New York ISO
Independent System Operator

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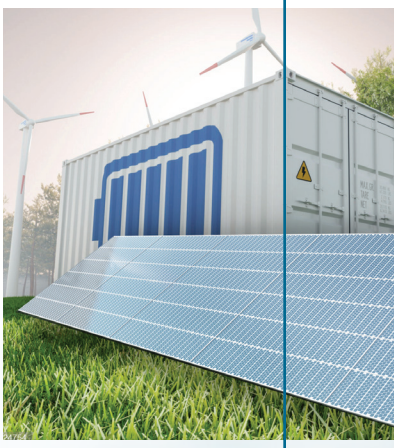
The New York ISO & Grid Reliability



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From the CEO

Reliability has been and will continue to be job one for the NYISO.

Richard Dewey
CEO, New York ISO

We operate under the strictest reliability standards in the country with oversight and collaboration from FERC, NERC, NPCC, the NYS Reliability Council and the NYSPSC.

The NYISO is an independent organization. This independence provides the strong foundation from which we make decisions. Any recommendation is always based solely on facts, data, information and in-depth analysis, free of influence from outside financial interests or politics.

Our governance process, where market changes are reviewed and debated, is open, transparent and includes participation from every corner of the industry.

Consumer, climate justice and environmental interests are represented. State and federal government entities also participate, including FERC, NYS DPS, NYSERDA, the NYS Utility Intervention Unit, the NYPA, LIPA, and NYC.

The NYISO-administered capacity market has a 20 year history of ensuring reliability.

The capacity market serves a vital role in New York State by ensuring the amount of electricity necessary to serve customers under the most stressful conditions is readily available.

The capacity market provides incentives for performance but also includes severe penalties for failure.

One critical element of the capacity market is the NYS reserve margin, developed annually by the NYSRC, with input from the NYISO, and subject to final approval from FERC and the NYS PSC. The reserve margin ensures a sufficient amount of capacity is available to the grid under the most extreme weather conditions. Re-evaluating the reserve margin annually allows for adjustments to reflect changes in demand, supply, and transmission capability.

We continue to be actively involved in discussions regarding capacity market reform at the state level. We will also engage in these discussions with the FERC as called for at the February 18, 2021 session.

At its core the NYISO-administered capacity market is a reliability construct. At the same time that we are deeply involved in the transition toward the grid of the future, reliability will not be sacrificed.

The NYISO is committed to reaching the renewable investment and decarbonization goals as mandated under the CLCPA. Important market design changes have recently been approved or are under development by the NYISO that will support the state's pursuit of the CLCPA goals.

System planning is critical to long-term reliability. The NYISO recently completed a climate study to plan for the effects of extreme weather on the bulk power system.

The NYISO also conducted a fuel security study in 2019 that evaluated impacts on resource availability and system reliability under prolonged and extreme winter weather conditions. The study provided critical insight into reliability performance that has proven valuable. We are committed to re-evaluating these conditions again in the future.

Sincerely,

Richard Dewey,
President & CEO, New York ISO

"Independent" is (Literally) our Middle Name

The name is the "New York Independent System Operator." There's a reason that the word "Independent" is part of our title.

When the NYISO was first created nearly 20 years ago to run New York's power grid and its wholesale electric markets, it was envisioned as an entity that would serve as a shared governance platform for a variety of interests, including transmission owners, generator owners, public authorities and municipal utilities, large and small consumers and environmental advocates. **For the NYISO to work best, it needed to be transparent, open and independent of all those stakeholders. Independence means that NYISO and its directors, executives and employees have no financial interests in any assets or transactions on the New York grid.**

Our democratic shared governance process supports transparency and the inclusion of multiple industry viewpoints.

It is NYISO's shared governance structure that promotes innovation and best practices by requiring that all the interested parties discuss and debate their diverse viewpoints regarding changes and improvements to NYISO's wholesale markets. Under this model, 58% of voting stakeholders must approve voting items before a committee before moving forward, a practice that requires consensus among entities with various interests.

Photo: NYISO

Our democratic shared governance process supports transparency and the inclusion of multiple industry viewpoints.

NYISO's independence from any single leg of that stool allows this cooperation to go forward.

"It's better to craft solutions to market issues through a consensus than through the imposition of regulatory mandates," said Jane Quin, director of the energy markets policy group at Con Edison and a frequent market participant in NYISO decision-making committees.

