



How Competitive Electricity Markets Power New York State's Clean Energy Goals

POLICY BRIEF

March 2024

Table of Contents

Attracting needed grid reliability resources while protecting consumers	3
The role of competitive electricity markets in grid reliability	4
Comprehensive approach to markets	4
Leveraging electricity markets' proven history	5
Energy Market	5
Capacity Market	6
Market innovations for a reliable grid of the future	7
Growing emphasis on ancillary services to balance an increasingly intermittent grid	7
Market enhancements currently underway	8
Winter reliability capacity enhancements	8
Dynamic reserves to balance intermittency	8
Advanced storage modeling	8
Carbon Pricing	9
Summary: Markets role on the road to 2040 reliability	9

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Attracting needed grid reliability resources while protecting consumers

At the New York Independent System Operator (NYISO), we recognize the importance of New York's climate goals and fully support the state's efforts to decarbonize. Today, about 50% of the electricity generated in the state comes from fossil fuel resources. Phasing out that portion of the power supply by 2040, while maintaining an equally reliable system that runs entirely on emissions-free resources, is a monumental endeavor. It will require new technology, significant upgrades to existing transmission infrastructure, and a historic level of investment.

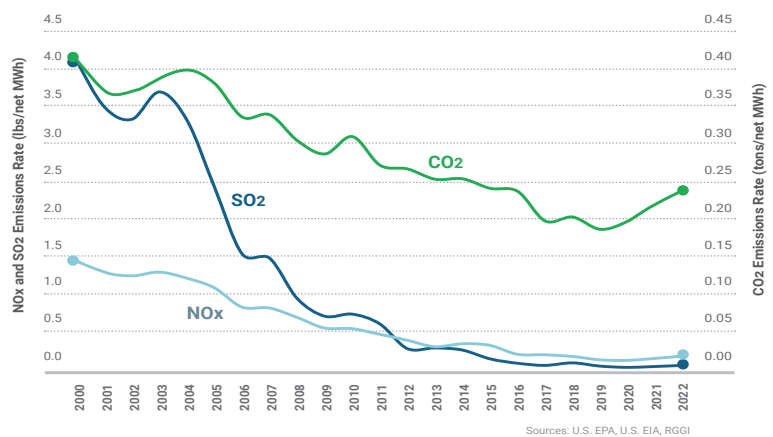
The transition to more weather-dependent resources will also require flexibility among supply and demand technologies to replace the reliability characteristics of retiring fossil fuel generators.

Also, as policies seek to promote electrification and phase out fossil fuel generation, new winter reliability challenges will arise. Signaling investment and innovation needs in NYISO-administered electricity markets will be critical in ensuring that a greener grid of the future is also a reliable one.

For the past 25 years, competitive wholesale electricity markets in New York have supported the reliable, efficient operation of the grid. Furthermore, as investors looked for opportunities to develop new resources to supply the grid, these markets ensured that the risk of those investments remained entirely on the developer, rather than on ratepayers. An added benefit of wholesale markets is that competition among resources rewards economic efficiency. Historically, this has resulted in cleaner supply coming onto the grid and displacing older, less efficient supply.

Wholesale markets use price signals to attract and retain enough supply in the most beneficial locations to provide needed reliability services. Today's system consists largely of controllable resources that can follow these price signals to respond to system needs. To ensure markets continue to attract investment in resources that can respond quickly to changing system conditions to balance intermittent resources, we are taking numerous steps to identify emerging needs on the grid and evolve and enhance market designs to address those needs.

» Emissions Rates from Electric Generation 2000-2022



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Long before the 2019 Climate Leadership and Community Protection Act (CLCPA) was put into law, our market design team led the nation in implementing rules designed to increase participation of storage, solar, and wind, and reduce barriers to entry. These market innovations, including a draft plan to integrate a social cost of carbon into wholesale energy prices, are examples of ways in which markets can create incentives in support of both reliability and clean energy goals.

In explaining the ability of markets to drive the innovation and investment necessary to support decarbonization of the grid, a basic understanding of the markets' role in grid reliability is essential.

