New York ISO

Power Trends 2022

The Path to a Reliable, Greener Grid for New York

THE NEW YORK ISO
ANNUAL GRID & MARKETS REPORT

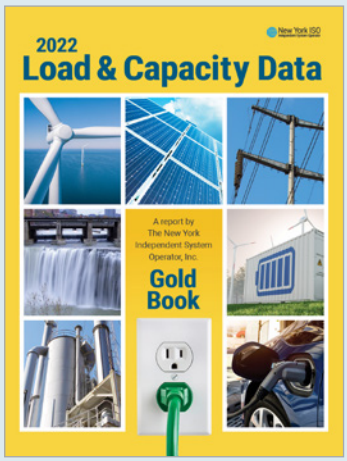
New York ISO

POWER TRENDS 2022 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.

POWER TRENDS 2022 DATA is from the 2022 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 2022 edition of *Power Trends*.

Power Trends is our flagship publication, summarizing and discussing the 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 stakeholders to build the cleanest, most reliable electric system in the nation. These objectives drive everything we do at the NYISO.

Since the company's inception in 1999, preserving electric system reliability has been a top priority for the NYISO. As we progress toward the state's public policy goals and new technology transforms the system, the way in which we plan for and meet reliability requirements must also change. New York's public policies emphasize clean-energy production and a rapid transition away from fossil fuels. The NYISO is at the forefront of this transition, working to achieve state emissions mandates with a balanced approach that maintains electric system reliability. It will be imperative to maintain adequate supply capabilities and characteristics necessary to ensure reliability as we transition to a zero-emissions grid. Achieving that balance will be the central challenge to the industry in the coming years.

As we have witnessed recently in other parts of the U.S., the efforts necessary to achieve electric system reliability, economic efficiency, and environmental benefits are interlinked. These endeavors can and must coexist in support of our power system, our economy, consumer interests, as well as the health, welfare, and safety of all New Yorkers.

All of us at the NYISO are committed to a continued strong partnership with lawmakers, policymakers, market participants and industry stakeholders to address the priorities and goals set forth under the state's Climate Leadership and Community Protection Act (CLCPA). The Climate Action Council (CAC), created under the CLCPA, released a *Draft Scoping Plan* to guide the state in reaching the CLCPA's requirements. *Power Trends 2022* is designed to inform the CAC's efforts as it finalizes the *Draft Scoping Plan*. We are confident that the information and expertise on grid operations, system planning, and competitive wholesale electricity markets will assist the CAC's efforts.

In keeping with our objective to be recognized as the authoritative source of information on the power industry, this year's *Power Trends* provides a summary of the opportunities and challenges before us. This edition discusses recent changes, as well as other efforts underway, that we have made to the markets to support a grid in transition. *Power Trends* presents long-term solutions to addressing the upcoming changes to New York's electric grid reliably and efficiently.

The NYISO is committed to offering the information, tools, independent perspectives, and expertise necessary to assist in the transition to a zero-emission power system by 2040. We believe *Power Trends* shows our dedication to serving the reliability, economic, and environmental needs of all New Yorkers.

Thank you for reading.

Rich Dewey

Richard Dewey
President and CEO

Grid of the Future Video Series

The series examines New York's, nation-leading transition to clean energy and builds upon the New York ISO's award-winning efforts to highlight the important work the NYISO has undertaken to deliver the #GridoftheFuture.

Future episodes will explore

- Planning for a zero-emissions grid by 2040
- Climate change & electric system reliability
- The impacts of beneficial electrification
- Benefits and challenges of renewables
- The role of energy storage
- The integration of offshore wind
- The essential need for transmission expansion

To learn more

Episodes of the #GridoftheFuture campaign are available on YouTube, Twitter, LinkedIn, and our 2040 Grid webpage

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Executive Summary

How New York's power grid serves consumers is changing dramatically. New York's bulk power system is evolving to meet the state's clean-energy objectives. The Climate Leadership and Community Protection Act (CLCPA), enacted in 2019, requires an economy-wide approach to addressing climate change and decarbonization. Included are mandates to deliver 70% of New York energy from renewable resources by 2030 and 100% emissions-free electricity supply by 2040.

The path to a greener grid must remain a reliable one. New York benefited from additional resources above the minimum levels required on the grid over the past several decades, providing for additional capacity in the event of unforeseen events like extreme weather. **These strong reliability margins have supported the reliability and resilience of the New York system, but today, those margins are narrowing.** Fossil-fueled resources are retiring, primarily due to emissions concerns, at a faster pace than clean-energy resources are entering. As we have seen in California and Texas, operating a reliable electric grid requires a flexible and well-planned transition to the grid of the future. Grid reliability and resilience are at the core of NYISO grid operations, market design, and system planning, and must remain a primary focus when enacting and implementing energy policies.

The pace of deactivation of current fossil-fueled resources must not exceed the pace of development and deployment of new, non-emitting electricity supply resources that can provide the reliability services that New Yorkers expect. This means that fossil-fuel resources will be needed to maintain reliability until non-emitting dispatchable resources can effectively replace them. As noted by the NYISO's independent market monitor, Potomac Economics, the NYISO's markets "will channel investment toward projects that enable the NYISO to achieve these goals while maintaining reliability at the lowest possible cost."[1]

The NYISO's recent *Comprehensive Reliability Plan* (CRP) evaluated these risks and concluded that reliability margins are shrinking. Additional generation deactivations, delays in transmission upgrades, and extreme weather threaten grid resilience and present risks to meeting New York's reliability requirements. The CRP's findings also pointed to the need to consider enhancements to reliability and resilience rules and

Power Trends Key Messages

> The NYISO has established new market rules that advance the state's clean-energy policies. Wholesale electricity markets are open to significant investment in wind, solar and battery storage.

> The transition to a cleaner grid in New York is leading to an electric system that is increasingly dynamic, decentralized, and reliant on weather-dependent renewable generation.

> Reliability margins are shrinking. Generators needed for reliability are planning to retire. Delays in the construction of new supply and transmission, higher than expected demand, and extreme weather could threaten reliability and resilience in the future.

> A successful transition of the electric system requires replacing the reliability attributes of existing fossil-fueled generation with clean resources with similar capabilities. These attributes are critical to a dynamic and reliable future grid.

> New transmission is being built but more investment is necessary to support the delivery of offshore wind energy to connect new resources upstate to downstate load centers where demand is greatest. Planning for new transmission to support offshore wind is underway.

A Powerful Purpose

We are dedicated to a reliable, sustainable power grid and competitive markets.

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

procedures. Revisions to current reliability rules, procedures, and practices will be necessary as the impacts of climate change, public policies, and economic conditions place new demands on the grid. Upcoming NYISO studies, like the *2022 Reliability Needs Assessment*, will refine our outlook on the reliability needs of the system over the next decade.

Supporting reliability, resilience, and state and federal clean-energy policy objectives also requires addressing New York's "Tale of Two Grids." Today, transmission constraints limit access to clean-energy technologies located in upstate New York from serving downstate New York, where most of the electricity demand is located. New transmission capability is under construction and will alleviate some constraints on today's system, increasing the flow of emissions-free electricity. Looking ahead, New York State has agreements with two developers to build new transmission for the delivery of renewable energy to New York City. However, it will be several years before these projects will be completed. Additionally, investment to support the development of offshore wind energy is under consideration, spotlighting the importance of the NYISO's planning processes.

Managing risks to reliability is not only achieved through forward-thinking grid planning. NYISO grid operators continuously manage the flow of electricity across 11,000 miles of high voltage transmission in New York, balancing changing supply and demand levels while meeting stringent reliability rules.

As traditional resources deactivate and are replaced by new clean-energy resources that are dependent upon weather conditions to supply the grid, the challenge becomes greater.

The impact of extreme weather on grid reliability and resilience is a constant focus of NYISO operations. In November 2021, the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC) issued a report, *The February 2021 Cold Weather Outages in Texas and the South-Central United States*,[2] which examined the power system outages stemming from extreme cold

weather conditions. The report included 28 recommendations to improve reliability. In evaluating the recommendations, the NYISO found that 18 of the 28 recommendations are applicable to NYISO operations, and that the NYISO either currently meets, or is implementing these recommendations.

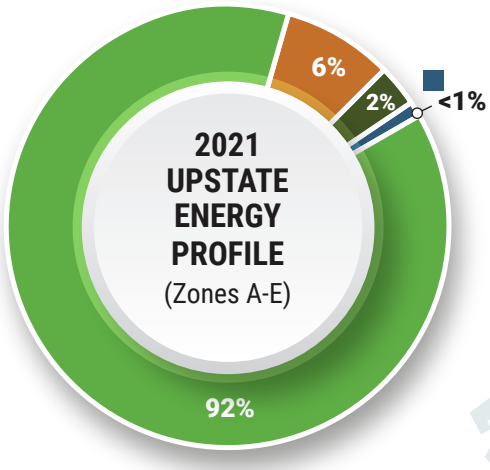
In keeping with our mission and vision, the NYISO is working diligently to be a market design leader — helping to build the cleanest and most reliable grid in the nation in the most cost-efficient manner. In 2021, the NYISO engaged stakeholders to develop a broad set of capacity market design reforms to eliminate barriers to certain clean-energy resources seeking to interconnect to the grid pursuant to the state's clean-energy policies. The groundbreaking proposal, supported by over 80% of stakeholders, 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. Speaking on the approval of the NYISO proposal, the New York State Public Service Commission Chairman stated, "The clean-energy future is a lot more secure because of this ruling. This is a major win for the state's CLCPA objectives."[3]

Additional market enhancements are underway to further meet these challenges and position the NYISO as a national leader in competitive wholesale electricity markets. Through engagement with stakeholders and regulators, new market rules for energy storage integration, participation in our wholesale electricity markets by distributed energy resources, and new ancillary services products will support a more dynamic grid. Market rules that incentivize investment in resources that can respond rapidly to changing conditions will be essential for maintaining reliability of the grid of the future.

Figure 1: **New York's Tale of Two Grids**

Addressing the Tale of Two Grids

A historic level of investment is underway, with a number of projects in construction, setting great expectations that New York's transmission system will meet the clean-energy needs of the grid of the future. These efforts will deliver more clean energy to consumers while enhancing grid resilience and reliability.



< Smart Path Project

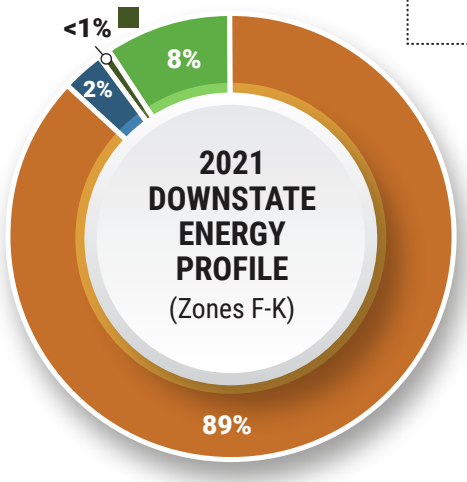
200 miles of transmission being rebuilt in the North Country to "unbottle" existing renewable energy in the region.

^ AC Transmission Project

150-mile, $1.2B transmission upgrade under construction to increase delivery of clean power generated in northern and western New York to downstate customers.

< Western NY Transmission Project

$181M transmission upgrade to improve access to renewable energy from the Niagara Power Project.



^ Transmission Needs for Offshore Wind

The NYISO is reviewing proposals to upgrade transmission to deliver future offshore wind resources to customers in NYC and the rest of NY.

2021 energy production from:

- **Zero-Emissions**
- **Hydro Pumped Storage**
- **Other Renewables**
- **Fossil Fuels**

Introduction

The NYISO serves the energy industry, policymakers, and New York's electric energy consumers through highly skilled and experienced grid operations, innovative wholesale electricity market design, and expert system planning. For more than 20 years, New Yorkers have also benefited from improved economic efficiency of the grid, which has driven a shift toward cleaner sources of generation.

The NYISO is regulated by the FERC and regulated in certain aspects by the New York State Public Service Commission (NYPSC). The NYISO operates the New York power system to the strictest reliability standards in the nation and is overseen by the NERC and the Northeast Power Coordinating Council (NPCC). The New York State Reliability Council (NYSRC) establishes state-specific reliability rules that are more stringent than the rest of the United States.

New York's renewable and environmental goals are driving profound changes on the electric system. The CLCPA, which targets a zero-emissions grid by 2040, is shifting how energy is produced, delivered, and consumed in New York. The NYISO believes New York's energy and environmental objectives are attainable by balancing reliability, economic, and policy priorities.

The NYISO's analysis of future clean-energy scenarios concludes that maintaining reliability on the grid of the future will require significant amounts of on-demand, flexible resources that can account for the intermittency of renewables.

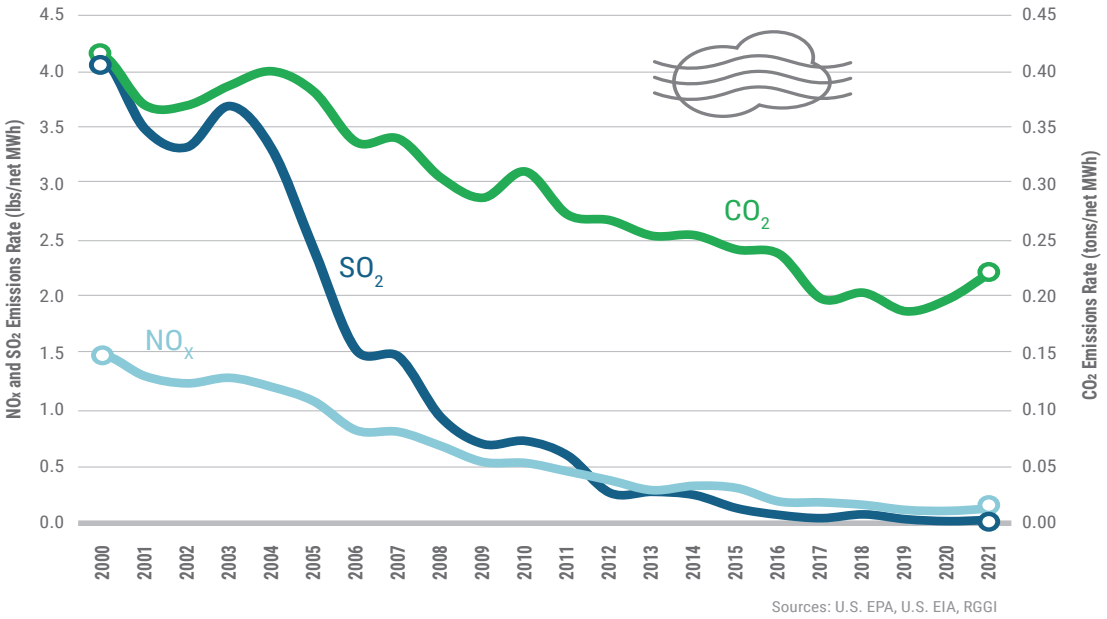
Simply deactivating existing generation without having new resources on the system capable of providing comparable attributes risks the ability to maintain a reliable electric system. To facilitate a successful transition, to weather-dependent resources, we must build and interconnect technologies that fill in reliability gaps and mimic the reliability attributes of our existing fleet of generation.

The Essential Role of the NYISO's Markets

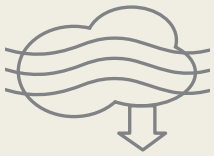
Over two decades ago, public policies at the state and federal levels directed the formation of competitive wholesale electricity markets in New York to achieve economic efficiencies for consumers while maintaining reliability of the system. Competitive wholesale electricity markets shifted the risk and cost consequences of investment decisions from consumers to electricity suppliers.

The NYISO supports reliability through three complementary markets: energy, ancillary services, and capacity. Wholesale electricity markets have successfully delivered efficiency gains on the grid while also achieving cleaner energy production, making the markets an effective platform for advancing public policy and new, more efficient technology.

Figure 2: **Emission Rates from Electric Generation in New York: 2000-2021**



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



> Since 2000,
the power sector's CO_2 emissions rate decreased by 46%. 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, respectively.

NYISO's markets are designed through an open and transparent shared governance process that includes participation by utilities, suppliers, consumer interests, environmental advocates, environmental justice interests, New York State entities, and municipalities. The rules developed in this process are subject to review and approval by FERC.

Principles that shaped our innovative market design at the outset remain essential today: investment signals must align with system needs, thereby supporting and enhancing grid reliability, and achieving the lowest cost possible. NYISO energy market software selects the least-cost mix of supply offers every five minutes, every day, balancing supply with consumer demand, while meeting stringent reliability rules. Through competition, wholesale electricity markets incentivize suppliers to minimize costs, which increases their likelihood of being selected by competitive markets to provide the services needed to keep the grid reliable and resilient.