NYISO was created three decades after the formation of its predecessor, the New York Power Pool. The power pool was created by utilities seeking a grid operator that could manage the transmission of power around New York while balancing the needs of different regional utilities. As the state grew, power sources grew more diverse and the grid became more complex, it was clear that New York needed a more robust and involved grid operator. At the same time, consumers demanded the ability to shop for their own power providers and have power transmitted to them over an open access transmission grid. The NYISO grew out of that need

"It's a carefully-balanced construct based on trust. The idea was to construct an open and transparent marketplace that establishes fair prices and does so without any undue influence of one set of interest over another."

— Ray Stalter, Director of Regulatory Affairs, New York ISO

and moved forward as a result of changes to state and federal energy policy. The need for independence was recognized by these governments along the way.

Today, the NYISO's robust markets provide power for consumers, create certainty that enough electricity is available on high-demand days and otherwise keep the grid resilient and efficient. We function well in meeting the needs of stakeholders because we are empowered to do so, independently.

Shared Governance: How Stakeholders Have a Voice in Shaping the Electric Grid

While independence is at the core of the NYISO's mission, we don't make decisions alone. The NYISO's market policies, changes to our federally-regulated Tariffs (which guide grid management, system planning, and wholesale market rules), and other decisions related to the sale and transmission of power are all determined with input and approval by stakeholders.

This collaborative approach has been part of NYISO's business model from the start, in order to ensure that individual interests could not unduly influence grid reliability or energy market outcomes.

"In our shared governance model, we have wholesale consumers and suppliers, along with investors in new technologies, working together to develop the best market design," said Raymond Stalter, Director of Regulatory Affairs at the NYISO. "To do that successfully, we need to make sure we hear from all sides."

Under the shared governance process, representatives from interested stakeholders work together almost daily in support of the NYISO's mission to support transparency, reliability, and innovation. Stakeholders come from a wide range of backgrounds, including utilities and power producers and traders, regulators and policymakers, consumer interest representatives, and environmental advocates.

These stakeholders have a significant say in establishing priorities. Among their responsibilities, NYISO stakeholders have voting power to:

- Approve most proposed changes to our governing documents, including the federally approved tariffs. This responsibility is shared with the NYISO Board of Directors.
- Exercise responsibilities, including developing and adopting grid technical guidelines, shaping market design and system planning.
- Review and recommendation of Board of Directors candidates.

Stakeholder Input is Key to Success

"We view the stakeholder process as the keystone of the NYISO's success," said Jane Quin, Director of the Energy Markets Policy Group at Con Edison and a frequent attendee at NYISO stakeholder meetings. "It is critically important to a well-functioning energy market in New York."

Quin, who has worked with the NYISO on many projects related to transmission and wholesale markets, said the shared governance process has helped the power industry in New York avoid contention.

"While change does not come easy in the stakeholder process and frequently is a time-consuming proposition, I think the attitude of being open to change, both by the NYISO staff and its market participants, is important."

"What I find impressive about the NYISO is it's focus on continual improvement."

— Jane Quin, Director of Energy Markets Policy Group, Con Edison and frequent attendee at NYISO stakeholder meetings

In all, governance members come from more than 150 organizations.

"I think the shared governance model makes a lot of sense," said Michael Mager, an attorney for Multiple Intervenors, a group representing large New York power consumers.

"While it often takes longer than desirable at times, I think the final product is usually much improved over where things started," said Mager. "It makes participation that much more meaningful."

Majority Rules: Reaching for the Magic 58%

Under NYISO structure, committee decisions need at least 58% approval rate. It's a threshold that assures that stakeholders with varying interests work together on issues. In a rare instance of a serious disagreement, stakeholders such as, for instance, power suppliers and utilities must "cross the aisle" and compromise in order to reach the majority threshold and pass projects under consideration."

While the NYISO board makes the final decision, stakeholder input is given significant weight. “The board wants to see consensus,” said John Buechler, NYISO’s former executive regulatory policy advisor, and a power industry veteran who helped create the current governance structure in the late 1990s.

Shared governance was introduced in 1999, when the New York Power Pool was turned into the much more expansive NYISO, with the specific purpose of leveling the playing field. Since then, more than 400 market participants have played an important role in how NYISO decisions are made.

"NYISO’s stakeholder governance process recognizes the important environmental consequences of its decisions by vesting environmental organizations with formal voting rights,” said Miles Farmer, Senior Attorney for the Natural Resources Defense Council. “Seeking input from a wide range of groups is the first step to making informed decisions that appropriately consider the public interest.”

