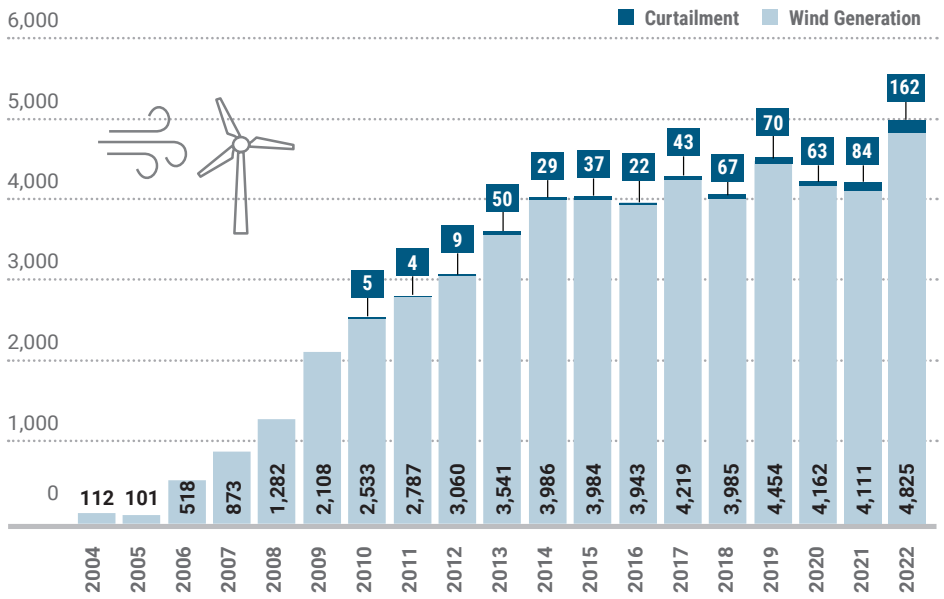


FIGURE 18 | Ongoing transmission upgrades contributed to greater curtailment of wind resources in 2022. Much of the curtailment was concentrated in NYISO Zones D and E and impacted by ongoing construction work on the Smart Path transmission project and the AC Upgrade from the Mohawk Valley to the lower Hudson Valley.

FIGURE 19: **ENERGY STORAGE NAMEPLATE CAPACITY - BTM STORAGE ONLY (MW)**

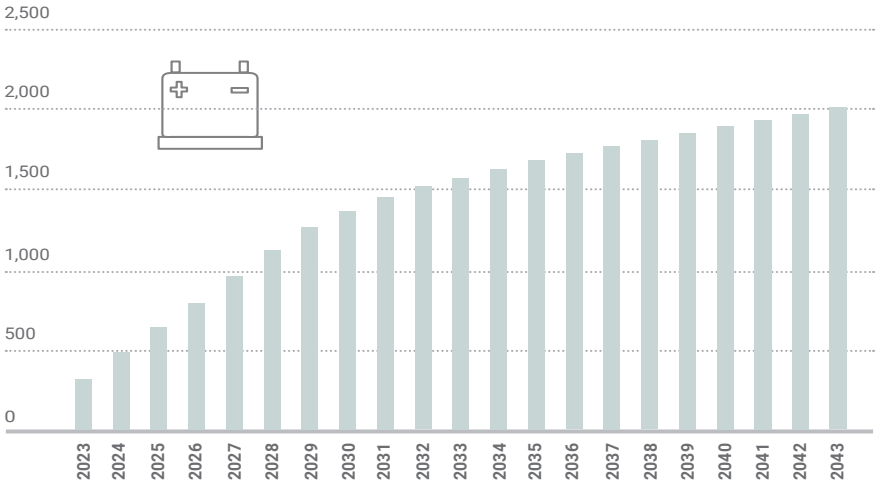


FIGURE 19 | Behind-the-meter storage resources will play a significant role in meeting New York's objective of 3,000 MW of storage resources by 2030. By supplying customers directly, these resources can reduce demand levels on the grid during peak hours. These reductions are offset by increased demand in other hours when storage is charging.