In addition to supplying energy to meet demand, the NYISO's markets solicit ancillary services such as energy reserves and system regulation services to support reliable grid operation even when conditions rapidly change.

How do we know that competitive markets are working properly to the benefit of New York consumers? The NYISO's federally approved market rules include strict provisions designed to promote competition and penalize uncompetitive market behavior. A multi-dimensional approach to reviewing how the markets operate and the prices they produce takes place each day.

- **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.

The path to a reliable, greener grid in New York requires well-informed public policies, expert grid operations and system planning, and innovative wholesale electric market design. The transition to an emission-free electric energy system envisioned by the CLCPA will have implications for both current and future reliability needs. As the system changes, reliability rules that have guided us for more than twenty years must now be re-examined for effectiveness.

The NYISO is actively engaged with stakeholders and policymakers on enhanced rules to support reliability and resilience in response to the risk of extreme weather, and the impact public policies are having on how electricity is produced and consumed. The NYISO is also engaged in essential grid studies to inform investors, policymakers, and the public, on the steps necessary to maintain and enhance grid reliability and resilience.

The NYISO's planning processes are designed to detect and provide sound solutions to future reliability risks. The NYISO's planning process also looks over several decades to identify and address additional transmission needs to fulfill public policy requirements, such as new transmission to integrate renewable and other clean-energy resources.

The coming pages of *Power Trends* discuss the leadership the NYISO is taking in both market design and transmission system planning.

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.

State of the Grid

Background and Overview

The traditional roles of electric generation and consumption will change. The adoption of battery storage resources will result in electricity supply having many of the same attributes as consumers; meanwhile, the growth of distributed energy resources and behind-the-meter technologies will empower consumers to provide reliability services to the grid similar to those of traditional generators. As a result, the complexity and the importance of accurate demand forecasting will grow increasingly important.

The NYISO's energy and demand forecasts serve multiple purposes, from five-minute forecasts that guide real-time grid operations to longer-range 30-year forecasts that help to inform the decisions of investors and policymakers. As the complexity of load forecasting has increased, the NYISO has integrated meteorology, information technology, and economics along with data from local utilities, market participants, and other stakeholders.

Short-Term Forecasting

On a typical day, demand ramps up throughout the morning, peaking in the afternoon or early evening hours. These daily patterns lead to seasonal patterns of electricity consumption. Traditionally, overall demand has been greater in the summer months in New York.

Figure 3: **2021 New York Control Area (NYCA) Bulk Electric System 2021 Actual and 2042 Forecasted Winter/Summer Load Shapes**

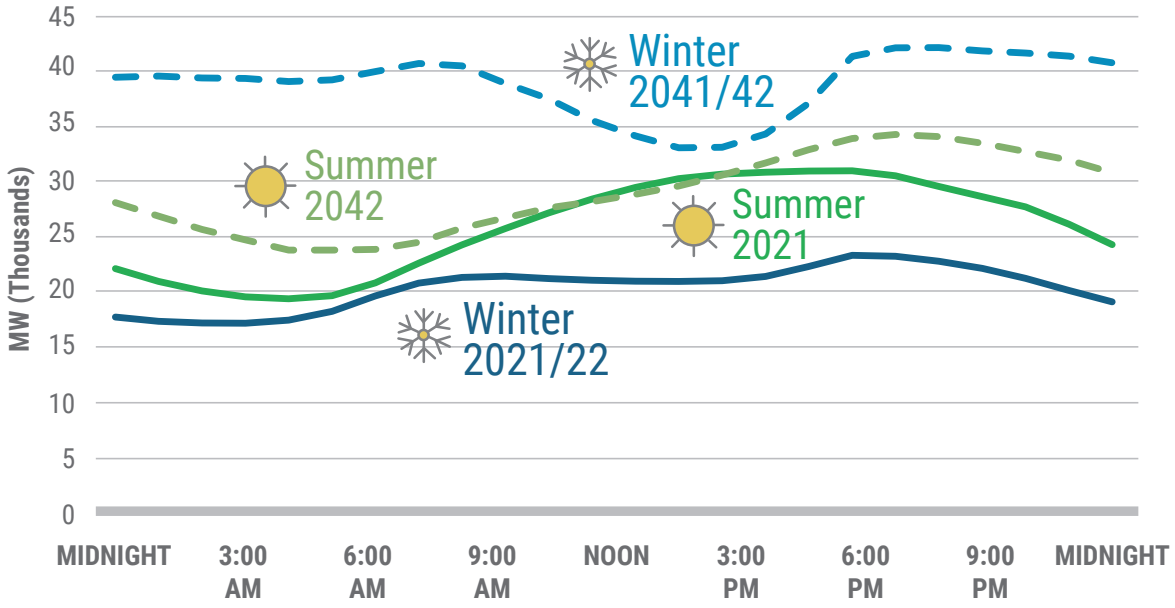
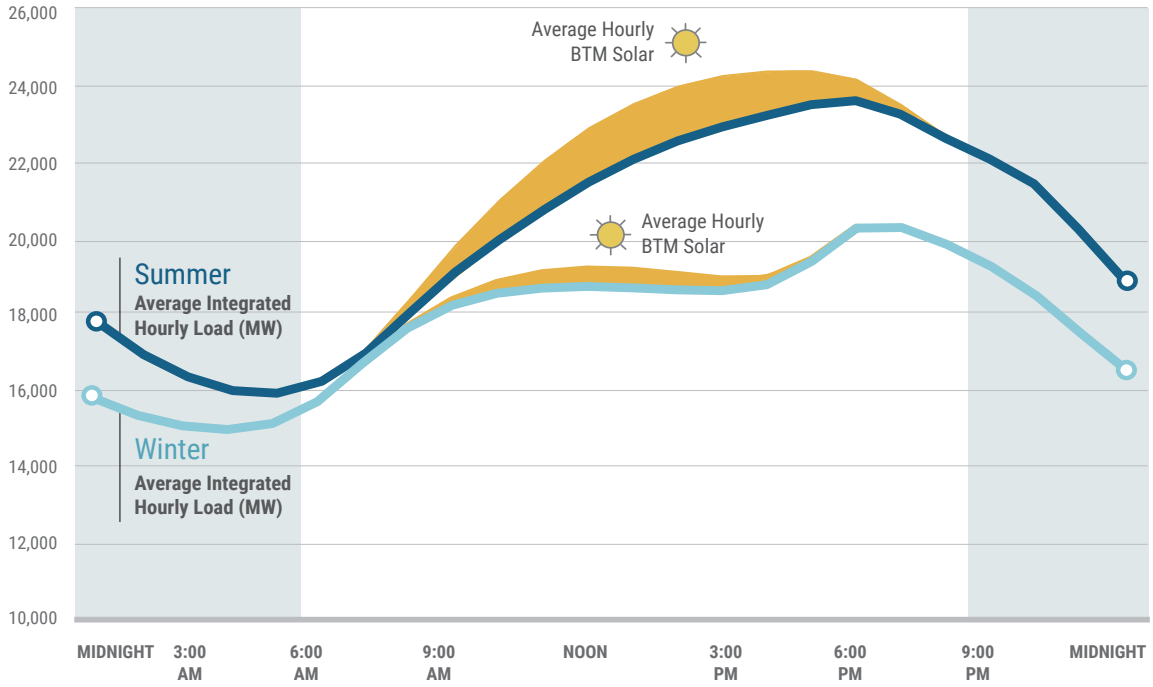


Figure 3 illustrates 2021 summer and winter 2021-22 peak-day hourly demand profiles in New York State. To demonstrate how electricity usage is expected to change as the state advances towards the objectives of the CLCPA, Figure 3 includes projected high-load weekday profiles for the summer of 2042 and the winter of 2041-42. Load shapes are expected to shift in the future, with daily peak demand likely to occur later in the day when the load-reduction effects of behind-the-meter (BTM) solar resources wane, which will increase the demand on the bulk electric system. In large part, this is because businesses and communities are continuing to adopt distributed energy resources (DERs) to produce electricity, such as solar installations on residential rooftops, commercial sites, and community solar. These BTM resources act to reduce the total energy consumed from the grid and can provide certain grid services similar to other types of electricity suppliers. While the NYISO does not have direct visibility into the performance of BTM resources, they are tracked in the demand forecasting and analysis process through real-time sampling to estimate the aggregate impact of these resources.

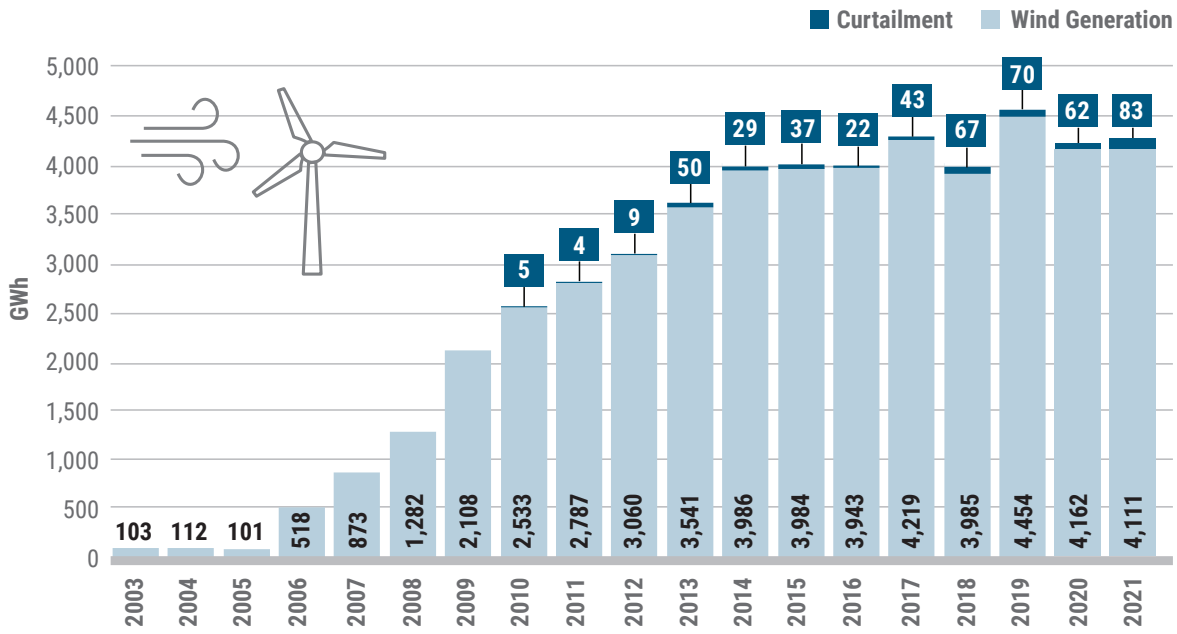
Figure 4: **Average Hourly Behind-the-Meter Solar Energy Production: Summer 2021 and Winter 2021-2022**



In response to the growing amount of the BTM solar over the last decade, the NYISO developed a unique forecasting system to quantify and forecast BTM solar capacity and generation on the system. Forecasting BTM solar generation patterns involves using additional weather station data, high resolution satellite data, and sophisticated numerical weather prediction models to forecast clear sky and cloudiness conditions across the state. Future development of this system is planned as the number and variety of BTM resources grow in response to the CLCPA goals.

Figure 4 illustrates how BTM solar contributed to serving load throughout the day in both summer and winter months. Note that during summer months, the solar resource is contributing towards meeting peak demand, with production continuing past the peak period. During winter months, however, solar resources are unavailable to serve peak periods because demand typically peaks after sunset. The result is that peak winter demand periods will need to be met by other available resources when lighting and heating ramps up.

Figure 5: **Wind Generation and Curtailment in New York - Energy Produced: 2003-2021**



The level of energy production from wind resources is constantly changing due to its dependency on weather conditions. Just as storm fronts may move across the region and bring windy conditions that can produce large amounts of energy, there are also multi-day instances where wind lulls occur across the region. Even as more wind capacity interconnects to the system, wind lulls create a need for dynamic resources to fill reliability needs. Increased geographic diversity of wind generation, including the addition of offshore wind, may mitigate some of this risk. As wind generation capacity levels increase, planning to meet demand with alternate available electricity supply during these lulls will be required.

Another challenge to future grid planning is constraints in the existing transmission system that limit the capability to deliver wind energy to consumers. Figure 5 illustrates how transmission constraints lead to curtailed production despite additional amounts of installed wind energy. **Additional transmission capability will lessen constraints and maximize the potential contribution of these renewable resources to meet electric demand and achieve public policy goals.**

Long-Term Forecasting and Climate Change

Economic and demographic shifts are key considerations in long-term forecasting. The amount of electricity needed by commercial and industrial users is a significant factor in overall demand. From an energy demand perspective, a strong economy generally translates into more economic activity, which in turn leads to higher levels of electricity consumption. Other factors, such as electrification of New York's economy, will alter traditional demand patterns that were previously more aligned with economic conditions.

Climate change is an additional consideration. The NYISO's *Climate Change Impact and Resilience Study* identified new load forecasting methods to account for rising temperatures in long-term forecasts. The study noted a statistically significant increase in average temperatures of 0.5 to 1.1 degree per decade. This trend is expected to contribute to an increase in the number of summer days with high demand. These findings were incorporated into NYISO long-term demand forecasts beginning in 2020.

Figure 6: **Electric Energy Usage - Actual and Forecast: 2021-2052 (GWh)**

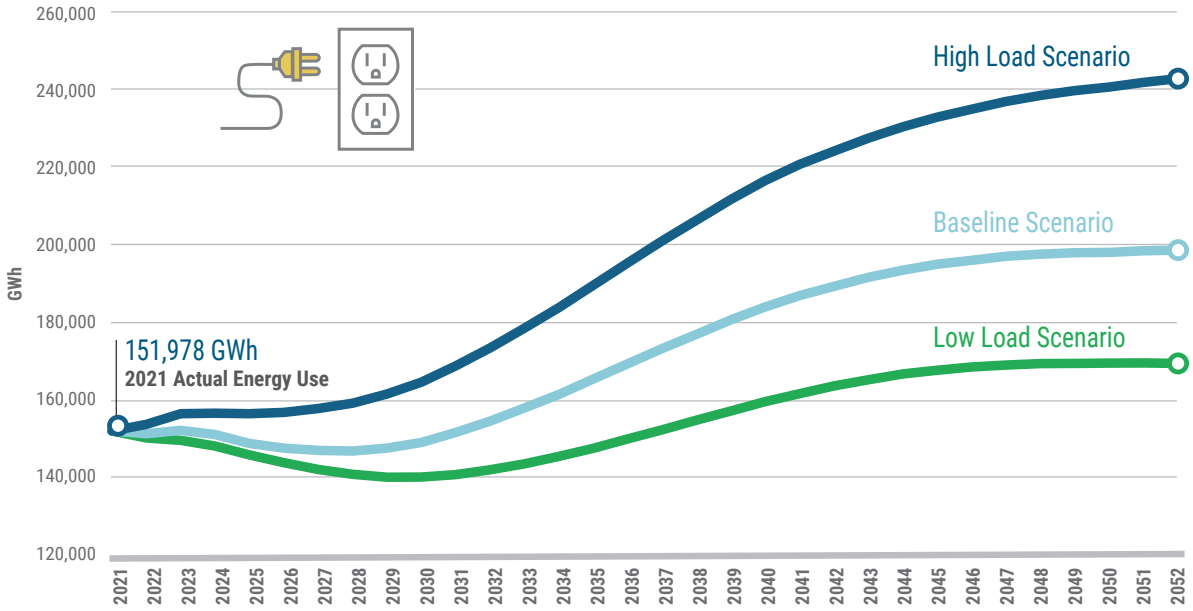
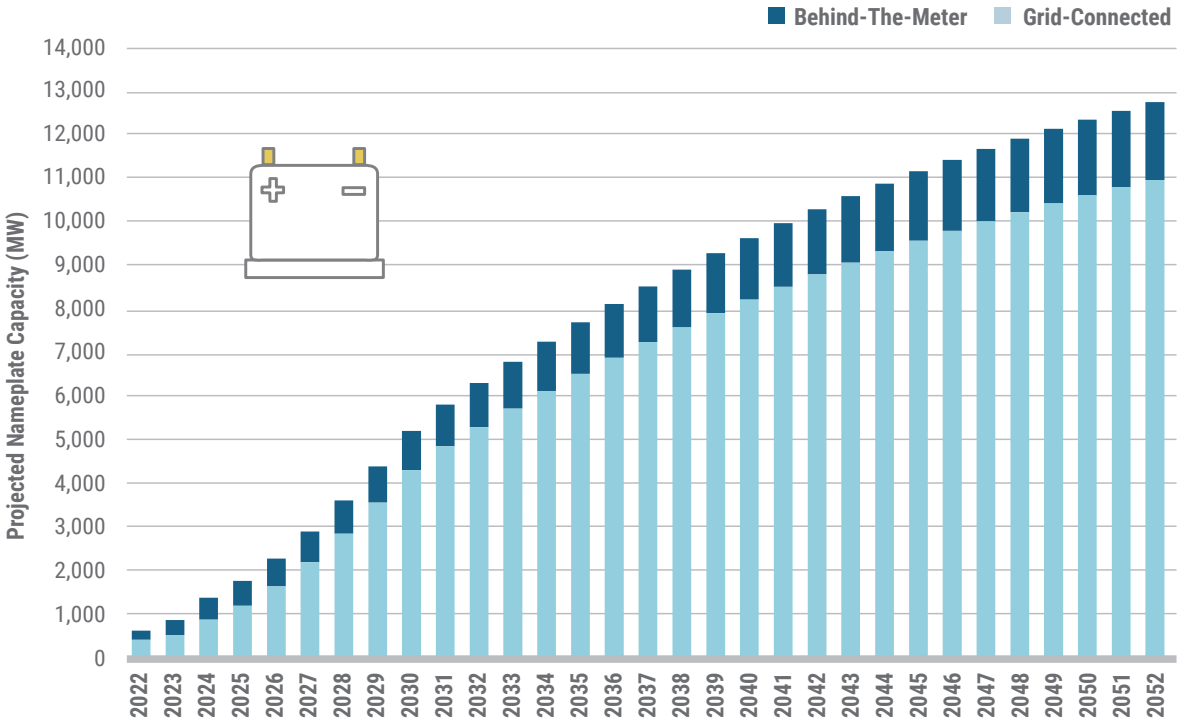


Figure 6 illustrates three energy forecasts through 2052 developed by the NYISO. The baseline scenario reflects the expected rate of load growth. The high-load scenario assumes higher adoption rates for electrification, and reduced adoption of energy efficiency measures and BTM solar. The low-load scenario assumes increased adoption of energy efficiency measures and BTM solar, which have the effect of reducing demand on the bulk electric system.