Photo: NYISO

A market participant makes a comment during a recent Business Issues Committee meeting.

Aaron Breidenbaugh, who represents New York City-based energy consumers as Director of Regulatory Affairs for Luthin Associates, agrees in the importance of giving stakeholders a vote that counts.

“It empowers everyone,” he said. “Broad stakeholder agreement is, and should be, needed to approve major reforms.”

Examples of significant market design elements fine-tuned through the shared governance process include:

- A Wind Forecasting system, AWS Truewind, to provide wind predictions to better balance the integration of wind resources to the electric grid. Wind-related revisions to the NYISO markets were approved through stakeholder discussions.
- Integration of renewables and rules and tools to lower barriers to entry for new technologies. The NYISO was the first to develop wind supply forecasting rules, and are applying those same rules to solar energy supply.
- Social cost of carbon pricing proposal, which is under development, to incorporate a carbon cost that creates greater incentives for emissions reductions from fossil fuel-based generators, while strengthening investment in carbon-free generation.

In Summary

Shared Governance is a collaborative approach that provides benefits for all participants. Shared Governance is fundamental to the New York ISO's operation, mission, and success as one of the most innovative independent grid system operators in North America and, indeed, around the world.

Keeping the Power Flowing: It's What We Do

When we sum up our mission, we like to say we have one overarching goal: to keep the power flowing, at all times. That's what we refer to when we talk about reliability: the ability to continually keep electricity moving over the 11,173 circuit-miles of high-voltage transmission lines that we manage, from the densely-packed heart of Manhattan to the most remote regions of upstate. Hospitals depend on us, as do businesses, schools, traffic lights, and homes. When we do our jobs correctly, most people don't even notice.

The concept is simple, but the system that runs it is not. The energy grid is an incredibly complex entity, and in recent years it has become more complex than ever before.

Our 3,000-pages of Tariffs include rules and requirements on reliability that govern everything we do. Our wholesale energy markets bring together power suppliers, transmission owners, and local distribution companies and utilities. The markets bring both reliability and economic benefit to New Yorkers by continuously meeting energy needs with the least-cost energy resources available.

At all times, energy supply must be precisely balanced with demand. To do that, we must be aware of hundreds of generators, the state of transmission lines, and the rising and falling of energy use across the state.

The price of electricity at any given time reflects the needs of the system, and provides an incentive to suppliers to maximize efficiency and invest in new technology in areas where it is most needed.

It's all overseen from our control room, where skilled operators constantly maintain this electrical juggling act, 24 hours a day, every day of the year.

Planning for a Reliable Future Grid

Reliability planning is critical to maintaining grid integrity. Our planning processes include

10 year need forecasts. This allows developers and investors to assess and assume the risks of investing in new resources, in order to avoid imposing investment risk onto consumers. We identify and determine reliability needs through our comprehensive planning process.

Every two years, we perform a reliability assessment that looks at grid needs over the next decade, followed by a reliability plan to address any issues found in that study. Our most recent Reliability Needs Assessment (RNA) looked at available resources, and the expectation of new generation coming online or old generation being retired. It also looked at transmission facilities that may be overloaded due to grid limitations.

Following the assessment, we conduct a Comprehensive Reliability Plan, which details our plan for continued reliability of the bulk power system over 10 years. This plan is used to resolve any reliability needs found in the assessment.

We will continue to assess and respond to the changing needs of the New York energy grid, confident in our ability to keep the lights on in New York.

How We Keep the Grid Reliable in New York

The power outages that occurred recently in Texas and California this past summer have raised questions of whether similar events could occur here in New York. It's worthwhile to examine how the NYISO's markets are different than the markets in those two states and to learn more about our unique approach to maintaining grid reliability.

The work we do as the New York Independent System Operator is distinct from the role the Texas and California grid operators play. Primary among those differences are the NYISO's capacity markets and planning functions. Let's explore some of those differences in detail:

1. New York has an Installed Capacity Market

A main part of the NYISO's mission is to manage the operation of the grid in New York and administer the wholesale electricity markets by which power and grid reliability services are bought and sold. One important grid reliability service — resource adequacy — is bought and sold through the Installed Capacity (ICAP) market. This is a major difference between the NYISO markets and those of Texas and California.