FIGURE 20: **SUMMER 2023 INSTALLED CAPACITY (MW) BY FUEL SOURCE - STATEWIDE, UPSTATE, & DOWNSTATE NEW YORK**

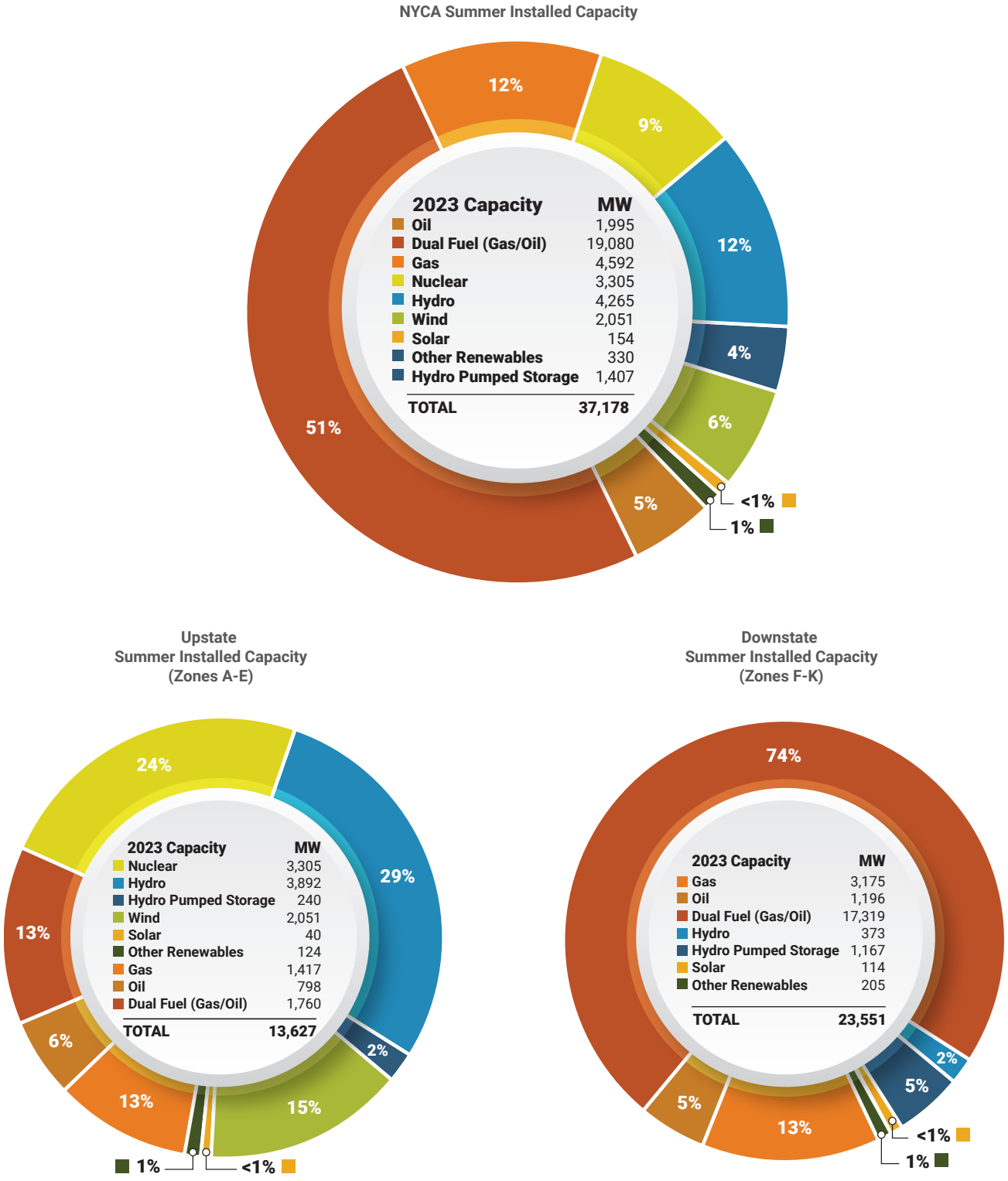


FIGURE 21: **2022 ENERGY PRODUCTION (GWh) BY FUEL SOURCE - STATEWIDE, UPSTATE, & DOWNSTATE NEW YORK**

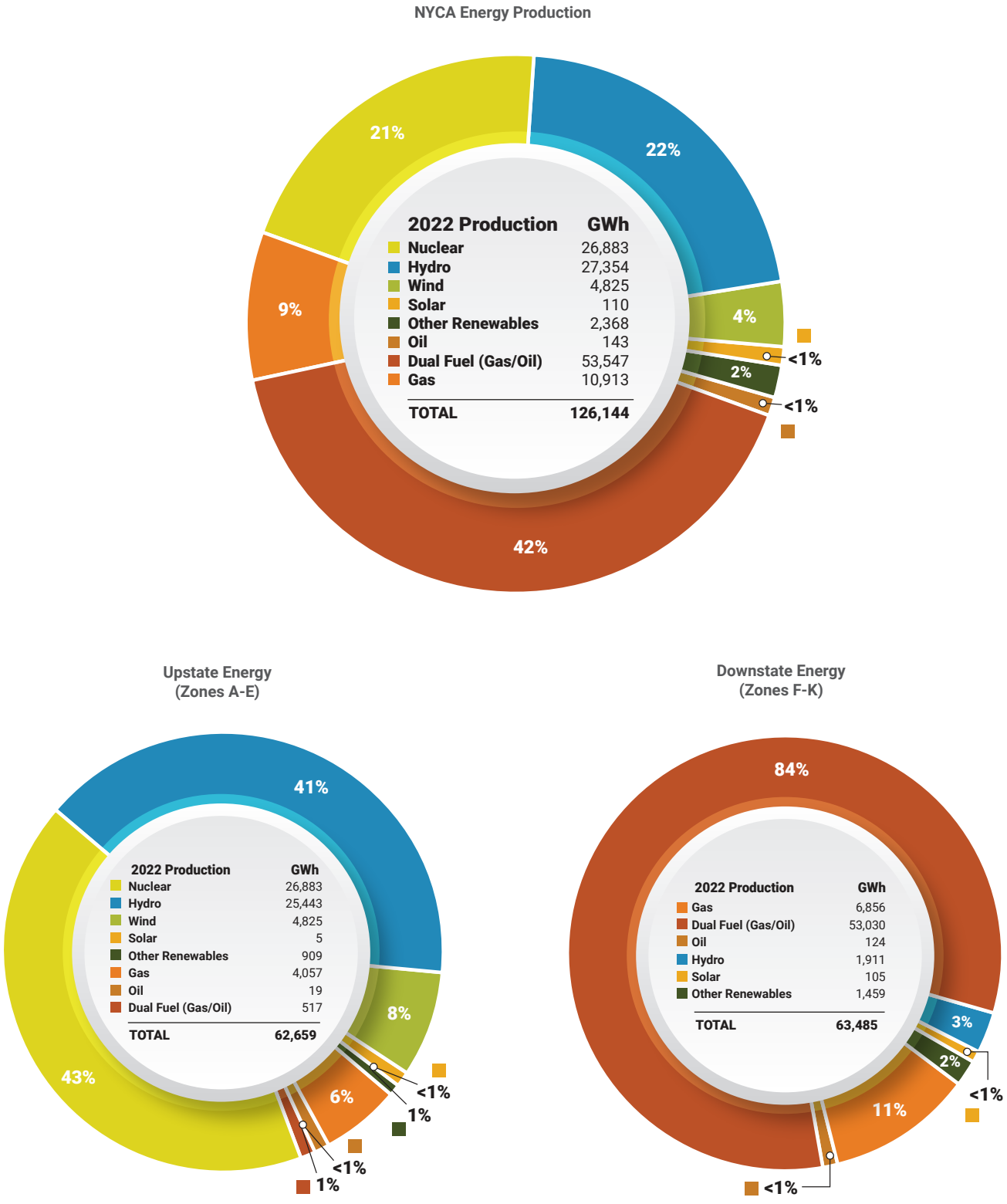


FIGURE 22: HISTORICAL GENERATING CAPACITY FUEL MIX IN NEW YORK STATE: 2000-2023

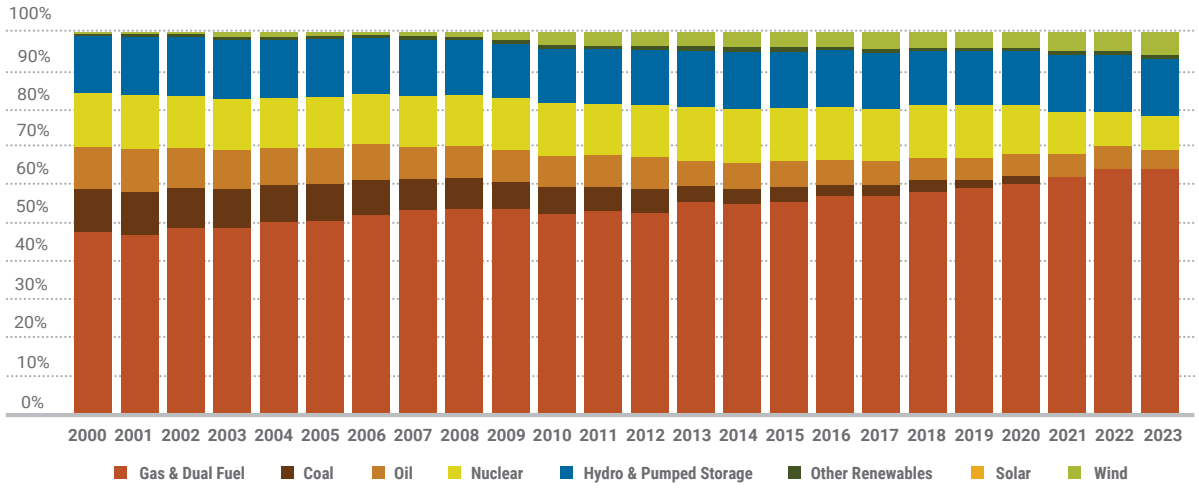