The growth of BTM storage resources has implications for long-term forecasts that must be resolved. Techniques like BTM solar forecasting are being developed for these types of DERs, but unlike BTM solar, the performance profiles of resource like energy storage systems are less predictable. The expectation is that over time they will act in the aggregate to flatten peaks and valleys in the demand profile across New York.

Figure 7: **Energy Storage Nameplate Capacity**

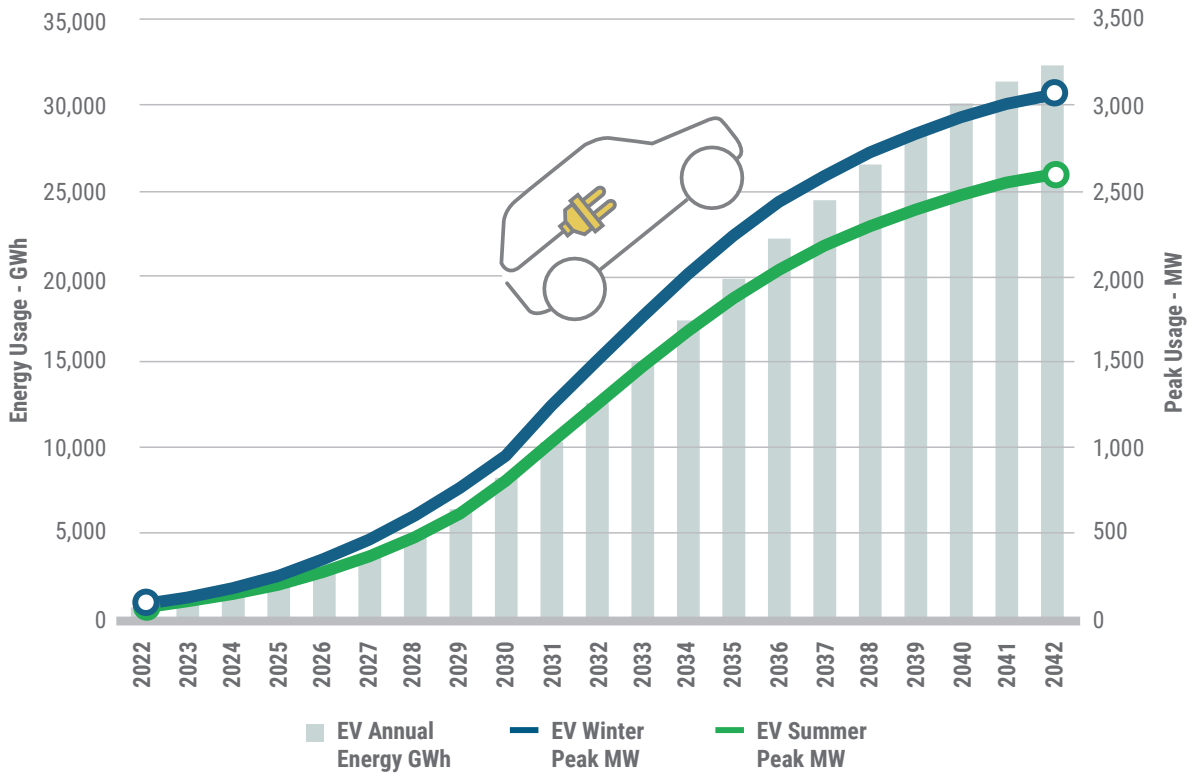


> Energy Storage Resources (ESRs) are devices used to capture energy produced at one time for use at a later time. ESRs include technologies like batteries and pumped hydro storage. ESRs promote reliability and efficiency, shift load, manage intermittent renewable energy, and reduce transmission congestion.

Figure 7 shows the NYISO's projections for the growth of energy storage capacity in New York State through 2052 for both grid-connected and BTM storage resources. Due to charging and discharging cycles, storage resources represent additional load to the grid because they consume more electricity than they inject. That demand is accounted for in future demand forecasts and must be met by available supply. The NYISO forecasts the impact of demand from storage resources to be less than 2% of the total forecasted electricity consumption across the NYCA system.

The effects of electrification programs in the building and transportation sectors will also impact demand significantly in the future as state and local policies are encouraging the transition of fossil-fuel-intensive sectors of the economy to electricity usage will increase overall electricity demand.

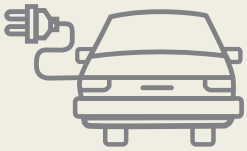
Figure 8: **Electric Vehicle Energy and Peak Impacts - Baseline Forecast**



Clean-energy production is a key underlying element of electrification policies, and the rate of adoption of technologies like electric vehicles (EVs) by consumers, businesses, and government is key to forecasting the total energy demand.

Figure 8 depicts the NYISO's forecast of EV energy usage and impacts on summer and winter peak demand. These forecasts assume over 7.7 million total EVs on the road in New York State by 2040, including passenger vehicles, trucks, and buses. Roughly 160,000 EVs are forecasted to be registered in New York by the end of 2022.

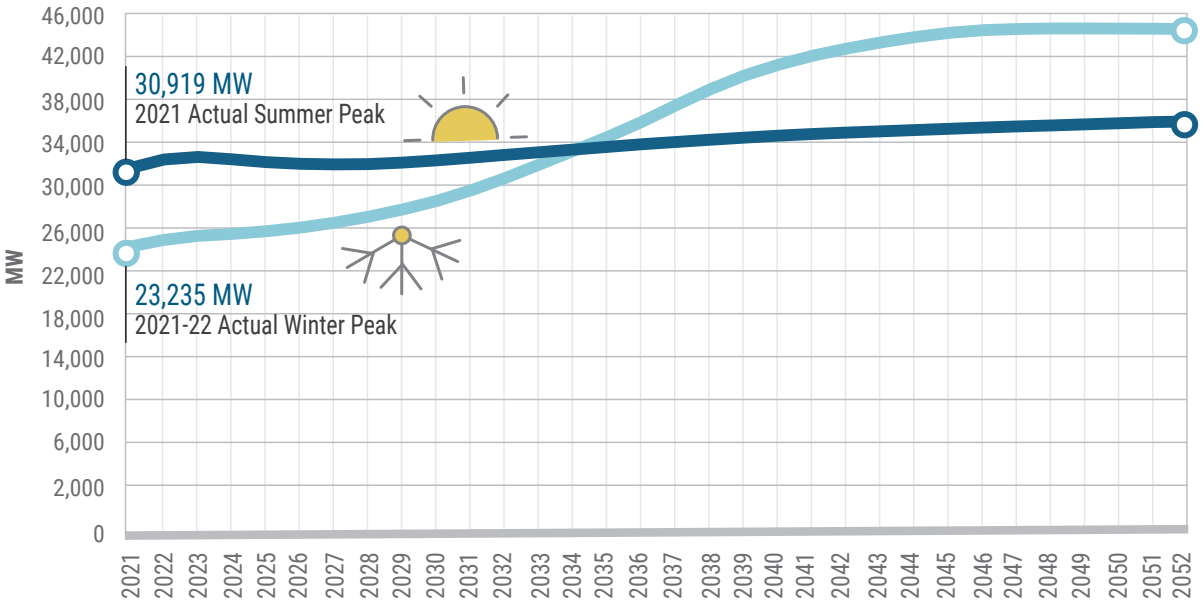
The conversion of space heating from fossil fuel to electric technologies will also add significantly to system demand. Much like EVs, forecasting demand from electric building heating involves examining the availability, efficiency, and adoption rates of alternative technologies over time. Most importantly for electrification anticipated by the CLCPA, forecasts of the adoption rates and usage characteristics of air source and ground source heat pumps are necessary. Unlike mature technologies such as air conditioning, little historical energy demand data for emerging technologies exists.



7.7 Million

total projected EV vehicles to be on the road in New York State by 2040, including passenger vehicles, trucks, and buses. Roughly 160,000 EVs are forecasted to be registered in New York by the end of 2022.

Figure 9: **Electric Summer and Winter Peak Demand - Actual and Forecast: 2021-2052**



> These forecasts show demand projections under expected weather conditions, and account for the demand-reducing impacts of energy efficiency programs, implementation of new building codes and appliance efficiency standards, expanded use of solar and other DERs, and expected impacts of expanded electric vehicle usage and electrification.

Hourly load profiles are changing due to the growing impacts of BTM solar, electric vehicle charging, climate change, and post-COVID-19 societal shifts in the occupancy rates of homes and businesses. The hour of the summer peak is advancing into late afternoon, and eventually the peak may move to the early evening. If electrification of space heating loads evolves as state energy policymakers anticipate, the winter peak will eventually surpass the summer peak. This will have implications for reliability planning and future capacity requirements. The current crossover from summer peaking to winter peaking is forecasted to occur in the mid-2030s.

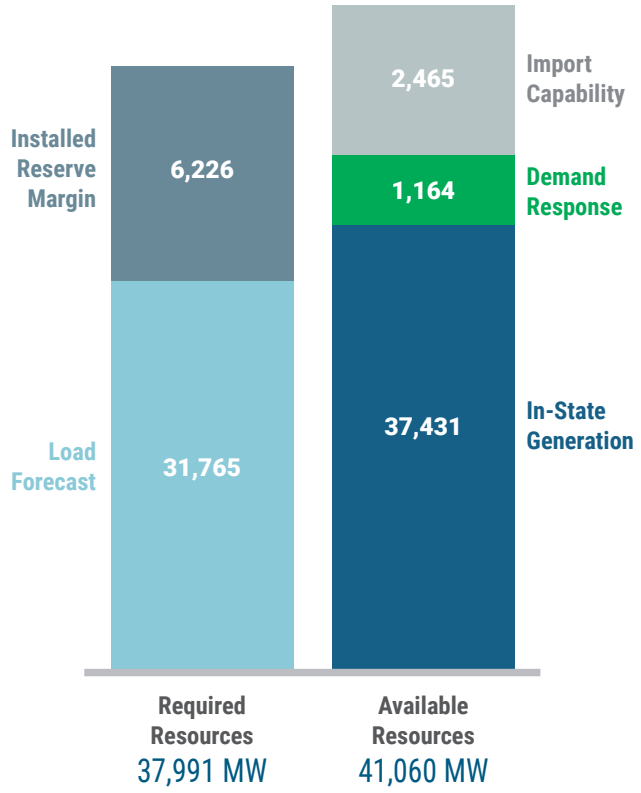
Resource Adequacy

Reliability rules require that there be enough generating capacity available to maintain resource adequacy. Resource adequacy is the minimum level of capacity necessary to meet forecasted peak electric demand while accounting for the performance of supply resources, transmission capability, and risks associated with extreme weather. The quantity of supply required to meet resource adequacy is developed annually through a regulatory process administered by the NYSRC. The NYISO supports the NYSRC's process through extensive system planning analyses. The NYSRC adopts a forecast for expected peak demand for the following year and determines a capacity reserve margin to sufficiently address potential risks to system adequacy, such as extreme weather

conditions and the unexpected outage of a generator or transmission line.

Using these analyses, the NYSRC establishes an installed reserve margin (IRM) identifying the minimum amount of installed capacity that must be available above forecasted peak demand to support system reliability. Once the proposed IRM is accepted by FERC and the NYPSC, the NYISO calculates capacity procurement requirements for each organization serving electric customers in New York, who then may meet their respective capacity requirements through purchases of capacity in the NYISO's market, directly from suppliers, or a combination of both.

Figure 10: **Statewide Resource Availability: Summer 2022**



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

The 2022-23 IRM represents a decrease over the prior year level of 20.7%. The IRM is likely to increase with the expansion of intermittent renewable resources on the system. In its *Technical Study Repor*t on the IRM, the NYSRC noted that increased wind penetration, "raises the IRM because wind capacity has a lower contribution to reliability than traditional resources."[4] Further, historically strong reliability margins, which represent both resource adequacy and transmission security capabilities above and beyond IRM and locational capacity requirements and have supported the reliability and resilience of the New York system, are narrowing.

Locational Capacity Requirements

Each year, the NYISO also calculates locational capacity requirements (LCRs) for the Hudson Valley (Zones G-J), New York City (Zone J), and Long Island (Zone K) regions of the state. Transmission constraints restrict the amount of capacity that can be delivered into these regions. In order to serve reliability, LCRs set the minimum amount of capacity necessary to be procured from supply resources located within those regions. LCRs for the 2022-23 capability year are 89.2% in the Hudson Valley region, 81.2% in New York City, and 99.5% in the Long Island capacity region.

Capacity Accreditation

As will be discussed further, FERC accepted the NYISO's Comprehensive Mitigation Reform (CMR) proposal, which includes new rules to allow the NYISO to use IRM and LCR models for accreditation evaluations. As a result, resources will receive capacity payments based on both: (1) how they contribute to reliability as modeled in the IRM and LCR setting process; and (2) their individual performance.

Public Policies Shaping the Grid

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

This past year alone featured several announcements and developments that are reshaping the grid. In late 2021, the Climate Action Council (CAC), created under the CLCPA, released a *Draft Scoping Plan* to guide the state in reaching the CLCPA's requirements. In addition to addressing the clean-energy objectives of the CLCPA, the *Draft Scoping Plan* calls for eliminating the use of fossil fuels in any new home construction by 2025, and for multi-family or commercial buildings by 2030. In addition, Governor Kathy Hochul announced the results of the state's competitive Tier 4 Clean Energy Standard solicitations, which sought proposals to deliver additional renewable energy into New York City. Two proposed transmission projects have since been awarded Tier 4 Renewable Energy Credit (REC) contracts. Further, on February 25, 2022, the U.S. Department of the Interior announced the results of the New York Bight offshore lease rights sale. The lease sale offered over 488,000 acres in the New York Bight for potential wind energy development. On January 12, 2022, the federal government, New York, and New Jersey announced a shared vision for developing a robust offshore wind energy domestic supply chain that will deliver benefits to residents of New York, New Jersey, and the surrounding region, including under-served communities.

> **Federal Energy Regulatory Commission (FERC)**
> The agency that approves the NYISO's tariffs and regulates its operation of the bulk power system, wholesale power markets, and planning.

The federal government has also been focused on steps to transition the nation's electric energy production to renewable energy supply technologies. The Infrastructure Investment and Jobs Act invests $11 billion to enhance grid resilience, $2.5 billion for the U.S. Department of Energy to help develop "nationally significant transmission lines, increase resilience by connecting regions of the country, and improve access to cheaper clean energy sources,"[5] and $3 billion for a Smart Grid Investment Matching Grant Program.