Resource adequacy promotes reliability by making sure enough generating capability is available to meet grid demand at peak times of electricity consumption. The NYISO's capacity

market offers a forum for buying and selling capacity through competitive auctions. Auctions are conducted monthly and for the summer and winter seasons. Consumers benefit from competitive auctions that minimize consumer costs. Investors in new technologies benefit from transparent locational pricing. Existing suppliers benefit from investment signals that reward units for maintaining or upgrading their performance. Our centralized capacity market offers price transparency to spur competition and drive costs down for maintaining resource adequacy. The capacity market also includes specific rules to incent performance and availability of resources when system needs are expected to be greatest as well as stiff penalties for non-performance. Texas and California lack capacity markets.

In addition, the NYISO's planning processes include generator deactivation studies and periodic assessments of both resource adequacy and transmission system needs to identify risks to reliability and to take action if necessary.

2. New York has regional coordination

California, like the NYISO, imports energy from several neighboring states. Texas, however, generally does not. In New York, both energy and capacity are imported from and exported to neighboring regions, benefiting reliability in the region and strengthening market competition. Resources importing capacity services into New York must meet strict market rules, just like resources located within the state, to be eligible to serve New York consumers.

3. New York has a diverse fuel mix

In New York, the electricity that comes out of the wall of your business or home originates from many different sources. According to our recent *Power Trends* report, in 2019 a third of New York's energy production was from dual-fuel generators that run primarily on natural gas but have the ability to use other fuels as well. Another third came from nuclear energy, and nearly a quarter came from hydropower.

In comparison, accounts of the incidents in California point to the state reducing fossil fuel and nuclear generating capability, leaving the state with fewer resources to balance the grid on days when there is reduced wind or clouds obscuring the sun. As CAISO's report to the governor said, "[I]n transitioning to a reliable, clean and affordable resource mix, resource planning targets have not kept pace to lead to sufficient resources that can be relied upon to meet demand in the early evening hours."

The NYISO followed closely the events in the south-central states related to cold weather related outages. On February 17, 2021, the Federal Energy Regulatory Commission (FERC) and the Northeast Electric Reliability Council (NERC) announced that they will open a joint inquiry into the operations of the bulk power system during the extreme winter weather conditions that

were experienced by the midwest and south-central states. FERC and NERC indicated that they will work with other federal agencies, states, and utilities to review the performance of the bulk power system and determine what further investigation is appropriate.

For the past decade wind and solar energy resources have played an increasingly important role in New York and its participation is expected to grow as the NYISO market rules evolve to address these new technologies. We have developed forecasting tools that accurately predict the levels of production from these resources, maximizing their reliability, economic, and environmental benefits. Studies such as the *Reliability Needs Assessment*, the "70x30 Scenario" in our *Congestion Assessment and Resource Integration Study* (CARIS), and our Climate Change Study show that wind and solar growth would require a diverse portfolio of resources to keep the grid in balance when nature does not cooperate.

4. Clear accountability for non-performance of supply resources

Our markets in New York help to drive out costlier, and often dirtier energy suppliers through economic competition. The NYISO coordinates with New York State to address reliability needs caused by generator deactivations. We also have a mandatory notice period for units seeking to deactivate to prepare for any potential reliability concerns.

Reliability rules require that New York carries enough capacity to meet peak demand levels, as well as additional resources to provide a margin of reliability safety for certain conditions. How do we know how much is needed? Grid planners develop models that depict what would happen to the grid if we lost the use of certain energy resources due to weather, fuel constraints, transmission outages, or other system conditions. This allows us to be ready for contingencies, including the potential loss of some of our largest supply resources.

In California, the role of resource management is shared between the independent system operator and the state. According to media accounts of outages last summer, the CAISO was unaware that certain energy resources were shut down, reducing the options of where to get electricity. As CAISO noted in its report to the governor, "the existing resource planning processes are not designed to fully address an extreme heat storm like the one experienced in mid-August."