FIGURE 23: NEW YORK CITY TRANSMISSION SECURITY MARGIN: EXPECTED SUMMER WEATHER

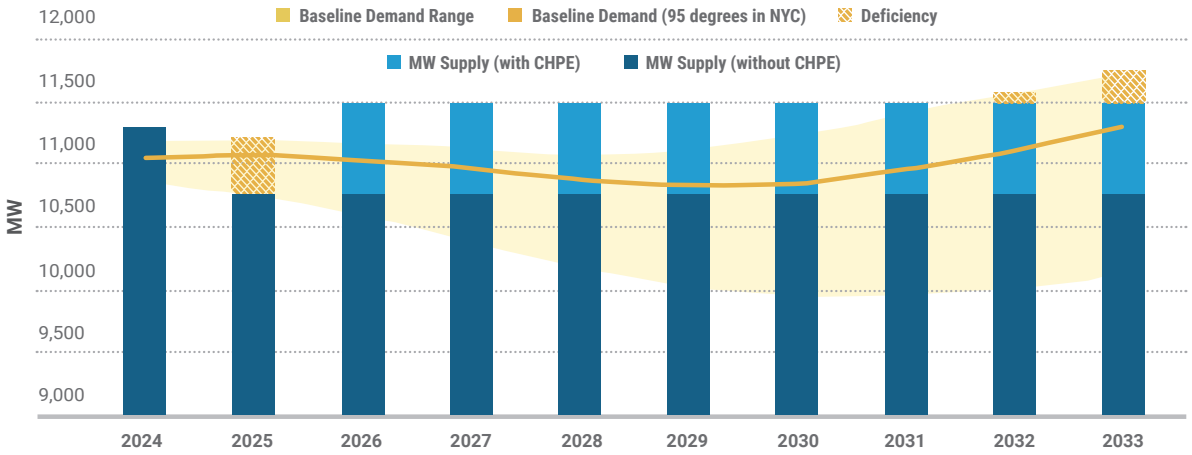


FIGURE 23 | NYISO's Q2 STAR report identified a reliability need in 2025 due to transmission security constraints that leave insufficient supply available to serve New York City's expected peak demand. Forecasted demand is influenced by expected economic conditions, the adoption rate of electrification policies, and the performance of new technologies, such as storage and electric vehicles. The NYISO is taking steps to identify solutions that will avoid that outcome. By 2026, the need is expected to be resolved with the timely completion of the Champlain Power Hudson Express transmission line, but delays in completion of that project could extend the duration of the need.