The role of competitive electricity markets in grid reliability

New York represents the 8th largest economy in the world and powering that economy requires maintaining a continuous balance of electric power so that the energy supply (generator-supplied electricity) is always able to meet demand (electricity used by consumers). Maintaining this balance is essential to having power available instantaneously when a consumer turns on or plugs in a device and to avoid damaging elements of the transmission system, which could lead to customer outages. It is the job of wholesale electricity markets to maintain this balance to keep the lights on, to power the devices everyone depends on, and to support the health, safety, and welfare of all our state's citizens around the clock. As New York moves towards its policy goals, these wholesale electricity markets will continue to be the foundation of delivering energy reliably.

Comprehensive approach to markets

In order to meet the complex needs of managing the energy grid, we operate multiple wholesale competitive electricity markets that work together to achieve a reliable system. These markets select the lowest-cost electricity resources available based on demand levels and suppliers' price offers in the markets. In this way, price signals are able to match the supply of electricity to demand at all times.



Wholesale Electricity Markets

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

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

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

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

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



The costs to procure adequate capacity for projected peak demand levels and to produce electricity in the precise quantities needed by the grid in real-time are all included within the cost of wholesale electricity, but the NYISO manages a separate market for each to support their different purposes.

Each of the NYISO-administered markets are interdependent, and facilitate a different piece of the reliability puzzle:

1. The **Capacity Market** secures commitments from supply resources to be available to meet seasonal resource adequacy requirements.
2. The **Energy Market** secures electricity production to meet demand in real-time.
3. The **Ancillary Market** secures flexibility services from suppliers to maintain balance in response to changing conditions on the electrical grid.

Wholesale market price signals guide investment decisions and performance but the rules that guide these markets continue to evolve to reflect the changing needs that clean energy policies and technologies are introducing to the grid. For instance, the ability of supply resources to rapidly increase or decrease their output levels, known as ramping capability, will become increasingly valuable as more wind and solar resources enter operation. Wholesale market signals will be needed to attract this capability and deploy it efficiently when it's needed. We are examining these emerging needs through planning initiatives that model future grid scenarios to identify challenges that may arise as the resource mix of the grid changes. Doing so helps to define the specific characteristics the grid will need so we can modify our markets to ensure they attract and retain the resources needed to deliver those characteristics and support reliability throughout the transition to a clean energy grid.

Leveraging electricity markets' proven history

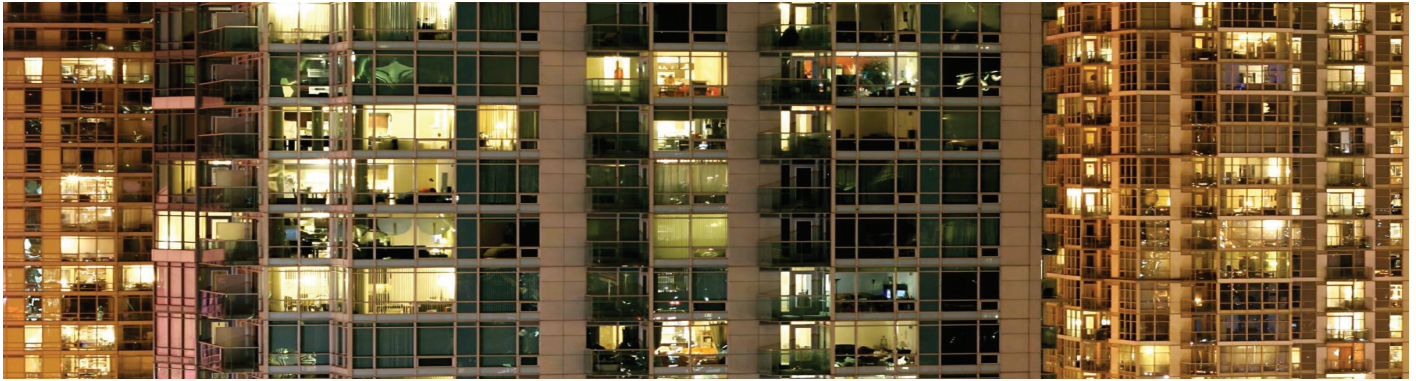
Transitioning to the clean energy grid of the future will require unprecedented investment in new supply resources. Wholesale competitive electricity markets in New York will ensure that the risk of these investments remains with the investor, rather than consumers.