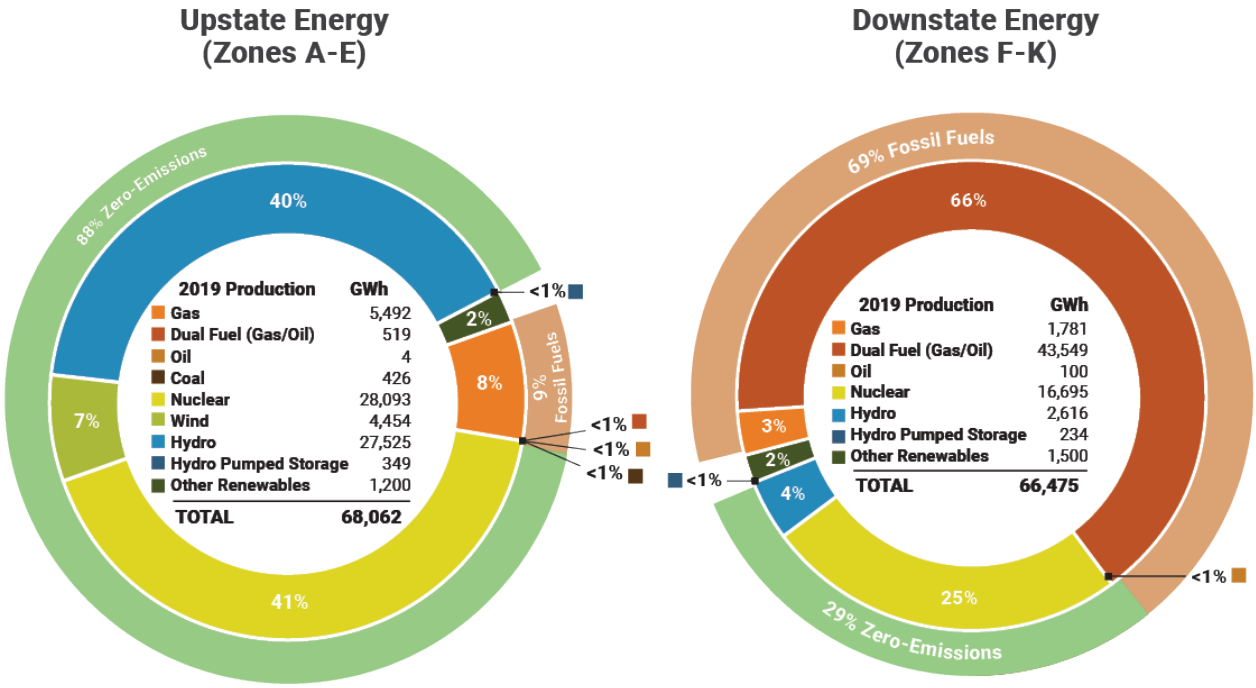
As we continue working on the grid of the future, we operate under the most stringent reliability rules in the nation. Our long-range reliability planning requires us to examine scenarios such as extreme weather events and unexpected transmission failures to maintain reliability. And our independent structure and shared governance process gives all members of the energy sector a say in decisions affecting our markets.

As the energy grid changes, we continue doing what we do best to make sure the energy grid in New York State stays reliable.

Fuel for the Wire: A Diverse Fuel Mix & the Tale of Two Grids

What's the source of power flowing out of your electrical outlets? In New York, that largely depends on whether you are upstate or downstate.

The electricity coming out of your wall can originate from sources as varied in geography as they are in types of resources. As discussed in our *Power Trends 2020, The Vision for a Greener Grid*, it takes a diverse mix of generation technology to produce enough energy to run the New York grid.



In 2019, a third of New York's energy production was from dual-fuel generators that run primarily on natural gas, but have the ability to use fuel oil or other fuels as well. Another third came from nuclear energy, and nearly a fourth came from hydropower. Energy production from wind power made up 3% of energy production from suppliers in New York last year.

With the approval of the Climate Leadership and Community Protection Act (CLCPA) the state has mandated that the grid be zero-emission by 2040.

New York's Diverse Fuel Mix and the Tale of Two Grids

A diverse fuel mix is important, because fuel mix affects both the reliability of the electric system and the price of power. A balanced array of resources enables the electric system to

better address issues such as price volatility and fuel availability, providing both reliability and economic benefits for consumers.

The mix of energy resources in upstate New York is very different than the mix of supply resources downstate. Upstate New York is home to most of the hydropower generation in the state, and attracts investment in large wind generation sites. New York City, Long Island and Westchester make up the largest population base in New York, and the biggest load center for power consumption. It also hosts the majority of fossil fuel burning generation in the state.

New York's transmission system can become constrained in its ability to deliver energy from clean energy resources in upstate New York to the large consumer demand areas downstate.

