De-Carbonization / DER Report for NYSRC Executive Committee Meeting 1/10/2025

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The January 2025 edition of the De-Carbonization / Distributed Energy Resources (DER) Report includes the following items:

- FERC Proposes to Approve Standards to Protect Grid for Clean Energy Transition
- NERC announced the release of their 2024 Long-Term Reliability Assessment (LTRA)
- U.S. Department of Energy Releases Energy Storage Strategy and Roadmap
- NY Times: The New Climate Gold Rush: Scrubbing Carbon from the Sky
- Washington Post: These (Flow Batteries) Could Harness the Wind and Sun to Replace Coal and Gas
- Snapshots of the NYISO Interconnection Queue and Cluster Queue: Storage / Solar / Wind / Co-located

FERC Proposes to Approve Standards to Protect Grid for Clean Energy Transition

At their December 19th open meeting, FERC proposed to approve the first of an expected suite of new reliability standards to protect the grid (News Release / Docket RM25-3-000 / as the nation makes the transition to expanded use of clean energy technologies. The Notice of Proposed Rulemaking (NOPR) marks the latest in the Commission's series of grid reliability orders pertaining to inverter-based resources (IBRs), issued over the last two years. The NOPR is intended to ensure reliability of the grid by accommodating the rapid integration of new power generation technologies, known as IBRs, that include solar photovoltaic, wind, fuel cell and battery storage resources and comprise a significant portion of new generating capacity projected to come online over the next decade.

The Notice of Proposed Rulemaking is entitled *Reliability Standards for Frequency and Voltage Protection Settings and Ride-Through for Inverter-Based Resources*. In this NOPR, FERC proposes to approve the NERC Reliability Standards PRC-024-4 (Technical Rationale) and PRC-029-1 (Technical Rationale), which address the ability of IBRs to "ride through" frequency and voltage excursions like faults on the transmission system. PRC-029-1 completed development in fall 2024 under Section Rule 321 of the NERC Rules of Procedure.

FERC also seeks more information on exemptions from ride-through requirements for certain legacy inverter-based resources. The Commission seeks to understand the volume of exemptions, the circumstances in which entities have invoked the exemption provision, and ultimately to understand what if any effect the exemption provision has on the efficacy of Reliability Standard PRC-029-1. FERC is requesting two informational filings that provide details of the requested exemptions from generator owners of legacy IBRs for frequency and/or voltage ride-through requirements.

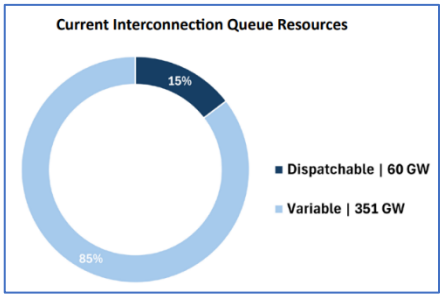
The NOPR covers the first two of a suite of new North American Electric Reliability Corporation (NERC) reliability standards that are intended to comprehensively address IBR data sharing, model validation, planning and operational studies, and performance requirements. The Commission directed NERC to develop the standards over a three-year period in Order No. 901 (RM22-12-000), issued in October 2023. Comments are due 60 days after publication in the Federal Register.

In related reliability action, the Commission accepted NERC's five-year performance assessment, directing NERC to submit a compliance filing within 180 days providing metrics to track development of reliability standards and its compliance monitoring and enforcement program (RR24-4, agenda item E-9).