Glossary

The following glossary offers definitions and explanations of phrases used in *Power Trends 2023*, as well as terms generally used in discussions of electric power systems and energy policy.

Ancillary Services: Services that support the reliable operation of the power system, which can include voltage support, frequency regulation, operating reserves, and blackstart capabilities.

Behind-the-Meter Generation: A generation unit that supplies electric energy to an end user onsite without connecting to the bulk power system or local electric distribution facilities. An example is a rooftop solar photovoltaic system that primarily supplies electricity to the facility on which it is located.

Bulk Power System: The transmission network over which electricity flows from suppliers to local distribution systems that serve end-users. New York's bulk power system includes electricity-generating plants, high-voltage transmission lines, and interconnections with neighboring electric systems located in the New York Control Area (NYCA). Also referred to as "Bulk Electric system", "grid", or "power grid".

Capability Period: Lasting six months, the Summer Capability Period runs from May 1 through October 31. The Winter Capability Period runs November 1 through April 30 of the following year. A Capability Year begins May 1 and runs through April 30 of the following year.

Capacity: Capacity is the maximum electric output that a generator can produce. It is measured in megawatts (MW).

Class Year: A group of projects seeking to interconnect to the transmission system in similar timeframes, and which have reached similar milestones in their development efforts. These projects are studied to assess the cumulative impact they may have on the system and determine the costs to mitigate those impacts.

Climate Leadership & Community Protection Act (CLCPA): A law that requires New York to reduce economy-wide greenhouse gas emissions 40% by 2030 and no less than 85% by 2050 from 1990 levels. The law establishes technology-specific mandates for deploying clean energy technologies as well as a Climate Action Council charged with developing a scoping plan of recommendations to meet these targets.

Comprehensive Reliability Plan (CRP): A study undertaken by the NYISO that evaluates projects offered to meet New York's future electric power needs, as identified in the Reliability Needs Assessment (RNA). The CRP may trigger electric utilities to pursue regulated solutions to meet reliability needs if market-based solutions will not be available to supply needed resources. It is the second step in the NYISO's Reliability Planning Process.

Curtailment: In the context of intermittent sources of generation, refers to signals from the NYISO directing an intermittent resource to reduce its output. Sometimes referred to as economic curtailment, the NYISO's signal is based on the intermittent resources' price offers in the energy market, whereby transmission constraints induce prices that make the continued operation of certain intermittent resources uneconomic, prompting a reduction in output to alleviate the transmission constraint.

Distributed Energy Resource (DER): A broad category of resources that includes distributed generation, energy storage technologies, combined heat, and power systems, and microgrids. A DER is generally customer-sited to serve the customer's power needs, but may, in some instances, sell excess energy production or ancillary services to the power system.

Electrification: Adopting technologies that support the transition of fossil-fuel-intensive sectors of the economy to electricity. Sometimes referred to as "beneficial electrification" due to its underlying goals of promoting societal benefits through emissions reductions.

Energy: Energy is the amount of electricity a generator produces over a specific period of time. It is measured in megawatt-hours (MWh). For example, a generating unit with a 1-megawatt capacity operating at full capacity for one hour will produce 1 megawatt-hour of electricity.

Energy Storage Resources (ESRs): Energy storage resources are devices used to capture energy produced at one time for use at a later time. ESRs include technologies like batteries and pumped hydro storage.

Federal Energy Regulatory Commission (FERC): The federal agency responsible for regulatory oversight of the NYISO's operation of the bulk power system, wholesale electricity markets, and planning and interconnection processes. The NYISO's tariffs and foundational agreements are overseen and approved by FERC.

Gigawatt (GW): A unit of power or capacity equal to one billion watts.

Gigawatt-Hour (GWh): A gigawatt-hour is equal to one gigawatt of energy produced or consumed continuously for one hour.

Installed Capacity (ICAP): the capability of a qualifying generator or load facility to supply and/or reduce demand when directed by the NYISO.