Thus, we have what we call the "tale of two grids." To meet the mandates of the CLCPA, the transmission system will need to be expanded to facilitate greater flows of electricity from clean energy resources upstate to downstate consumers. While the tale of two grids is a long-standing challenge for New York, a new chapter is being written.

We are in the midst of the largest improvements to transmission in a generation. Two pending projects, one in Western New York and one stretching from Central New York to the Hudson Valley, will significantly increase our ability to deliver clean energy from where it's produced to where it is needed most. These projects are expected to be in service by 2022 and 2023 respectively, increasing power flows from upstate to downstate by roughly 1,000 MW.

The Capacity Market's Role in Grid Reliability: FAQ

Having sufficient installed capacity is especially important as we work to achieve the state mandates requiring 70% clean energy by 2030 and a zero-emission electric system by 2040. With an increased reliance on intermittent resources such as solar or wind power, sufficient "fast-ramping" resources must be on hand to provide energy when the sun is not shining or the wind is not blowing.

The NYISO-administered capacity market serves a vital role in New York State by promoting reliability on the grid. In order for the electric grid to work, the amount of electricity put onto the grid must always equal the amount of electricity being consumed. At times when energy demand is at its highest, capacity must be available to keep the grid in balance.

By selling capacity, electricity suppliers commit themselves to being available to meet the energy needs of New Yorkers. The capacity market supports reliability every day, but especially on high-demand days such as in the summer when increased air conditioning use pushes load

to higher levels.

How do capacity markets support reliability on the energy grid?

Imagine a hot day in August. Around New York, grid-connected generators such as gas turbines, nuclear plants, hydropower dams and others are working hard to produce electricity to keep air conditioners humming. But as the temperature climbs, electric demand grows.

As New York increasingly relies on renewables like wind and solar power, additional installed capacity will be required to operate when the wind isn't blowing or cloud cover rolls in? It's situations like this where the Installed Capacity Market helps to make sure there's enough power to keep the New York energy grid flowing.

What is the NYISO-administered capacity market?

"Installed Capacity" refers to the maximum amount of electricity that a generator has demonstrated it can generate under the expected peak design conditions. The capacity market facilitates the purchase and sale of generating capacity. Through this market, resources are essentially paid to be available when needed.

Capacity is bought and sold through auctions (as well as individual contracts between generators and suppliers). We at the New York Independent System Operator (NYISO) manage the transmission of power across the electric grid in New York. As part of those duties, we operate multiple markets related to reliably running the electricity grid, including the capacity market.

Adhering to reliability criteria is vital for the welfare of all New Yorkers. This is an essential component of the state's economy, the 11th-largest in the world, as well as providing reliability in neighboring regions.

So the primary benefit of the capacity market is to make sure enough power is available to meet peak demand?

Yes. The capacity market is part of our comprehensive market design and planning regime, which strives to meet resource adequacy with the lowest possible cost of wholesale power.

In alignment with the reliability needs of the grid, the capacity market's location-specific price signals inform decisions about investments in new and existing generation supply.

How do the NYISO-administered capacity auctions work?

To maintain reliability, this system must have sufficient capacity to meet the highest levels of demand, no matter how briefly those levels occur.

The capacity market requires Load-Serving Entities (LSEs), such as utilities, to purchase sufficient capacity to meet their peak demand reliably. In a capacity auction, suppliers submit offers to reflect the cost of their available capacity, and LSEs submit bids to purchase it.

Auctions are held in an open and competitive process administered by the NYISO. Price

signals created by these auctions encourage new capacity to enter the market if needed on the grid. These signals also encourage existing suppliers to exit the market if they are unable to beat the clearing price.

How does New York's capacity market differ from those in other regions?

Some other independent system operators/regional transmission organizations in the United States rely on contracts between utilities to ensure enough power to meet demand. In New York, the NYISO's capacity market provides specific rules to maintain reliability. For instance, participating resources must demonstrate the maximum amount of dispatchable generation they can provide when asked, with stiff penalties from non-performance. New York's reliability rules require an annual "reserve margin" to set the bar for how much capacity is procured in the NYISO's market to make sure the system can meet the highest peak demand.

Why is the NYISO re-examining its capacity market now?

For more than a century, the grid was primarily supplied by “dispatchable” generation, meaning grid operators could dispatch the output from these resources in real-time to match changing load conditions. More recently, our market rules have evolved to meet changing public policy objectives and the entry of new energy resources, including renewable resources and energy storage resources.