Further, markets support continuous gains in efficiency and innovation. That is because inefficient producers are replaced by those with new, cost-effective, and clean technology. Competition not only creates the need for suppliers to be less costly than competitors, it also encourages innovation in order to realize future revenue opportunities. Market-based price signals are also transparent and can stimulate necessary infrastructure investment to meet renewable and decarbonization goals, energy conservation, and demand response.

Energy Market

The Energy Market provides a fundamental platform for utilities, large consumers, retail energy providers, and other load serving entities to purchase electricity in the NYISO marketplace. Put simply, the Energy Market provides a means for load serving entities to satisfy the immediate power needs of the customers they serve.





While some electricity is bought and sold directly between suppliers and utilities, much of the electricity consumed in New York is procured through the wholesale electricity markets. In these markets, suppliers compete to offer electric supply and ancillary services necessary to maintain reliability. Every five minutes, every day, these markets select the least-cost mix of supply to meet changing electricity demand across the state, all while adhering to strict reliability standards. After being selected in these auctions, generators deliver their services to the marketplace. Several factors influence which suppliers are selected for their services, including the location of generators, and the amount of electricity flowing across the grid.

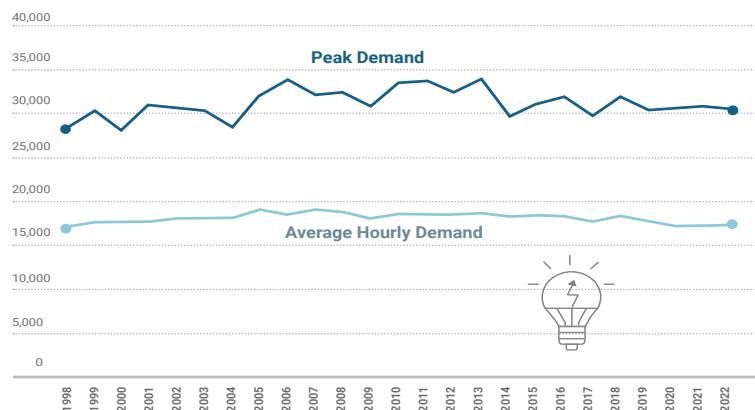
Capacity Market

Our highest priority is to maintain reliability of the electric system, and in keeping with our mission, we operate the capacity market to meet resource adequacy requirements and other reliability requirements. As the figure to the right shows, there is a significant gap between the average hourly demand level that New York’s power grid supplies and the peak demand level that it must be capable of supplying. The purpose of the capacity market is to procure enough capacity to reliably meet expected peak demand levels plus an Installed Reserve Margin (IRM) approved by regulators.

The IRM is derived from planning studies conducted in conjunction with the New York State Reliability Council and establishes the minimum level of capacity that must be procured to meet resource adequacy requirements.

The capacity market compensates resources that commit to being available to the system, acting as a transparent and cost-effective mechanism to avoid the danger of service interruptions and outages that might be triggered by insufficient supply. By participating in the capacity market, suppliers are obligated to be available to provide power when needed.

» **Historic Average Hourly Demand vs. Actual Hourly Peak Demand (MW)**



Market innovations for a reliable grid of the future

The operating characteristics of the power system are changing with the introduction of large quantities of renewable and duration-limited resources. The sudden loss of large amounts of energy due to rapid changes in weather conditions and the uncertainty surrounding predicting how much energy to count on from these resources introduces operational challenges that must be addressed. We are continuously studying how clean energy resources will change the reliability needs of the grid to determine where markets can be refined to deliver those needs most effectively.

Growing emphasis on ancillary services to balance an increasingly intermittent grid

Ancillary services refer to functions that help grid operators maintain a reliable electricity system by maintaining the proper flow and direction of electricity. These increasingly essential grid services address imbalances between supply and demand, avoid power system interruptions, and help the system recover after a power system event. Ancillary services can include the following structures:

- **Synchronized regulation** corrects for changes in electrical imbalances that might affect the stability of the power system every six seconds
- **Contingency reserves** are used to respond to an unexpected outage of a system component, such as a generator, transmission line, circuit breaker, switch, or other electrical element
- **Flexibility reserves** are an emerging concept for addressing variability and uncertainty on longer timescales than contingency and regulating reserves

We are working with stakeholders via our transparent [Shared Governance process](#) to expand ancillary services products to better support reliable grid operations and help to balance the intermittent nature of the anticipated renewable generation fleet. These products will help signal and procure the grid reliability attributes that will become increasingly important in balancing weather-dependent resources to achieve a reliable grid, attributes that were previously provided by fossil fuel generators.