FERC is also actively exploring ways to facilitate greater investment in transmission. The Commission issued an Advanced Notice of Proposed Rulemaking (ANOPR) in 2021 to seek input on potential reforms designed to expand investment in transmission. FERC is also actively engaged with state regulatory commissions through the Joint Federal-State Task Force on Electric Transmission. As an initial step to address the issues raised in the ANOPR, on April 21, 2022, FERC issued a Notice of Proposed Rulemaking (NOPR) seeking comment on proposed reforms to the Commission's existing regional transmission planning and cost allocation requirements. Also on April 21, 2022, FERC announced that a technical conference focused on cost management for transmission facilities developed through local or regional transmission planning processes has been scheduled for October 6, 2022.

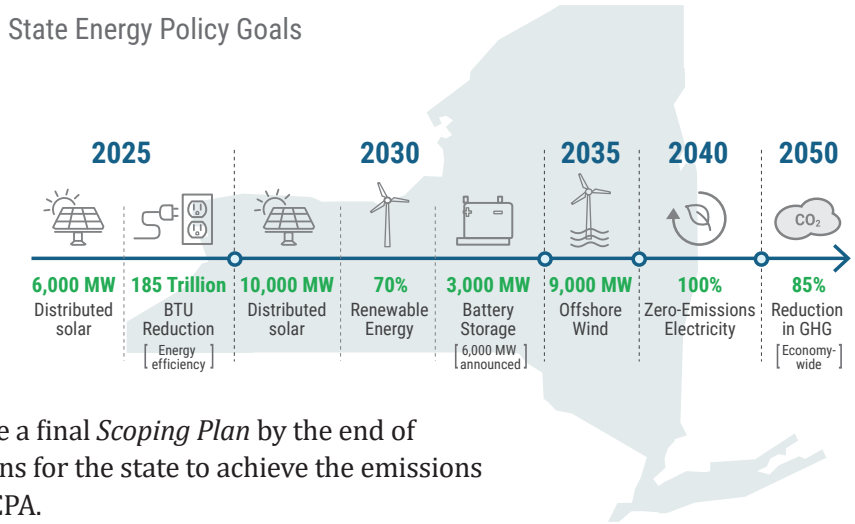
Summary Table of Key Environmental Regulations and Energy Policies

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

Discussion of Key Environmental Regulations and Energy Policies

Climate Leadership and Community Protection Act (CLCPA)

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



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

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

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

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

The NYISO is actively assessing the implications of these compliance plans in its Reliability Planning Process, particularly via the *2022 Reliability Needs Assessment* (RNA) and ongoing quarterly *Short-Term Assessments of Reliability* reports.

NYS Accelerated Renewable Energy Growth and Community Benefit Act

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

The Act also authorized the New York Power Authority (NYPA) to undertake the development of transmission investments needed to achieve CLCPA targets. The NYPSC utilized this authority to authorize NYPA to pursue construction of its "Smart Path Connect" transmission expansion project in northern New York. NYPA, in partnership with National Grid, submitted its application to the NYPSC's Article VII transmission permitting process, which entails public participation prior to a final determination from the NYPSC before construction can begin. The project is expected to increase the capacity of transmission lines in northern New York, where significant wind and hydro capacity exists and constraints on existing lines contribute to curtailment of these resources.

The Act also directed the New York State Department of Public Service (DPS), in consultation with the New York State Energy Research and Development Authority (NYSERDA), NYPA, the Long Island Power Authority (LIPA), the investor-owned utilities, and the NYISO to conduct a comprehensive study to identify cost-effective distribution and local and bulk power system upgrades to support the state's climate and clean-energy policies.

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

New York City Residual Oil Elimination

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

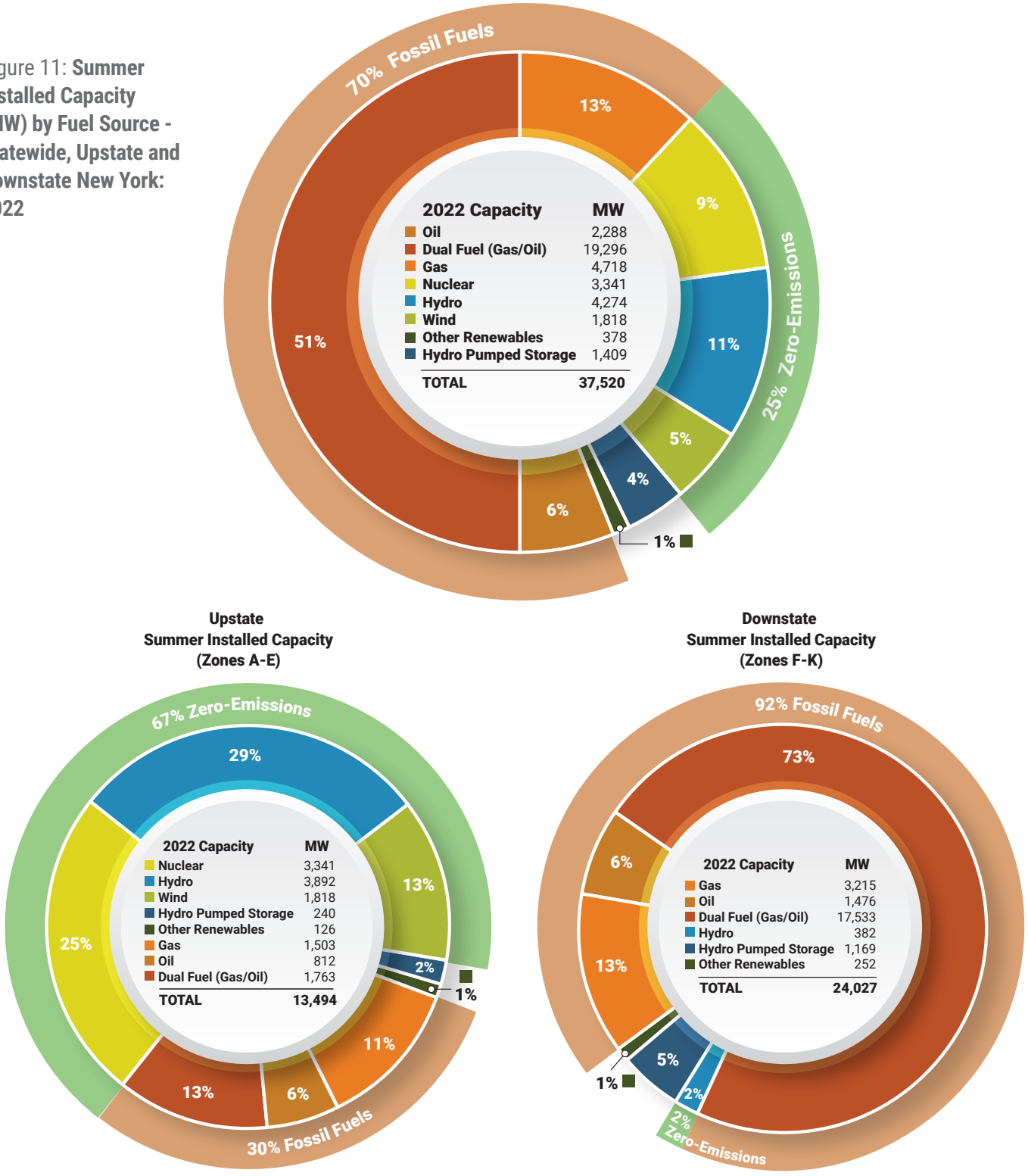
Generators have taken steps to convert their facilities to comply with the law. While oil accounts for a relatively small percentage of the total electricity production in New York State, it is often called upon to fuel generation during critical periods, such as when severe cold weather limits access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

New York City Local Law 97

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

New York Control Area Summer Installed Capacity

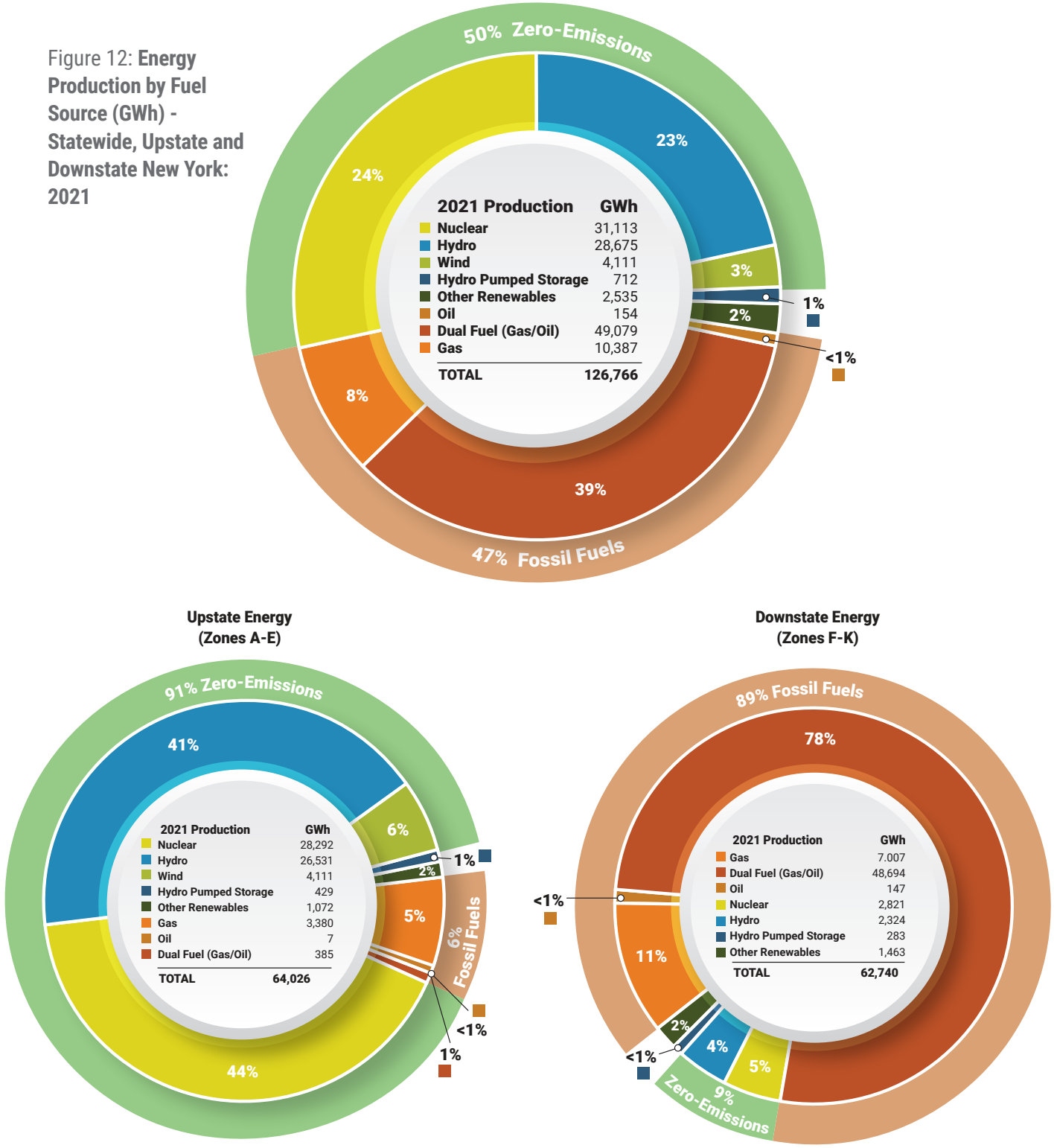
Figure 11: **Summer Installed Capacity (MW) by Fuel Source - Statewide, Upstate and Downstate New York: 2022**



> **Figure 11:** provides the projected mix of resource capacity expected to be available for the 2022 Summer Capability Period. The mix of capacity resources for Summer, 2022 is very similar to the mix of resources providing capacity to the system in Summer 2021.

New York Control Area Energy Production

Figure 12: **Energy Production by Fuel Source (GWh) - Statewide, Upstate and Downstate New York: 2021**



> **Figure 12:** provides information on the production of electricity, by fuel type, in 2021. Stemming from the deactivation of Indian Point, production from nuclear generation fell from 29% of NYCA production in 2020 to 24% in 2021. That supply was primarily replaced by dual fuel units, which made up 39% of NYCA production in 2021 as compared to 35% in 2020. Combined, zero-emissions resources made up 91% of upstate production in 2021, which is very similar to 2020 production levels, while fossil units downstate made up 89% of the production from that region in 2021 as compared to 77% in 2020.

Competitive Markets for a Grid in Transition

Overview

Through the success of the NYISO-administered wholesale electricity markets, 12,890 MW of new generation have been developed since wholesale electricity markets began in 1999, with their locations informed by locational energy and capacity price signals.

Wholesale energy and ancillary services markets provide the least-cost mix of resources to maintain daily and intra-daily operational reliability, dispatching every six seconds and re-running the markets across New York every five minutes. Capacity markets work in tandem with these markets to preserve the availability of these services through competitive monthly and seasonal auctions.

Together, the energy, ancillary services, and capacity markets support reliability through competitive markets that reward performance, even in the most challenging conditions, while minimizing overall consumer costs.

How Wholesale Electricity Markets Operate

The NYISO calculates the price of electricity by determining the expected demand for electricity and evaluating numerous supply offers to meet that demand. 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. All selected suppliers receive the price set by the last supplier needed to meet demand — this is known as the clearing price.

This pricing structure is particularly advantageous for lower emitting energy resources with lower fuel costs like wind, hydro, and nuclear because they are more likely to be selected to supply electricity anytime they are capable of producing energy.

This market design provides incentives for existing resources to improve efficiency and reduce costs to increase their chances of being selected by the NYISO to meet demand. As new resources

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 to meet peak demand and encourage generators to invest in new technology and deactivate outdated resources.

> **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.

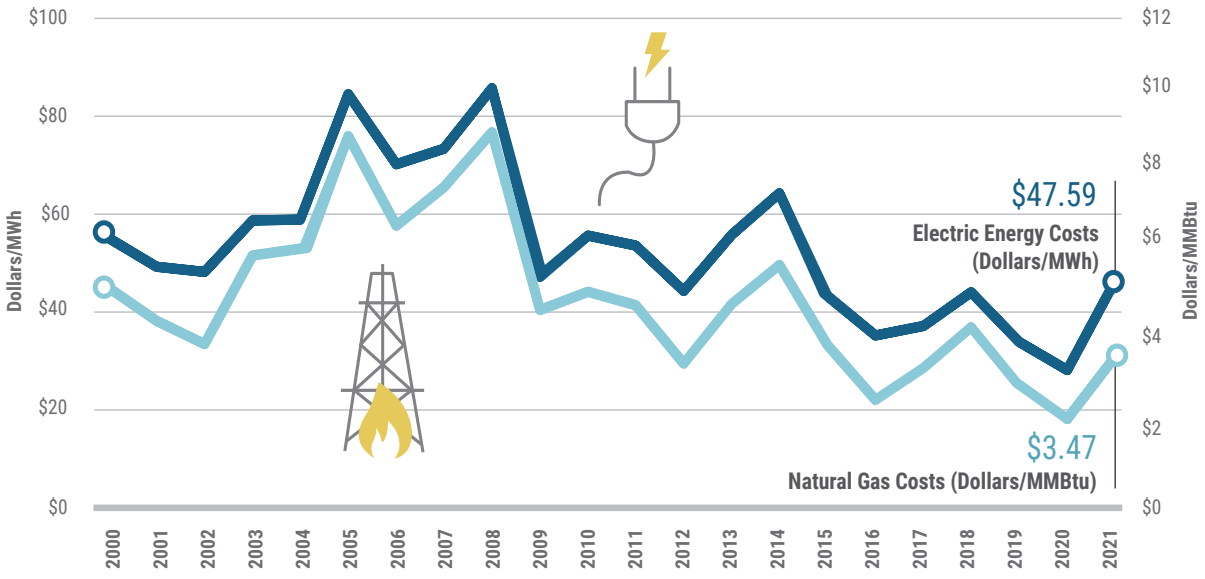
enter the market and existing resources improve their efficiency, resources that are incapable of reducing costs to remain competitive are pushed out of the market. In this manner, wholesale competitive markets provide a structure for continuous improvement in overall efficiency, benefiting all New Yorkers while supporting reliability.

While competitive electricity markets deliver least-cost supply to consumers, Figure 13 also illustrates how closely tied current electricity prices are to the price of natural gas, the primary fuel currently used for power generation in New York state.