Installed Reserve Margin (IRM): The level of capacity that must be secured, above projected system peak demand, to maintain reliability after accounting for unplanned and scheduled outages as well as transmission capability limitations. The IRM requirement can be met through a combination of installed generation, import capabilities, and demand response. The IRM is established by the New York State Reliability Council (NYSRC) and designed to maintain specific resource adequacy criteria.

Interconnection Queue: A queue of transmission and generation projects that have submitted an Interconnection Request to the NYISO to be interconnected to the state's electric system. Depending on the level of proposed capacity, most projects must undergo three studies before interconnecting to the grid: a Feasibility Study (unless parties agree to forego it), a System Reliability Impact Study (SRIS), and a Facilities Study.

Intermittent Resource: An electric energy source whose output varies due to the fluctuating nature of its fuel source. Examples include solar energy which is dependent upon sunlight intensity, or wind turbines where output is dependent on wind speeds.

Load: A consumer of energy, or the amount of energy consumed. Load can also be referred to as demand.

Locational Capacity Requirement (LCR): A portion of the statewide installed capacity that must be physically located within a locality to meet reliability standards. Locational requirements have been established for the New York City (Zone J), Long Island (Zone K), and lower Hudson Valley (Zones G-J) capacity zones.

Megawatt (MW): A measure of electricity that is the equivalent of 1 million watts. It is generally estimated that one megawatt provides enough electricity to supply the power needs of 800 to 1,000 homes.

Megawatt-Hour (MWh): A megawatt-hour is equal to one megawatt of energy produced or consumed continuously for one hour.

New York Control Area (NYCA): The area under the electrical control of the NYISO. It includes the entire state of New York, divided into 11 load zones.

North American Electric Reliability Corporation (NERC): The not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. NERC's jurisdiction includes users, owners, and operators of the bulk power system.

Peak Load: The maximum power demand on the electric grid measured in megawatts (MW). Peak load, also known as peak demand, reflects the highest average hourly demand experienced on the system.

Peakers: Peaking power plants, also known as peaker plants or just "peakers," are power plants that generally run only during periods of high demand — known as peak demand — for electricity.

Public Policy Transmission Planning: Part of the NYISO's Comprehensive System Planning Process. Public Policy Transmission Planning consists of two steps: (1) identification of transmission needs driven by Public Policy Requirements that should be evaluated by the NYISO; and (2) requests for specific proposed transmission solutions to address those needs, and the evaluation of those specific solutions. The NYPSC identifies transmission needs driven by Public Policy Requirements and warranting evaluation, and the NYISO requests and evaluates specific proposed transmission solutions to address such needs.

Reliability Needs Assessment (RNA): A report that evaluates resource adequacy and transmission system security over years four through 10 of a 10-year planning horizon and identifies future needs of the New York electricity grid. It is the first step in the NYISO's reliability planning process.

Resource Adequacy: The ability of the electric system to supply electrical demand and energy requirements at all times, taking into account scheduled and unscheduled outages of system elements. A system is considered adequate if the probability of having sufficient resources to meet expected demand is greater than the minimum standards to avoid a blackout.

Short-Term Assessment of Reliability (STAR): NYISO quarterly process to examine reliability needs over a 5-year period, with a focus on the first three years, including the impact of generator deactivations.

Transmission Constraints: Limitations on the ability of a transmission facility to transfer electricity.

Transmission Security: The ability of the electric system to withstand disturbances, such as electric short-circuits or unanticipated loss of system elements.