» Listen Now: [Podcast Episode 27 - Master Class in Electricity Markets](#)



"It's going to be a vastly more complex grid, but it is going to drive our transition to a decarbonized and sustainable future."

Rana Mukerji, NYISO Senior Vice President, Market Structures

In a greener grid of the future, a premium value of energy supply will be its flexibility. We are working on several market innovations that will attract flexible resources that perform when needed and reward those resources that can support balancing grid supply and demand. With ever-increasing intermittency, extreme weather, and demand from electrification and economic development, the economic force of markets is essential for maintaining reliability.

NYISO leads the nation in creating market rules and structures that enhance renewable resource participation in markets, support grid reliability services, and support environmental goals.

Market enhancements currently underway

Winter reliability capacity enhancements

More than half of New York's generating capacity relies on fossil fuel. The prospect of a winter-peaking system introduces new reliability challenges, driven by the inability to secure fuel on the coldest days. Proper price signals must be designed to encourage participation from firm, reliable supply resources. We are working with stakeholders to identify the emerging winter risks and determine what market changes are needed to compensate suppliers for meeting these needs.

Dynamic reserves to balance intermittency

Operating reserves ensure sufficient supply to meet changing conditions in real-time, such as unplanned generator outages. Historically this need was solved by identifying a fixed, system-wide reserve requirement. As intermittent renewable capacity grows and supply to the grid is more susceptible to changing weather conditions, establishing dynamic reserve requirements will support renewable energy integration by more accurately accounting for uncertainty. Phase 1 design requirements are anticipated through 2026 and discussions will continue with stakeholders thereafter.

Advanced storage modeling

Coordinating the growing fleet of storage resources requires advanced modeling techniques in day-ahead and real-time markets, and improved tools for grid operators to manage capabilities so that these resources are deployed at the most effective times to meet New York's reliability needs. Efforts are underway with stakeholders to develop these capabilities so that battery storage resources, which act as both load and supply and have limited-duration capabilities, are utilized in an optimal manner. We anticipate deployment of the new tool in 2027, in advance of 2030 goals calling for 6,000 MW of storage capacity.



Carbon pricing

Economists widely agree that one of the most effective means of decarbonizing the power grid is to integrate the cost of carbon dioxide emissions into the cost of energy. Several years ago, we worked with stakeholders to develop a carbon pricing proposal that would incorporate a cost of CO₂ emissions in the electricity markets we administer, rewarding investment in clean energy while promoting efficiency improvements to fossil-fuel plants. Numerous studies confirm the proposal's ability to meet the goals faster and more cost-effectively while maintaining grid reliability. This nation-leading proposal is capable of working in concert with the State's cap and invest program and RECs frameworks.

Our market design team continues to work with stakeholders to define and implement various market enhancements and has been a leader in defining and implementing structures that expand integration of decarbonized solutions.

Summary: Markets role on the road to 2040 reliability

As New York progresses towards the mandates established by the CLCPA, extensive technical considerations must be prioritized in running a complex electrical grid system 24-hours per day, 7 days per week, 365 days per year. Creating supply procurement mechanisms that align with those technical considerations is paramount to reliably delivering power to consumers, so that the resources required to meet New Yorkers' needs are available and ready to perform when needed. Markets are the most powerful means to drive needed energy infrastructure investment in support of reliability. While state incentives attract investment in clean energy generation, markets will continue to be needed to attract the capabilities necessary to balance the system, including flexibility and responsiveness to balance the availability of wind and solar to ensure that the greener grid is also a reliable grid.

The enhancements noted above are examples of a broader, comprehensive plan we are pursuing with its stakeholders to assess the changing needs of the grid and provide market designs that address those needs. **Competitive electricity markets will remain essential to maintaining reliability throughout the transition to a decarbonized grid by balancing intermittent resources, and providing the innovation, flexibility, and diversity to support reliability efficiently and cost effectively.**

Reliably managing New York's power grid & wholesale energy markets since 1999



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