The NYISO saw record low prices for wholesale electricity in 2020, however, 2021 brought a rebound in the demand for energy that was reflected in electricity markets. The daily demand for electricity in New York grew by nearly 1.5% in 2021. The average wholesale price for electricity climbed from a record low average price of $25.70/MWh in 2020 to $47.59/MWh a year later.[6] As noted by the NYISO's independent market monitor, wholesale electric prices in New York have "generally increased as a result of the retirement of the Indian Point 2 in April 2020 and Indian Point 3 in April 2021. As eastern New York has become more reliant on natural gas-fired generation, spikes in congestion because of tight gas market conditions on cold winter days have become more frequent."[7]

> **Until there are enough clean energy resources** on the grid to replace the reliability services provided by fossil fueled generation, natural gas must continue to play an important role in meeting energy needs in New York to maintain system reliability which supports the health, safety, and welfare of New Yorkers.

Figure 13: **Average Annual Natural Gas Costs and Electric Energy Prices: 2000-2021**



As the calendar turned to 2022, cold weather and seasonal demand for fossil fuels to meet heating needs added to existing demand for power generation, creating additional upward pressure on prices. Fossil fuel costs have risen and become more volatile due to economic factors rooted in the pandemic and amplified by the Russian invasion of Ukraine. Spiking global demand for fossil fuels, lagging supply, and global instability caused by war, have combined to bring fossil fuel prices to historic high levels. The average monthly wholesale cost of electricity in New York's markets from January 2021-2022 tripled from $40.69/MWh to $137.49/MWh.[8]

Market Design, Planning, and Grid Operations Support Reliability and Resilience

Recent events in California and Texas, highlight the critical importance of careful planning to develop the necessary infrastructure for maintaining system reliability. These events also highlight the importance of strong market signals to encourage and incentivize investment in the system necessary to respond to extreme weather conditions. In November 2021, the FERC and NERC issued a report, *The February 2021 Cold Weather Outages in Texas and the South Central United States.*[9] The February 8-20, 2021, extreme weather events led to 210 deaths and caused an estimated $80-$130 billion in economic harm to Texas alone.[10] The report included a series of 28 recommendations, including nine Reliability Standards changes. The NYISO evaluated the report for best practices as it implemented plans for the 2021-22 winter season. In April 2022, the NYISO participated in a FERC technical conference on improving winter readiness and reported that 18 of the recommendations were applicable to NYISO operations. **The NYISO has in place, or is implementing, each applicable recommendation.**

Current NYISO market rules reward suppliers who adopt measures to support resource availability and performance. Investments in equipment which promote availability, efficiency, and flexibility, make resources more competitive and more likely to be selected in our competitive wholesale electricity markets. Further planning analyses will continue to inform the development of new reliability service capabilities. As part of the Grid in Transition efforts, the NYISO will use operations and market metrics to identify and prioritize market enhancements to support reliability while seeking to attract investments in innovative new technologies and capabilities.

Designing Competitive Markets for a Grid in Transition

As the portion of electricity produced from intermittent renewable sources increases in response to public policy directives, balancing intermittent supply will become increasingly challenging. Periods in which renewable energy production outpaces demand will increase curtailment of output from renewable resources, while periods of low renewable generation and higher demand levels will require large amounts of flexible, dispatchable resources.

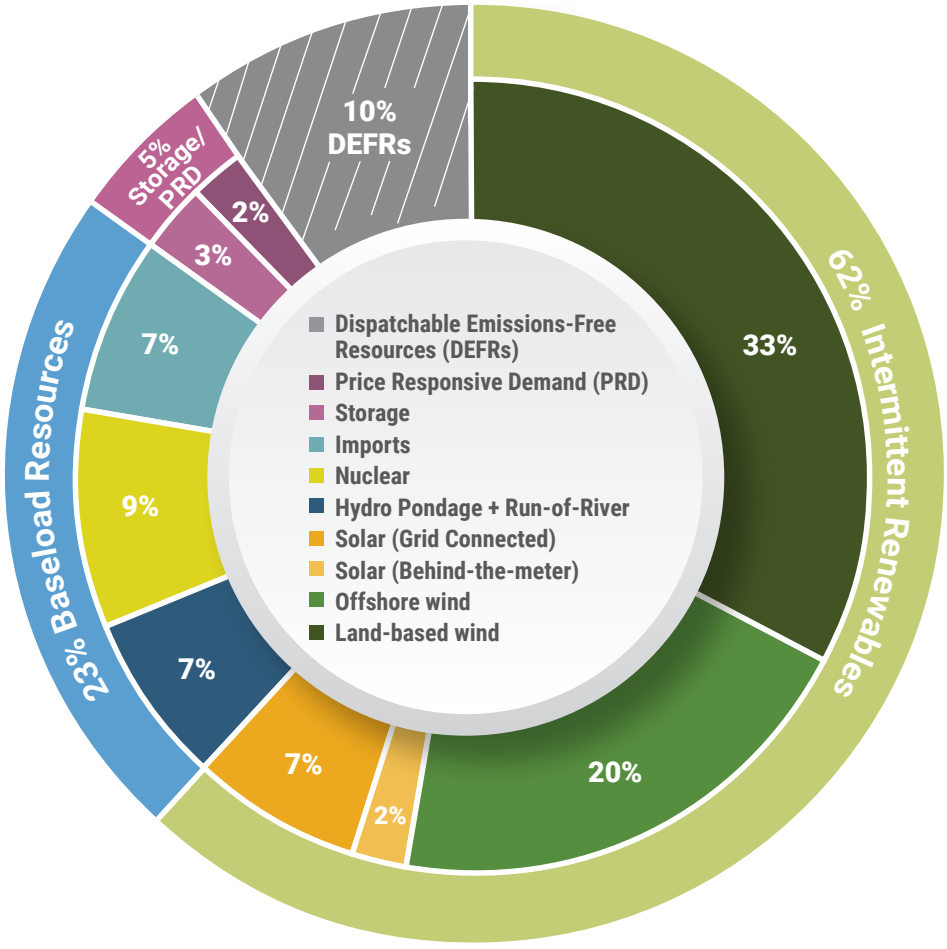
A balanced approach to achieving a clean-energy grid is essential. Deactivating existing generation without having resources that are capable of providing comparable reliability services risks the ability to maintain a reliable electric system. Energy storage is a large part of the potential solution, but the electric system will require electricity production to reliably meet demand and provide sufficient charging capability for the large levels of storage expected to enter the system.

Since the CLCPA was enacted in 2019, the NYISO has taken steps to better understand the reliability, operational, and market implications of such a transformation in the resource mix operating within the state. In late 2019, the NYISO released a report, *Reliability and Market Considerations for a Grid in Transition,*[11] its *Grid in Transition Report*. In 2020, based on the considerations described in its *Grid in Transition Report*, the NYISO released two important studies, *New York's Evolution to a Zero Emission Power System*[12] *and Climate Change Impact and Resilience Study.*[13] These studies helped inform the NYISO and its stakeholders about the operational, reliability and investment implications of transitioning to a carbon free grid by 2040. The *Grid in Transition Report* and following studies continue to frame the NYISO's approach to evolving its market design, including the NYISO's consideration of enhancements to the energy and ancillary services markets.

Grid impacts identified by the NYISO's analyses include:

- **The variability of output** from wind and solar resources presents a fundamental challenge to balancing supply with electricity demand;
- **The growth of behind-the-meter** supply will increase the variability of demand on the system, making load more dynamic than it is today;
- **Battery storage resources** can help to fill-in short term reductions in renewable resources output, but extended periods of low- or zero-renewable output rapidly deplete the short duration storage capabilities of existing battery technologies;
- **Dispatchable, emission-free resources** with longer duration energy output capabilities are needed to balance renewable intermittency on the system; and
- **Climate change** will impact meteorological conditions and cause events that introduce additional reliability risks.

Figure 14: **Climate Study: Projected CLCPA Winter 2040 Energy Production by Resource Type**



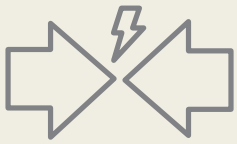
> Dispatchable Emission-Free Resources (DEFRs). Intermittency from increased renewables creates the need for energy that can, like fossil fuels, be dispatched immediately and produce for extended periods, but which are emissions-free. Technologies being developed in this category now include green hydrogen and renewable natural gas.

> Price-Responsive Demand. PRDs, or flexible load, enable operators to balance renewable intermittency by adjusting demand in response to price signals.

The future grid requires ready access to resources that can rapidly adjust energy output when renewable availability is uncertain, or to manage more extreme correlated supply contingencies. The NYISO has taken steps to place large-scale renewables on dispatch, which has provided an important tool to the operation of the grid and allows the NYISO to curtail these resources to manage transmission constraints or over-generation issues.

However, the power grid will need additional dispatchable emission-free resources that can quickly increase production capability. Reliable operation of the power system will become more complex under these expected conditions, and the probability of reliability risks will grow due to uncertainties in demand, supply, and available infrastructure. The NYISO believes these risks can generally be described as risks to energy security. That is, these changes put at risk ensuring the availability of enough energy when and where needed for all New Yorkers to continue to enjoy safe and reliable electric service.

The NYISO currently manages energy security through its day-ahead and real-time energy and ancillary services markets. In these markets, energy, regulation, and operating reserves are simultaneously procured to meet demand while respecting transmission limits. However, considering emerging risks due to uncertainties, the NYISO believes changes to its energy and ancillary services markets will be necessary for the wholesale electricity markets to continue to support safe, reliable delivery of electricity to New Yorkers.



> 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 Dispatch, Voltage Control and Black Start.

Existing ancillary services products continue to provide value and support management of system reliability. However, changes in the resource mix are leading to operational challenges. For instance, challenges related to simultaneously balancing consumer demand and intermittent supply are expected to increase over time.

Balancing Intermittency

As part of its multi-year Grid in Transition initiative, the NYISO is continuing to work with stakeholders to define the operational risks and flexibility needs on a system with greater reliance on intermittent resources, higher load forecast uncertainty, and increased extreme weather events. The NYISO is examining changes to existing ancillary service products and options for new ancillary service products to attract new, more flexible resources that can aid in balancing the intermittency of renewable resources. Specifically, the NYISO believes that new or modified ancillary service products will be required and that response times from resources will need to be quicker. The NYISO is considering products such as operating

reserves that can be activated with longer lead times to fill-in energy voids left from renewables and limited duration resources, such as batteries, when those resources run out of energy.

Additionally, the NYISO expects that dynamically determining reserve requirements, and changes to real-time capabilities to better manage limited energy/duration resources, will be necessary. These changes are critical to ensuring that the markets procure sufficient services and efficiently utilize resources to address operational risks.

Integrating New Technologies

The NYISO continuously looks for opportunities to increase the participation of new and emerging resource technologies through enhancements to its competitive wholesale market design. Examples include implementation of participation models for energy storage resources (ESRs) in August 2020 and co-located resources consisting of a combination of storage and other generating technology, such as wind or solar, in December 2021. The NYISO is accelerating development of participation models for hybridized resources, internal HVDC transmission lines, and implementing DER participation rules in 2022. These participation models are designed to maximize the ability of the participating resources to provide reliability services in our markets consistent with the reliability standards set by NERC, NPCC, and NYSRC, and regulatory requirements established by FERC.

The NYISO's Comprehensive Mitigation Reform (CMR)

While the capacity market exists to help ensure reliability, it must also take into account public policies. To ensure rules intended to preserve competition in the capacity market do not interfere with the state's clean-energy policies, the NYISO engaged stakeholders and policymakers to revise its buyer-side capacity market mitigation (BSM) measures. If the BSM rules did not evolve, they were likely to interfere with CLCPA policies by mitigating new entrants necessary to achieve New York State's policy objectives.

In conjunction with BSM reforms, the NYISO also pursued capacity accreditation tools to more accurately reflect capacity market suppliers' contributions to resource adequacy.

NYISO's Shared Governance

> **What is it:** The process used by NYISO and stakeholders for making policy decisions that dictate how New York's electric system and wholesale electricity markets will operate. This transparent and inclusive process ensures that individual interests cannot unduly influence grid reliability or energy market outcomes

> **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.

> **By the numbers:** 150+ shared governance members. 31+ active committees/working groups, and a 58% approval is required on committee decisions.

The NYISO's approach will incentivize efficient investments to attract and retain the necessary resources to maintain resource adequacy.

After extensive engagement with stakeholders in the NYISO's shared governance process, in January 2022 the NYISO filed with FERC a set of market reforms with an ambitious goal to resolve the long-standing tensions between federal market oversight and state clean-energy public policies. The CMR proposal offered a durable resolution between FERC's obligation to protect the NYISO-administered capacity market from buyer-side capacity market power and New York State's authority to address New York's resource mix. The proposal was the product of an extensive shared governance process that resulted in approval by more than 80% of NYISO stakeholders. The CMR proposal was approved with strong backing across all five stakeholder sectors, including unanimous support from New York State entities, New York City, municipal interests and the New York Transmission Owners, and significant support from both existing capacity suppliers and consumer interests. The NYISO's independent market monitor also played a major role in developing the CMR proposal.

The Comprehensive Mitigation Reform (CMR) proposal sought to:

1. Remove certain resources from being reviewed under the NYISO's buyer-side capacity market mitigation (BSM) rules if they serve the goals of the CLCPA; and

2. Adopt a marginal capacity accreditation market design to improve the accuracy of the capacity values assigned all capacity supply resources from a resource adequacy perspective.

On May 20, 2022, FERC accepted the NYISO's proposal, subject to certain compliance requirements. Regarding BSM rules reforms, FERC stated "we agree with NYISO that it is appropriate to change course and exclude resources that serve the CLCPA's objectives from the BSM Rules." In supporting the Commission's acceptance of the capacity accreditation component of the NYISO's proposal, FERC Commissioner Christie stated, "Getting capacity valuations right is essential both for reliability purposes and to ensure consumers do not pay for capacity that does not perform when needed."

The NYISO is engaging stakeholders to address implementation details associated with the landmark proposal.

Enhanced Planning for the Future Grid

Overview

The NYISO's planning responsibilities are composed of three primary components:

- **Comprehensive system planning** which examines near-term and longer-term issues impacting reliability, economic, and public policy transmission planning;
- **Interconnection planning** to evaluate the reliability implications of resources interconnecting and deactivating from the grid; and
- **Interregional planning** with neighboring grid operators

Topical grid studies are also conducted to fulfill an essential element of our mission to be the authoritative source of information, and to provide independent analysis and data to stakeholders, asset owners, investors, and policymakers.

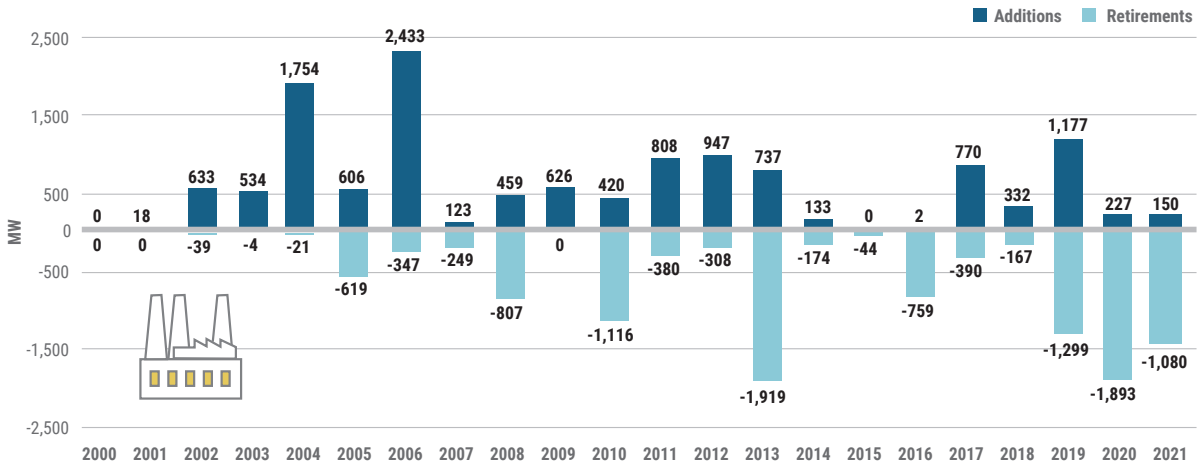
The NYISO's planning studies use sophisticated models to assess the capability of the transmission system and the adequacy of resources to meet New York's electricity needs. There are numerous factors considered in these models, including:

- Forecasts of consumer demand and peak loads, including the implications of distributed energy resources and behind-the-meter technologies that change traditional views of expected supply and demand;
- The impact of changes in generation and transmission resources available to the electric system;
- Economic outlook data; and
- Climate conditions that can impact demand levels as well as supply and transmission capability.

As the state's public policy goals have encouraged investments in renewable energy resources, developers increasingly are proposing generation in New York's upstate regions (Load Zones A-E), away from downstate load centers, based on physical factors such as the suitability of wind conditions for energy production and land availability. In response to state policies, developers have proposed more than 50,000 MW of new offshore wind, land-based wind, solar, and energy storage capacity for potential interconnection to the grid.