New York ISO

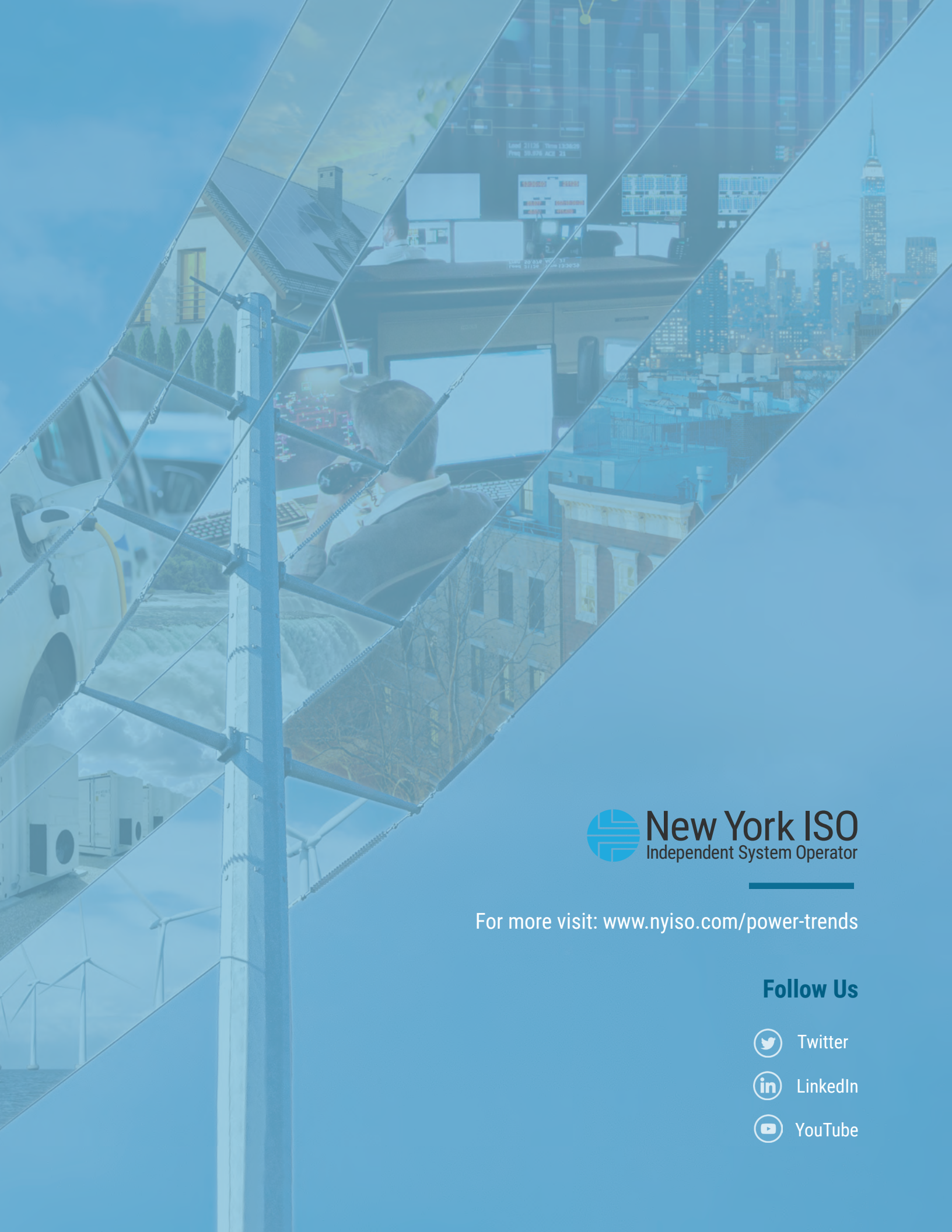
The reliability of the electric system is an essential component for a vibrant economy, and necessary to ensure the health and safety for all New Yorkers.

About the ISO

The NYISO is subject to the oversight of the Federal Energy Regulatory Commission and regulated in certain aspects by the New York State Public Service Commission. NYISO operations are also overseen by electric system reliability regulators, including the North American Electric Reliability Corporation, Northeast Power Coordinating Council, and the New York State Reliability Council.

The NYISO is governed by an independent 10-member Board of Directors. The members of the NYISO's Board of Directors have backgrounds in electricity systems, finance, information technology, communications, and public service. The NYISO is unaffiliated with any market participant or government entity. The members of the Board, as well as all employees, have no business, financial, operating, or other direct relationship to any market participant. The NYISO does not own power plants or transmission lines.

The NYISO engages stakeholders in a robust and transparent shared governance process that involves representation from a variety of interests, including transmission owners, generator owners, public authorities and municipal utilities, large and small consumers, and environmental advocates. Through open engagement and consensus building with stakeholders, rules and procedures address our wholesale electricity markets, system planning, and grid operations are developed.



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