An increased reliance on intermittent resources, such as solar or wind, will fundamentally change the manner in which the balance between supply and demand is maintained, will require new flexible generation to maintain reliability, and will require changes in how the NYISO manages the grid.

Is the NYISO prepared to make changes to the capacity market?

Yes. We have already started that process including the implementation of new market rules to facilitate the entry and increase the usage of energy storage technologies.

In the past year, we worked with stakeholders to create new, innovative rules for integrating energy storage technology onto the grid, including storage resources that can provide energy to the grid for as little as two hours. The NYISO is currently looking into other ways to enhance our markets, and has outlined its approach through a recent report, entitled The Grid in Transition. The report details a comprehensive approach to redesigning flexible, competitive electricity markets, creating incentives that align with the changing needs of the grid.

A comprehensive examination of our markets is currently underway. The NYISO’s energy market and capacity market work together to meet the reliability needs of New Yorkers in a cost-efficient manner. For instance, we have created a carbon pricing proposal for our energy market that would help grow renewable energy while encouraging less-efficient fossil fuel

plants to close down or upgrade their equipment.

We believe the best way to consider changes to the capacity market and other NYISO markets is through our shared governance process. During this process, stakeholders from all sectors of the energy world get together to discuss changes to our operating rules. Everyone gets a say in this democratic process, including generation owners, utilities, environmentalists, consumers and others.

The Road to 2040: The Path to a Cleaner Grid

The New York energy grid is on a journey. We know the destination (an emission-free grid) and we know when we're supposed to get there (2040). But the road map is yet to be entirely written.

The Climate Leadership and Community Protection Act (CLCPA), enacted by the state in 2019, mandates these changes in the next 20 years. As the manager of the energy grid and the wholesale electric markets, part of our job is to help achieve this goal.

How will we do that? Through such techniques as:

- **Implementing new market mechanisms** that encourage investment in renewables and other technologies that support an emission-free grid while maintaining grid reliability.
- **Producing system planning studies** that model the grid of the future and the changes needed to maintain reliability and support grid efficiency.
- **Preparing for the impacts of a changing climate** on the energy grid.

This blog series will examine in detail the many facets of the Road to 2040, and answer some of the questions raised by the changing grid. For example:

- How will the challenge of maintaining reliability on the grid change over time as more intermittent resources are deployed?
- What emerging technologies could replace fossil fuels to serve load and support reliability?
- What is the role of energy storage, and how can that be combined with renewable resources to make wind and solar power more valuable?
- How can consumers play a bigger role in New York's energy grid by not only purchasing energy, but supplying electricity to other consumers?

Other concepts raised by the CLCPA that are being discussed by policymakers in New York and beyond include:

- **Dispatchable, Emission-Free Resources (DEFRs).** NYISO planning studies recognize the need for resources that can be dispatched on demand to maintain grid reliability. Understanding what emerging clean energy technologies can deliver these flexible services, while complying with the CLCPA, is critical to planning for the transition to clean energy. Technologies being discussed include green hydrogen and renewable natural gas.
- **Hybrid storage** consists of energy storage technology installed with renewable resources. Battery storage located next to solar or wind can improve the efficiency and intermittency of those resources while decreasing construction and interconnection costs, making it more appealing to developers.
- **Upgrades to the energy transmission network** around New York State, which would make more efficient use of renewable resources while reducing the need for fossil-fuel technology.
- **Price-Responsive Demand (PRD),** an emerging market tool that gives consumers a greater role in how they use energy. Under PRD, consumers adjust their energy use in response to power prices. For instance, electric car owners could charge their cars in the middle of the night instead of right after they come home from work, reducing load at a time when energy demand is at its highest, while air conditioning or hot-water systems could be managed differently to store thermal energy and minimize energy consumption during peak periods.
- **Green hydrogen, renewable natural gas, or other "seasonal storage."** This uses excess renewable energy production to produce renewable fuels, which in turn can be stored and used to generate power during higher demand periods.
- **Carbon capture.** This technique calls for capturing and sequestering carbon dioxide produced during the burning of fossil fuels (along with other industrial applications). Carbon capture could be used to allow some fossil fuel generators to continue to operate with few emissions. Today, the fast-ramping nature of fossil fuels generators offer a vital service to help balance fluctuations in the grid.
- **Innovative storage ideas.** It's not just batteries. Energy can be stored with everything from heavy weights to compressed air held underground. We'll discuss some of the ideas being considered, and its viability.