The CLCPA is attracting new clean-energy resources to interconnect to the grid, while policies like the DEC's Peaker Rule will result in reduced availability or deactivation of the existing higher-emitting fossil fuel-fired generation units. As the statewide generation resource mix changes in response to these policies, new near-term challenges may arise in maintaining the long-term reliability of the New York electric grid. The pace of deactivations and interconnections is carefully evaluated by the NYISO to identify and act upon risks to system reliability.

Figure 15: **Additions, Uprates, and Deactivations (Nameplate Capacity)**



The New York grid faces unprecedented reliability challenges as the clean-energy transition gains momentum. The *2021-2030 Comprehensive Reliability Plan* recently concluded that while the state's bulk electric system meets current reliability requirements, risks to reliability and system resilience remain. The key factors driving this risk include:

- **Shrinking reliability margins** across the New York grid as resource retirements outpace new additions;
- **Potential resource deficiencies** if additional New York power plants become unavailable or consumption is greater than forecasted;
- **Timely completion of planned transmission projects.** If projects are delayed for any reason, the grid's ability to reliably serve customers could be jeopardized.
- **Extreme weather events,** such as heatwaves or storms, could result in deficiencies to service demand statewide, especially in New York City. This outlook could improve as more resources and transmission are added to New York City.

NYISO's Comprehensive System Planning Process

Understanding the impacts to the generation, transmission, and load components of the bulk electric system is critical to understanding the challenges to reliable electric service in the coming years. The NYISO is evolving its Comprehensive System Planning Process (CSPP) to match the pace of change on the grid while continuing to find needs and opportunities for investment to promote reliable and efficient operations.

The CSPP establishes the rules by which the NYISO solicits, evaluates, and selects the more efficient or cost-effective solutions to address reliability, economic, and public policy-driven transmission needs in New York. The NYISO's CSPP has four components — the Local Transmission Planning Process, the Reliability Planning Process/Short-Term Reliability Process, the Economic Planning Process, and the Public Policy Transmission Planning Process. In concert with these four components, interregional planning is conducted with the NYISO's neighboring control areas in the United States and Canada under the Northeastern ISO/RTO Planning Coordination Protocol.

Planning for a Reliable Electric Grid

The Reliability Planning Process itself is composed of four components:

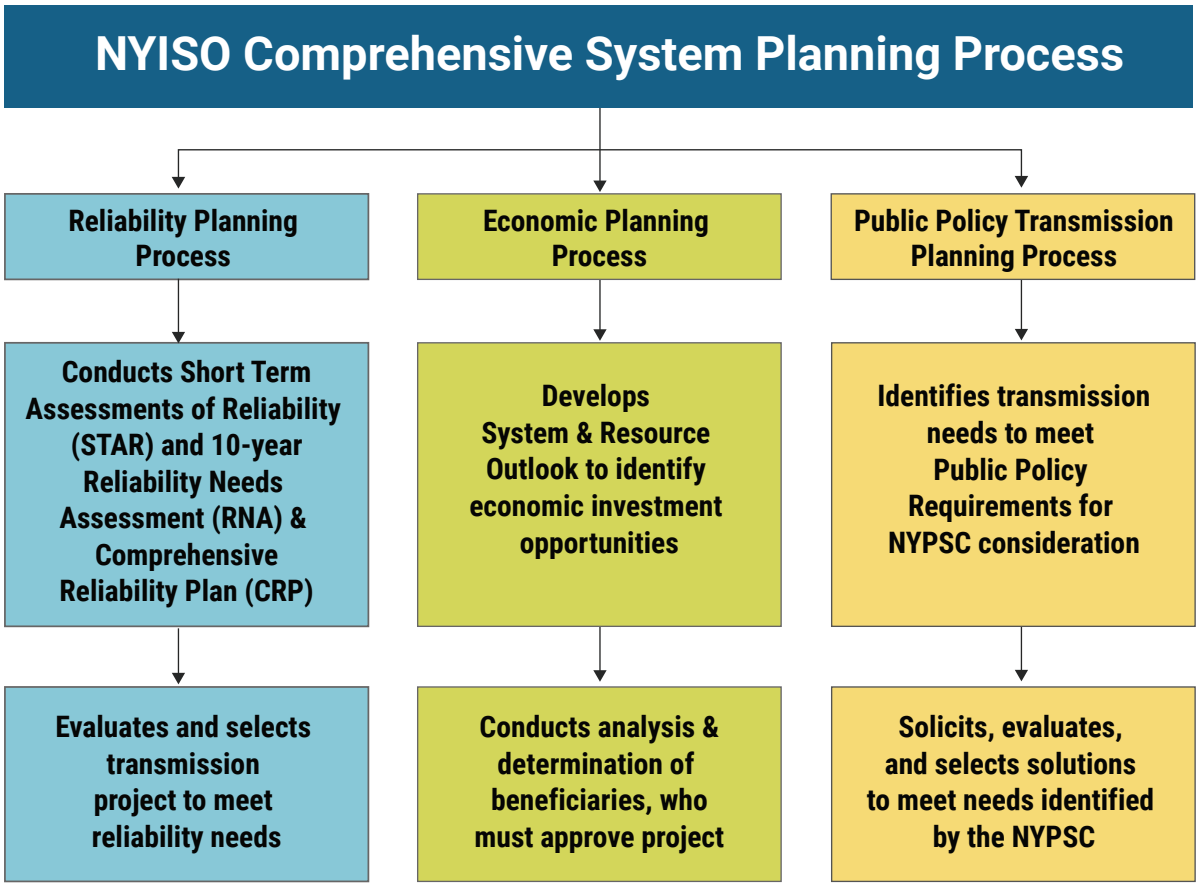
1. Each transmission owner conducts a public Local Transmission Planning Process for its transmission district that feeds into statewide planning;

2. The quarterly *Short-Term Assessments of Reliability* (STARs) address near-term needs, with a focus on needs arising in the next three years. The Short-Term Reliability Process includes assessing the potential for reliability needs arising from proposed generator deactivations;

3. The *Reliability Needs Assessment* (RNA) focuses on longer-term reliability needs for years four through ten of a ten-year, forward looking study period; and

4. The *Comprehensive Reliability Plan* (CRP) integrates all of the planning studies into a ten-year reliability analysis for New York.

Together, these processes enable the NYISO to nimbly identify reliability needs ranging from localized needs to broader statewide needs arising over the next decade.



Following this process, in December 2021 the NYISO issued its *Comprehensive Reliability Plan* (CRP), which concluded that the New York State Bulk Power Transmission Facilities will meet all currently applicable reliability criteria from 2021 through 2030 for forecasted system demand in normal weather. The report cautioned, however, that the margin to maintain reliability over the next ten years will narrow or could be eliminated based upon changes in forecasted system conditions.

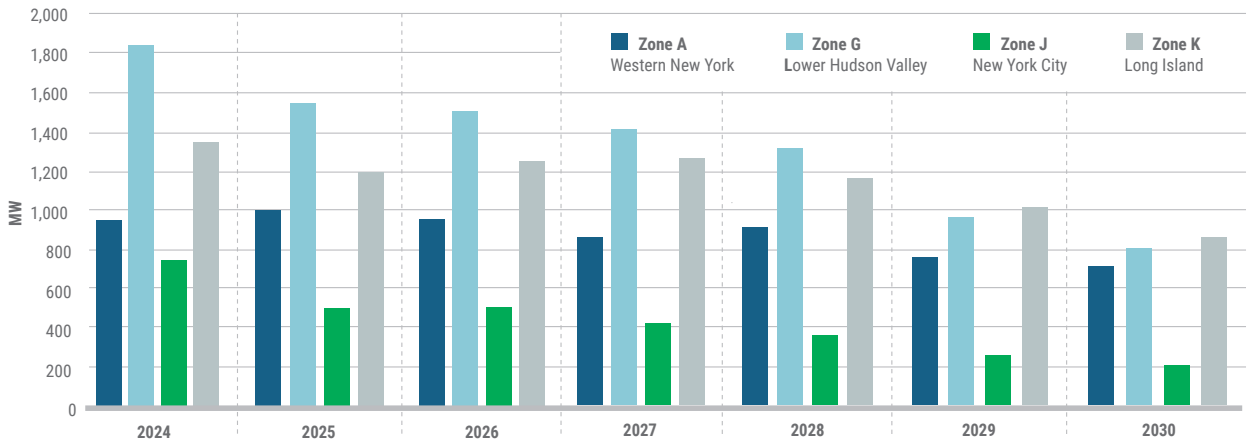
Risk factors that could potentially lead to deficiencies in reliable electric service include:

- Delayed completion of generation and transmission projects;
- Additional generator deactivations that are not anticipated;
- Unplanned outages due to equipment failures; and
- Extreme weather.

The CRP concluded that reliability margins will shrink in upcoming years due primarily to the planned unavailability of simple cycle combustion turbines that are impacted by the DEC's Peaker Rule.

Figure 17 shows diminishing reliability margins in New York City for a variety of conditions.[14] The baseline analysis of normal weather and limited generation outages shows positive but narrowing reliability margins across the ten-year period. However, heatwave conditions combined with the impact of additional forced generation outages would result in deficiencies to serve demand in New York City in many of the years studied. A heatwave with a statewide average maximum temperature

Figure 16: **Zonal Resource Adequacy Margins**



> Reliability margins will shrink in upcoming years due primarily to the planned unavailability of simple cycle combustion turbines that are impacted by the DEC's Peaker Rule. This figure shows the tightening of zonal resource adequacy margins for western New York (Zone A), lower Hudson Valley (Zone G), New York City (Zone J), and Long Island (Zone K). New York may experience even smaller resource adequacy margins if additional power plants become unavailable or if demand is greater than forecasted.

Figure 17: **New York City Transmission Security Margins**

of 95-degrees Fahrenheit may result in very thin margins in 2023 and significant deficiencies beginning in 2025, while an extreme 98-degree Fahrenheit sustained heatwave would test the system limits today and exceed grid capabilities beginning in 2023.

Over the next ten-year period, the NYISO is forecasting a decrease in energy usage due to energy efficiency initiatives and increasing amounts of behind-the-meter solar generation. However, significant load-increasing impacts are forecasted for the future due to expected growth in electric vehicle usage, large cloud-computing data centers, and other electrification (i.e., conversion of home heating, cooking, water heating and other end-uses from fossil-fuel based systems to electric systems).

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

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.

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 meet 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.** As has been discussed, the NYISO is exploring a number of wholesale electricity market enhancements focused on improving signals to drive investment in resources with the characteristics and attributes needed for continued grid reliability.

The dangers of severe weather impacting the grid have been demonstrated around the country. In certain instances, grid operators resorted to disconnecting large segments of customers from the grid, to bring supply and demand into balance. New York is not immune from such extreme weather, which could lead to greater electrical demand and more forced outages of resources than currently accounted for in the baseline forecasts underpinning the CRP. In consideration of these climate-related risk factors, the New York grid may cross a "tipping point" in future years such that the transmission system and resources may not fully serve the demand. Together with stakeholders, the NYISO will monitor and track these developments and consider their potential impacts in future system reliability planning studies.

The CRP's findings also pointed to the need to consider enhancements to reliability and resilience rules and procedures. Reliability rules require that New York maintain enough supply capacity to meet forecasted peak demand levels. The CRP demonstrated that system margins are expected to narrow. Revisions to current reliability rules, procedures, and practices may be necessary as the impacts of climate change, along with changes to economic conditions and public policies, place new demands on the grid.

Following the issuance of the *2021-2030 CRP*, the next cycle of the Reliability Planning Process is already underway. The *2022 RNA* will evaluate the reliability of the New York bulk electric system through 2032, considering forecasts of peak power demand, planned upgrades to the transmission system, and

changes to the generation mix over the next ten years. The RNA assesses an actionable base case set of assumptions, as well as various scenarios that are provided for information. The *2022 RNA* is planned to be completed by the end of the year. In the immediate term, the NYISO will conduct STARs every quarter to assess reliability needs within a five-year horizon. For instance, the NYISO will continue to assess the reliability impacts of generators deactivating in response to the DEC Peaker Rule. If necessary, the NYISO will seek solutions to address any near-term reliability needs identified through that process. As a last resort, deactivating generators may be retained for an interim period until a permanent solution is in service.

Planning for an Economically Efficient Grid

For the first time, the NYISO is compiling a 20-year *System & Resource Outlook* (Outlook), which will be issued in the summer of 2022. 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* provide a full power system outlook to stakeholders, developers, and policymakers.

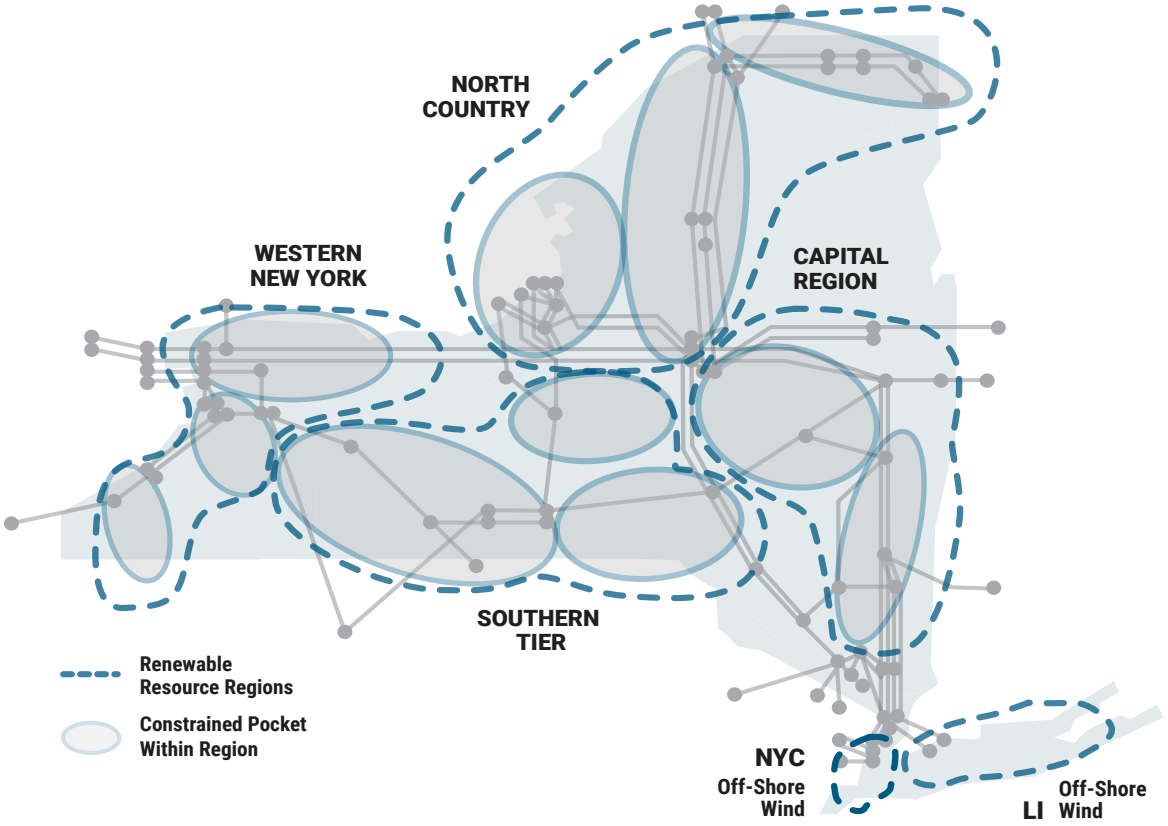
The *Outlook* will provide a wide range of potential future system conditions and enable comparisons between possible pathways to an increasingly greener resource mix. By forecasting transmission congestion, the NYISO will:

- Identify regions of New York where renewable generation may be heavily curtailed due to transmission constraints;
- Quantify the extent to which these constraints limit delivery of renewable energy to consumers; and identify potential transmission opportunities that may provide economic operational benefits.

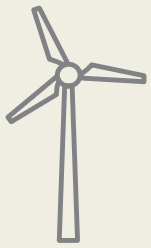
The new Outlook process will provide transmission developers and resources the ability to request their own studies using the NYISO tools, to identify the most economic opportunities for investment. Moreover, if a developer proposes a regulated transmission project to address constraints identified in the Economic Planning Process, the NYISO will perform an evaluation of the proposed project. Load serving entities (LSEs) identified by the NYISO as the project beneficiaries must approve the selection of a proposed regulated transmission project by a super-majority vote. If a project is approved, it is eligible for cost allocation and recovery through the NYISO tariffs.

The NYISO's 2019 Economic Planning Process conducted an analysis of New York's electric system to identify transmission constraints that may prevent the delivery of renewable energy to achieve the CLCPA's 70% renewable energy mandate for 2030. The analysis modeled a set of demand and generation assumptions, including 15,000 MW of utility-scale solar, 7,500 MW of behind-the-meter solar, 8,700 MW of land-based wind, and 6,000 MW of offshore wind capacity. This detailed study was designed to help policymakers and developers identify opportunities for transmission expansion to facilitate achievement of the state's climate policy goals.

Figure 18: **Renewable Generation Pockets**



The 70% by 2030 analysis identified transmission-constrained "renewable generation pockets," as well as the levels of renewable generation curtailments that would occur within each pocket. "Curtailments" occur when renewable generation exceeds the transmission limits, requiring suppliers to reduce their output to avoid overloading transmission facilities. The generation "pockets" revealed by the study represent regions in the state where renewable generation resources cannot be delivered fully to consumers statewide. The study projected that transmission constraints in these pockets will likely result in curtailment of 11% of the total potential renewable energy production across New York, with curtailment levels in some individual pockets as high as 63%. As more renewables are added to the bulk electric system without additional transmission expansion, greater congestion and curtailment levels will occur. **The findings underscored an important point: additional transmission investment is necessary throughout New York to achieve the objectives of the CLCPA. The *System & Resource Outlook* will provide an updated assessment of transmission opportunities across the state.**



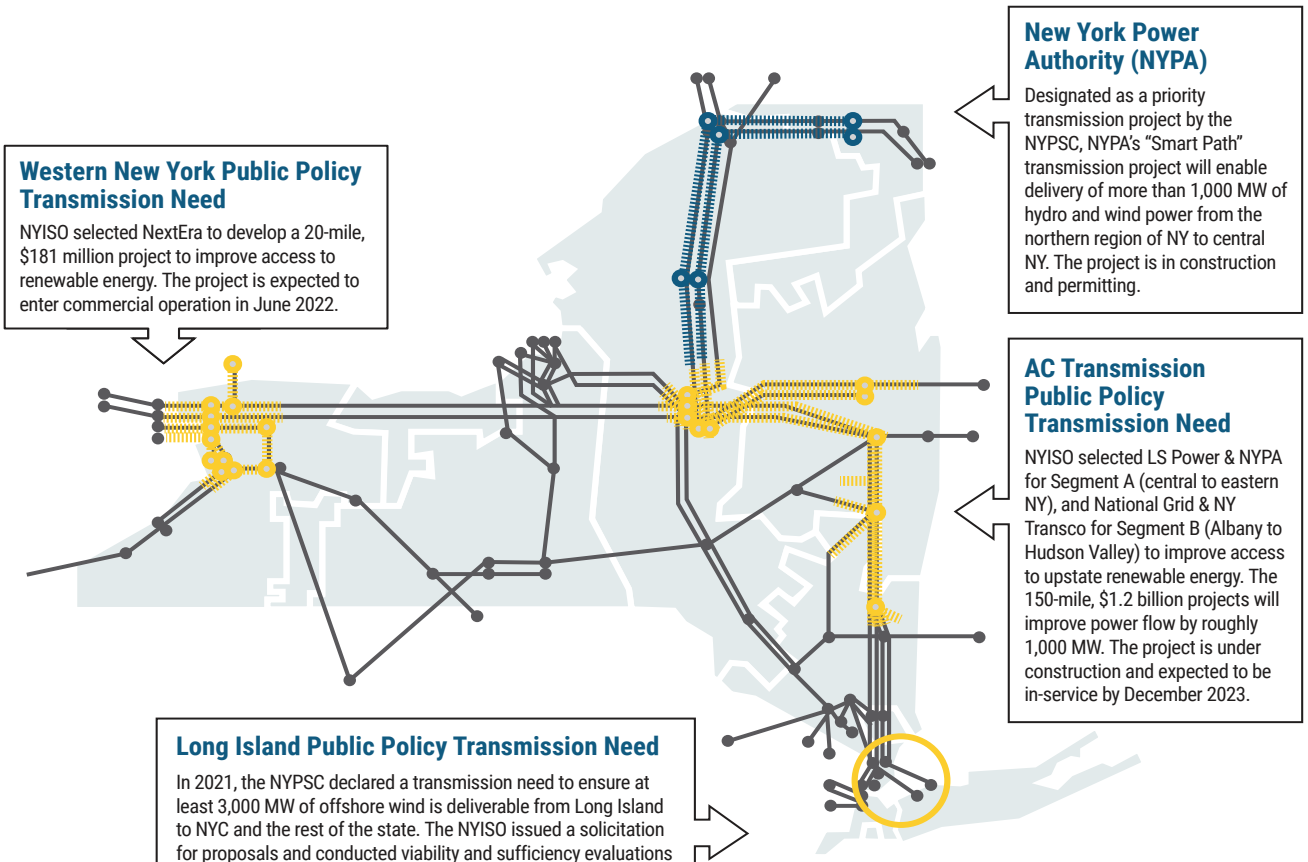
> Wind Curtailment
Signals from the NYISO directing wind resources to reduce output in response to transmission constraints.

Planning for Public Policy Requirements

Under the NYISO's Public Policy Transmission Planning Process, interested entities propose, and the NYPSC identifies, transmission needs driven by Public Policy Requirements. A Public Policy Requirement is a federal or state law or regulation, including a NYPSC rulemaking order, which drives the need for additional transmission capability in the state. In response to a declared public policy need, the NYISO requests that interested entities submit proposed solutions and evaluates the viability and sufficiency of those proposed solutions to satisfy each identified need. The NYISO then ranks the solutions and may select the more efficient or cost-effective transmission solution to each identified need.

The NYISO provides cost recovery for selected solutions through transmission charges in its tariffs. Considering typical schedules for development and construction of transmission, the NYISO estimates that the timeline for projects pursued through its Public Policy Process from the NYPSC's declaration of a need to the in-service date of a transmission project could span approximately five to six years. Given the timeframes specified by the CLCPA, the NYISO's Public Policy Process is well suited today to address transmission needs for 2030 and beyond and can work in conjunction with other efforts to build transmission underway.

Figure 19: **New Transmission Projects in New York State**



Clean-energy policies are driving the need for investment in the transmission system to ensure that clean-energy supplies are deliverable to consumers. Specific transmission infrastructure investments to meet these needs depends, in part, on the evolution of the resource mix and the geographic distribution of new renewable generation.

Most of New York's renewable energy capability is located in upstate and northern New York. To bring renewable energy to market, three new transmission projects are under construction representing the single largest investment in transmission infrastructure in New York State in more than 30 years.

Western New York Public Policy Transmission Project

In October 2017, the NYISO's Board of Directors selected the Empire State Line proposal from NextEra Energy Transmission New York to address the public policy need for new transmission in western New York. This need was identified to support the state's goal to more fully utilize renewable energy from the Robert Moses Niagara Hydroelectric Power Station as well as imports from Ontario. The transmission upgrades are also expected to provide reliability, environmental, and economic benefits.

The NYPSC has granted all regulatory approvals and the project commenced construction in March 2021. The project is anticipated to enter into service by June 2022.

AC Transmission Public Policy Need

In December 2015, the NYPSC identified a Public Policy Transmission Need to relieve congestion on the interfaces between upstate and southeastern New York, which run from central New York, through the Capital Region, to the lower Hudson Valley. The NYPSC action sought to increase transfer capability from central to eastern New York by at least 350 MW (Segment A) and from the Albany region through the Hudson Valley region by at least 900 MW (Segment B).

Over 1,000

FERC, NERC, NPCC, and NYSRC requirements that the NYISO must adhere to in the operation and planning of the grid.

In April 2019, the NYISO's Board of Directors selected a joint proposal by LS Power Grid New York and NYPA for Segment A, and a joint proposal by National Grid and New York Transco for Segment B. The projects will reduce total system electricity production costs, lower system capacity procurement costs, replace aging transmission infrastructure, improve system performance, reduce emissions, and add resilience and operating flexibility to the New York power grid. The selected developers of the projects have each received all necessary regulatory approvals from the NYPSC. Both the Segment A and Segment B projects commenced construction in 2021 and are planned to enter into service by December 2023.

Long Island Offshore Wind Export Public Policy Transmission Need (LI PPTN)

The NYISO initiated its 2021-2022 cycle of the Public Policy Transmission Planning Process by soliciting proposed transmission needs that stakeholders or interested parties believe are driven by Public Policy Requirements. The NYISO filed for consideration by the NYPSC the proposed transmission

needs. Upon considering the various comments submitted, the NYPSC issued an order that identified the CLCPA as a Public Policy Requirement driving transmission needs associated with the delivery of offshore wind energy from Long Island to the rest of the state.

The NYISO issued a solicitation for projects to address the LI PPTN in accordance with the NYPSC Order and received 19 proposals from four developers. Out of the 19 proposed projects, the NYISO identified 16 viable and sufficient transmission projects and one viable and sufficient Other Public Policy Project.

The NYISO filed its Viability & Sufficiency Assessment with the NYPSC in April 2022. The NYISO is in the process of evaluating the competing transmission projects for purposes of selecting the more efficient or cost-effective solution and will rank projects based on their satisfaction of the metrics set forth in the tariffs and in the NYPSC Order. Based upon the results of the NYISO's evaluation, and input from stakeholders and interested parties, and the NYISO's independent market monitor, the NYISO Board of Directors may select the more efficient or cost-effective Public Policy Transmission Project to meet the Long Island Public Policy Transmission Need. The selected project will be eligible for cost allocation and recovery under the NYISO's tariff.

Additional Transmission Investment Driven By State Policies

NYPA Smart Path Connect Transmission Projects

Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act, the NYPSC may authorize NYPA to undertake the development of certain transmission enhancements needed expeditiously to achieve CLCPA targets. On October 15, 2020, the NYPSC adopted criteria for designating priority transmission projects. The NYPSC also approved NYPA's request to proceed with development of its proposed projects in northern New York. NYPA, which has elected to co-develop these projects with National Grid, refers to these upgrades as the "Smart Path Connect" project. These transmission upgrades seek to increase the capacity of certain transmission lines in northern New York to deliver renewable energy from northern New York and Canada to customers further down state.

> **New York Public Service Commission (NYPSC)** The Department of Public Service (DPS) is the staff arm of the NYPSC. The NYPSC regulates the state's electric utilities and exercises jurisdiction over the siting of major electric generation and transmission facilities in New York State.

Tier 4 Transmission Projects

The NYPSC's October 15, 2020, Clean Energy Standard Order adopted a new Tier 4 REC product for resources that can deliver capacity and energy into New York City. NYSERDA issued a Tier 4 REC solicitation on January 13, 2021, seeking to develop transmission corridors to bring renewable energy from upstate New York and Canada to New York City. On September 20, 2021, Governor Hochul announced two Tier 4 awards, including the Champlain-Hudson Power Express (CHPE) proposal to deliver Canadian hydropower directly to Queens, as well as a NYPA-led proposal, known as Clean Path NY, which proposes to deliver renewable energy from upstate New York directly to New York City. On April 14, 2022, the NYPSC approved the Tier 4 REC contracts with CHPE and with Clean Path NY. The CHPE project has received all necessary permits and is advanced in the NYISO's interconnection process. The Clean Path NY project is in the early stages of the interconnection process, and has not received Article VII certification from the NYPSC, which is necessary prior to construction of the project.

System Planning Directives

In addition to authorizing NYPA to develop transmission, the Accelerated Renewable Energy Growth and Community Benefit Act directed the DPS, in consultation with NYSERDA, NYPA, LIPA, the investor-owned utilities, and the NYISO, to conduct a comprehensive study to identify cost-effective distribution and local and bulk electric system upgrades to support the state's climate and clean-energy policies. The utilities submitted a Local Transmission and Distribution Report in November 2020. Following a public comment period, the NYPSC directed the utilities to pursue certain planned local transmission and distribution upgrades primarily designed for local reliability enhancements, which will also increase capacity to carry more renewable energy.

DPS and NYSERDA's Initial *Power Grid Study*, released in January 2021, concluded that the transmission system, with the inclusion of the Western New York and AC Transmission public policy transmission projects and the NYPA Smart Path Connect project, have positioned the state to achieve the 70% by 2030 renewable energy requirements of the CLCPA without the need for further additional transmission capability. The report indicated that additional transmission will be needed to achieve the CLCPA's objective of a zero-emissions electric system by 2040. The Initial *Power Grid Study* indicated that transmission upgrades would also be needed to deliver the 9,000 MW of offshore wind capacity called for in the CLCPA.

To meet the state's climate change laws, the investor-owned utilities each proposed a portfolio of local transmission and distribution projects. In orders issued in fall 2021 and early 2022, the NYPSC requested further benefit-cost analyses of these projects, and more broadly directed a state restructuring of transmission and distribution planning to meet the requirements of the CLCPA. In response, the investor-owned utilities have proposed a "Coordinated Grid Planning Process" to be developed in 2022 and implemented in 2023 in coordination with the NYISO and its existing planning processes. Finally, the NYPSC initiated a series of additional planning actions, including:

- Studying a potential meshed offshore transmission system for offshore wind;
- Integrating energy storage into offshore wind projects;
- Directing use of HVDC and advanced grid technologies to maximize the efficiency of offshore wind transmission projects;
- Authorizing Con Edison to propose a hub for injection of offshore wind into New York City; and
- Directing a research plan for additional onshore bulk transmission projects, and various initiatives on energy storage.

The NYISO is continuing to engage with the DPS, NYSERDA and the utilities on these initiatives.

Enhancing Transmission Planning Processes

The NYISO has engaged in a series of planning process enhancements. In April 2021, FERC approved the NYISO's reformulation of its Economic Planning Process to expand its economic analysis of transmission system congestion to include the entire New York State transmission system, extending the study period to 20 years, and analyzing the deliverability of energy from resources to loads.

Most recently, FERC granted the NYISO's request to adopt rules to allocate new transmission facilities to developers that propose them and implement the rights of transmission owners of existing facilities to build, own and operate upgrades to their lines. This process will expedite project consideration and avoid disputes over the right to build transmission projects needed to meet state climate change policies.

Opportunities to continue to enhance the NYISO's planning processes are being further explored with stakeholders and policymakers. FERC's 2021 ANOPR, Building for the Future Through Electric Regional Transmission Planning and Generator Interconnection and subsequent NOPR seeking comment on proposed reforms to existing regional transmission planning and cost allocation requirements offer opportunities for further advancements. Within New York, the DPS is leading engagement on a proposed Coordinated Grid Planning Process. The NYISO is engaged with the investor-owned utilities and the DPS on structuring planning processes within the utilities' local transmission plans that will be integrated with the NYISO's reliability, economic and public policy transmission planning processes.

Interconnection Planning

In response to federal and state policies and the advancement in the cost efficiency of new technologies, developers are proposing an ever-growing portfolio of new clean-energy projects to interconnect to the grid. Interconnection rules that support grid reliability, along with siting and other regulatory processes that facilitate timely review and consideration of projects, are necessary to effectively respond to the rapid growth of projects being developed in response to the state's clean-energy policies. The NYISO's interconnection study process identifies potential adverse reliability impacts associated with new resources interconnecting to the grid. The process, which requires significant coordination by the NYISO with developers and affected transmission owners, identifies necessary system upgrades and their estimated costs to allow investors to make more informed investment decisions.

The volume of resources seeking to interconnect to the grid has increased dramatically in recent years. To facilitate this growing investment, 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 seeking to obtain the necessary information to develop projects interconnecting to the grid.

Grid planning

> **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.

Power Trends
New York ISO

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Podcast Ep.18: Zach Smith, NYISO VP System Resource & Planning, on Reliability Risks from Extreme Weather, Transmission Constraints, and Electricity Economics. Go to: www.nyiso.com/podcast

The enhancements have proven effective in accelerating the interconnection study process. The improvements were applied for the first time to the Class Year 2019, the largest in the NYISO's history. The vast majority of the Class Year 2019 projects were renewable generation and energy storage. The NYISO is currently processing Class Year 2021, providing further experience to consider.

Through a 2022 project initiative, the NYISO anticipates developing additional reforms to revise the interconnection process to provide for further coordination between the separate processes conducted by the NYISO and transmission owners. Improved coordination of the interconnection processes should help mitigate the potential for inconsistent treatment among project developers, provide for more comprehensive study results, and more explicitly identify the potential for interactions among projects in different processes.

Interregional Planning

Through their respective interregional processes, the NYISO, ISO-New England, and PJM collaborate to identify and resolve planning issues with potential interregional impacts. Interconnections with neighboring systems are important tools to support grid reliability, resiliency, and market efficiency by providing opportunities for the exchange of capacity and energy. Interregional transmission facilitates access to a diversity of resources, supporting reliability and resilience while maintaining economic efficiency.

The NYISO, ISO-New England, and PJM have implemented the Northeastern ISO/RTO Planning Coordination Protocol and other joint agreements to increase their joint planning and coordination. The protocol supports:

- Exchanging data and information between the regions;
- Coordinating interconnection requests and transmission requests with cross-border impacts;
- Developing a Northeastern Coordinated System Plan;
- Performing planning studies through an open stakeholder process; and
- Allocating the costs associated with interregional projects having cross-border impacts consistent with regions' tariffs and applicable federal regulatory policies.

The three regions hold regular bi-annual meetings to share information on their regional plans and potential cross-border projects. These meetings are open to participation by all interested parties.

Significant interest is building among stakeholders, including NYSERDA, in evaluating options for an integrated, or "meshed" offshore transmission grid to integrate offshore wind resources that will serve New York, ISO-New England, and PJM. The Interregional Planning Stakeholder Advisory Committee met in fall 2021 and winter 2022 to receive input on the scope and timing of an interregional transmission study for offshore wind integration. The NYISO, along with NYSERDA, ISO-New England, PJM, and numerous industry participants, have joined the technical review committee of

the *Atlantic Offshore Wind Transmission Study*[15] to be conducted by the National Renewable Energy Laboratory in conjunction with stakeholders and funded by the U.S. Department of Energy. The study will evaluate coordinated transmission solutions to enable offshore wind energy deployment along the U.S. Atlantic Coast, addressing gaps in existing analyses.

As a member of the Eastern Interconnection Planning Collaborative (EIPC), the NYISO also conducts joint evaluations with planning authorities across the entire Eastern Interconnection, a region that includes 40 states and several Canadian provinces from the Rocky Mountains to the Atlantic Ocean, and from Canada to the Gulf of Mexico. The EIPC was the first organization to conduct interconnection-wide planning analysis across the eastern portion of North America. In 2021, the EIPC completed a study, *Planning the Grid for a Renewable Future*,[16] which looks at the challenges and best practices to plan and operate transmission systems with a high penetration of renewables. Later in 2021, EIPC issued a *State of the Grid Report*[17] which summarizes planning studies being conducted across the Eastern Interconnection. The EIPC is also engaged with the *U.S. Department of Energy's National Transmission Planning Study*[18] to identify transmission expansion opportunities "that will provide broad-scale benefits to electric customers; inform regional and interregional transmission planning processes; and identify interregional and national strategies to accelerate decarbonization while maintaining system reliability."[19]

Federal Transmission Planning Reform

On July 15, 2021, FERC issued an ANOPR, Building for the Future Through Electric Regional Transmission Planning and Generator Interconnection. FERC is considering taking action to address the proliferation of renewable energy resources, the emergence of new technologies, and other factors that are transforming the electricity supply mix.

The ANOPR raises fundamental policy questions and signals that FERC may adopt sweeping regulatory changes. The NYISO sees an opportunity to build on the existing successes of its processes and to evolve them to address current conditions. The NYISO urged FERC to consider that in New York, incremental, yet significant, reforms can meaningfully address many of the issues raised in the ANOPR.

Maintaining a reliable grid

> **Monitor Risk Factors:** Through our reliability planning processes, we will continue to identify and address risks to reliability and resilience.

> **Monitor & Track Local Transmission Owner Plans:** Local transmission owners need to complete the projects identified in their Local Transmission Owner Plans (LTPs), on schedule.

> **Monitor & Track Potential New Developments:** The energy industry is in transition. Economic conditions, governmental programs and environmental regulations are changing quickly. The NYISO will monitor and track these developments and consider their potential impacts in future system reliability planning studies.

> **Consider Enhancements to Reliability and Resilience Rules & Procedures:** Revisions to current reliability rules, procedures, and practices may be necessary as the impacts of climate change, along with changes to economic conditions and public policies, place new demands on the grid.

> **Continue Coordination with the New York State Public Service Commission:** Transmission needs declared by the NYPSC to support the CLCPA are leading to the largest investment in decades. If the NYPSC determines an additional public policy need for new transmission, the NYISO will solicit projects from developers to fulfill that need.

The NYISO believes there are three key areas that FERC should consider:

1. Reforms to promote the build-out of transmission to support future resources, and to accommodate further interconnections beyond the minimum upgrades required for a reliable interconnection

2. Reforms to create actionable scenario planning through which the NYISO could consider, and act on, needs identified using alternative assumptions in the base cases used for reliability planning; and

3. Reforms to expand the metrics and the time horizons used to select transmission under the reliability, economic and public policy processes without requiring a consolidated approach to all aspects of the regional transmission planning process.

Following the ANOPR process, on April 21, 2022, FERC issued a NOPR seeking comment on its proposed reforms to the Commission's existing regional transmission planning and cost allocation requirements. The proposals in the NOPR would require public utility transmission providers to:

- Conduct scenario-based long-term regional transmission planning on a sufficiently forward-looking basis to meet transmission needs driven by potential changes in the resource mix and demand;
- Adopt enhanced transparency requirements for local transmission planning processes and improve coordination between regional and local transmission planning with the aim of identifying potential opportunities to "right-size" replacement transmission facilities;
- Seek the agreement of relevant state entities within the transmission planning region regarding the cost allocation method or methods that will apply to transmission facilities selected in the regional transmission plan for purposes of cost allocation through long-term regional transmission planning; and
- Revise their existing interregional transmission coordination procedures to reflect the long-term regional transmission planning reforms proposed in the NOPR.

Maintaining Grid Readiness

NYISO Cyber and Physical Security

The NYISO maintains a comprehensive program to address cyber and physical security risks, enabling the secure operation of New York's bulk electric system and wholesale electricity markets in the face of an ever-evolving threat landscape. Energy is one of the sixteen infrastructure sectors identified by the Department of Homeland Security as critical to the nation's well-being. Accordingly, the systems and networks of electric sector organizations must remain secure, functional, and resilient at all times.

The NYISO's security program draws from mandatory NERC Critical Infrastructure Protection (CIP) standards and other cybersecurity frameworks, guidelines, and best practices. The NYISO's security posture is premised on continuous evaluation of its assets within the context of a highly dynamic range of cyber and physical security risks. The NYISO implements its compliance with mandatory cyber and physical security regulatory requirements as part of a layered, defense-in-depth strategy that relies on strong, security focused processes, state-of-the-art technology, and skilled staff to protect its critical infrastructure assets from incursion, around-the-clock.

A key element of the cybersecurity program is maintaining a high degree of situational awareness to reduce the time between the introduction of a potential threat to when that threat is identified and effectively mitigated. The NYISO has a state-of-the-art Cybersecurity Operations Center (CSOC), operating around-the-clock to continuously evaluate and respond to rapidly evolving cyber risks. Using advanced technologies that collect and orchestrate threat and vulnerability indicators, security events, and alerts from government and other sources, skilled analysts are able to assess and remediate cyber risks as they occur.

The NYISO's security program continuously works with government and industry partners. The NYISO collaborates on cyber and physical security activities with New York State, including the DPS, the Division of Homeland Security and Emergency Services and the New York State Police, as well as with New York electric utilities and other market participants. We lead cybersecurity training and roundtable exercises that test participants' incident response plans, identify opportunities for improvement, and enhance information sharing among state agencies and the industry.

At the national level, the NYISO engages on power grid security with FERC, NERC, the Electricity Information Sharing and Analysis Center, the Departments of Energy and Homeland Security, and the Federal Bureau of Investigation.

> Critical Infrastructure Protection (CIP)

A set of standards designed to secure the assets required for operating the bulk power system.

The NYISO implements the cyber and physical security standards as part of a layered, "defense-in-depth" posture that seeks to defend its critical infrastructure assets from incursions.

The NYISO participates in cyber and physical security policy and standards development activities and real-time cybersecurity threat information sharing. The NYISO also works with other grid operators to enhance operational and situational awareness, and routinely participates in industry wide grid security exercises — such as NERC's GridEx — that test the electric sector's response to challenging simulated cyber and physical security threat scenarios and incidents.

The electric industry maintains stringent industry infrastructure protection standards and is addressing the management of cyber risks as a very high priority. The NYISO, other grid operators, and industry participants have worked collaboratively with regulators to identify best practices and develop standards designed to maintain the ability to procure equipment and services in manners that mitigate supply chain risks. The NYISO has continued to increase its focus on enhancing procurement and cybersecurity practices which address cybersecurity threats.

Over the next decade as the energy industry is transformed by public policy and technological innovations, the NYISO is undertaking a multi-year strategy to utilize cloud-computing platforms to provide secure, dynamic, high-performing, and cost-optimized technology services.

NYISO Business Continuity

Business continuity and disaster recovery are closely related disciplines that support an organization's ability to remain operational after an adverse event. The NYISO has processes in place for coordinating, facilitating, and executing activities that identify and mitigate operational risks that can lead to disruptions before they occur. The NYISO is subject to NERC CIP Standards requiring the development and testing of disaster recovery plans in support of continued stability, operability, and reliability of the bulk electric system.

> **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.

The NYISO has long maintained a comprehensive organizational business continuity and disaster recovery program, which includes pandemic planning, safeguards for business information systems, and contingency plans in the event of a significant disruption of NYISO systems or facilities. The NYISO's pandemic plan enables it to sustain operations and carry out essential functions during a widespread infectious disease outbreak, where impacts may affect availability of labor and intellectual capital. The pandemic plan, which was implemented at the onset of the COVID-19 outbreak in March 2020, provides escalating levels of action that are proportional to the risk to its operations resulting from an outbreak.

In navigating the COVID-19 outbreak, the NYISO took several steps to protect grid reliability and the health and safety of our employees, including quickly transitioning to remote work for most employees, while enlisting control room operators to live on-site for a period of months in order to avoid exposure to the virus.

Despite the significant disruptions caused by the pandemic, the NYISO's strong commitment to business continuity planning and testing continues to lead to a high level of overall performance in project delivery, systems operations, and stakeholder engagement.

A Final Word

The transition to a greener grid in New York is leading to an electric system that is increasingly dynamic, decentralized, and reliant on renewable generation. Public policies are driving change on the grid through investments in new clean-energy resources and transmission system upgrades, but also through the deactivation of generation resources that provide critical reliability services to the grid.

Because these deactivations are outpacing new supply additions and upgrades, reliability margins are tightening. Delays in the construction of new supply and transmission, increases in the expected rate of generator deactivations, higher-than-expected demand levels, and the impacts of extreme weather could threaten reliability and resilience. The NYISO is committed to a reliable transition to a clean-energy future. A successful transition will require retaining certain traditional resources needed for reliability until new resources can address reliability risks.

The NYISO is leading the way in meeting these challenges. NYISO's leadership in developing innovative market design enhancements, like the Comprehensive Mitigation Reform proposal, demonstrate our expertise in grid operations, market design, and system planning. 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.

There are additional challenges ahead. As policymakers seek widespread change in how energy is produced and consumed, the NYISO is providing critical data and information to advise policymakers on the reliability implications of current and new policies. The NYISO will continue to be actively engaged with stakeholders and policymakers on the steps necessary on the path to a more reliable and greener grid for New York.

Glossary

The following glossary offers definitions and explanations of phrases used in *Power Trends 2022*, 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".

Climate Action Council (CAC): A 22-member committee tasked with preparing a *Scoping Plan* to achieve the state's clean energy and climate agenda.

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).

Capacity Factor: Capacity factor measures actual generation as a percentage of potential maximum generation. For example, a generator with a 1 megawatt capacity operating at full capacity for a year (8,760 hours) would produce 8,760 megawatt-hours (MWh) of electricity. The generator's annual capacity factor would be 100%.

Carbon Pricing: A market-based approach to create incentives for reduced carbon dioxide emissions by incorporating costs associated with carbon dioxide emissions, such as damage to crops or health care costs, into energy markets.

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.

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.

Co-located (Hybrid) Resources: Generation co-located with energy storage resources behind a single Point of Interconnect.

Comprehensive Mitigation Reform (CMR): NYISO proposal, accepted by FERC in May 2022, to remove certain resources from being reviewed under buyer-side capacity market mitigation rules if they serve the goals of the CLCPA, and to adopt a marginal capacity accreditation market design.

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 NYISO's Reliability Planning Process.

Critical Infrastructure Protection (CIP) Standards: A set of requirements designed to secure the assets required for operating the bulk power system. CIP requirements include the security of electronic perimeters, protection of critical cyber assets, personnel training, security management, and disaster recovery planning. CIP standards are developed by NERC, and approved by FERC.

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.

Day-Ahead Market (DAM): A NYISO-administered wholesale electricity market in which electricity and ancillary services are auctioned and scheduled one day prior to use.

Demand Response (DR) Programs: A series of programs designed to facilitate economic- and reliability-based load reduction measures by compensating electricity users that reduce consumption at the direction of the NYISO, either by economic dispatch or in response to a reliability condition. The NYISO demand response programs include Day-Ahead Demand Response Program (DADRP), Demand Side Ancillary Services Program (DSASP), Emergency Demand Response Program (EDRP), and Special Case Resources (SCR) program.

Dispatchable Emissions-Free Resources (DEFRs): Intermittency from increased renewables creates the need for energy that can, like fossil fuels, be dispatched immediately, but which is emissions-free. Technologies being developed in this category now include green hydrogen and renewable natural gas.

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.

Eastern Interconnection: The Eastern Interconnection is one of the three electric grid networks in North America. It includes electric systems serving most of the United States and Canada, from the Rocky Mountains to the Atlantic coast. The other major interconnections are the Western Interconnection and the Texas Interconnection.

Electricity Market: In economic terms, electricity is a commodity capable of being bought, sold, and traded. An electricity market is a system enabling purchases. The NYISO administers the wholesale electricity markets in New York, enabling competing generators to offer their output to retailers.

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: 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 power 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 Supplier: A qualifying generator or load facility that can supply and/or reduce demand as 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.

Load Serving Entity (LSE): An entity, such as an investor-owned utility, public power authority, municipal electric system, or electric cooperative that procures energy, capacity, and/or ancillary services from the NYISO's wholesale markets on behalf of retail electricity customers.

Locational Capacity Requirement (LCR): A portion of the

statewide installed capacity that must be physically located within a locality to meet reliability standards. Locational Installed Capacity 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 a 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 when there is a 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 New York State Public Service Commission 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.

Real-Time Markets: A NYISO-administered wholesale electricity market in which electricity and ancillary services are settled every five minutes. The Real-Time Market addresses changes in operating conditions relative to what was anticipated in the Day-Ahead Market. For instance, changes to load or anticipated generator output are accounted for in the Real-Time Market through a competitive auction process.

Regional Greenhouse Gas Initiative (RGGI): A market-based regulatory program in the United States to reduce greenhouse gas emissions. RGGI is a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia.

Reliability Needs Assessment (RNA): A report that evaluates resource adequacy and transmission system security over years 4 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.

Renewable Energy Credit (REC): 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 of the state's Clean Energy Standard (CES).

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.

Tier 4 Renewable Energy Credits (REC) Program: The NYSERDA Tier 4 REC program aims to increase the penetration of renewable energy in New York City and reduce reliance on fossil fuel generation. All eligible resources must be either located in New York City or be deliverable through a new transmission interconnection to New York City.

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.

Zero-Emissions Credit (ZEC): A mechanism to link the environmental attributes associated with the energy produced by certain eligible zero-emissions generators. In New York, one ZEC equates to one MWh of energy generated by eligible nuclear generators.

Endnotes

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NYISO In Brief

The New York Independent System Operator (NYISO) is a not-for-profit corporation responsible for maintaining the safe, reliable flow of power throughout the Empire State.

The mission and vision of the NYISO establishes the foundation from which all our responsibilities are delivered and the vision describes a future that we strive to achieve. Together, they provide the basis for the NYISO's Strategic Objectives and Strategic Initiatives, as well as a reference to guide decision making and action at all levels of the organization.

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.

The NYISO manages the efficient flow of power on more than 11,000 circuit-miles of electric transmission lines on a continuous basis, 24 hours-a-day, 365 days-a-year — in compliance with the most rigorous reliability requirements in the nation.

As the administrator of the wholesale electricity markets, the NYISO conducts auctions that match the power demands of electric utilities and energy service companies with suppliers offering to sell power resources.

The NYISO's Comprehensive System Planning Process assesses New York's electricity needs and evaluates the ability of proposed power options to meet those needs. This planning process involves stakeholders, regulators, public officials, consumer representatives, and energy experts who provide vital information and input from a variety of viewpoints.

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 a 10-member, independent 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.

New York ISO
Independent System Operator

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