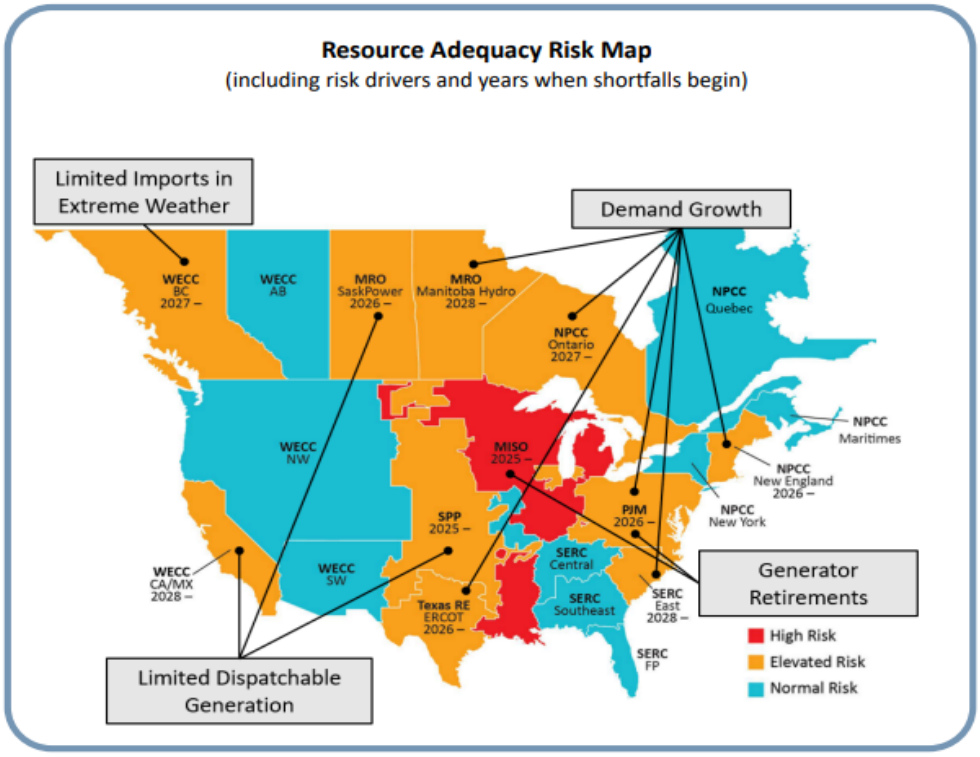
NERC announced the release of their 2024 Long-Term Reliability Assessment (LTRA)

On December 17th, NERC Announced the release of their 2024 Long-Term Reliability Assessment (LTRA), (also see Infographic / Video) which highlights critical reliability challenges that industry is facing over the next ten years. This year's report points to the mounting reliability challenges that industry is facing, including satisfying escalating energy growth, managing generator retirements, and removing barriers to resource and transmission development. As a result, well over half of the continent is at elevated or high risk of energy shortfalls over the next 5 to 10 years. Recommendations to address reliability concerns include managing generator deactivations, enhancing future LTRAs with more expansive energy risks analysis, streamlining siting and permitting, promoting natural gas-electric system coordination, and ensuring essential reliability services are maintained

The report finds that most of the North American Bulk Power System (BPS) faces mounting resource adequacy challenges over the next ten years as surging demand growth continues and thermal generators announce plans for retirement. New solar PV, battery, and hybrid resources continue to flood interconnection queues, but completion rates are lagging behind the need for new generation. Furthermore, the performance of these replacement resources is more variable and weather dependent than the generators they are replacing. As a result, less overall capacity (dispatchable capacity in particular) is being added to the system than what was projected and needed to meet future demand.



In the diagram at right, areas categorized as High Risk (red) fall below established resource adequacy criteria in the next five years. High-risk areas are likely to experience a shortfall in electricity supplies at the peak of an average summer or winter season. Extreme weather, producing wide-area heat waves or deep-freeze events, poses an even greater threat to reliability. Elevated-Risk (yellow) areas meet resource adequacy criteria, but analysis indicates that extreme weather conditions are likely to cause a shortfall in area reserves. Normal-Risk areas (blue) are expected to have sufficient resources under a broad range of assessed conditions.



Highlights for the New York area include:

- Public policies, such as New York state's 2019 Climate Leadership and Community Protection Act (CLCPA), are driving rapid changes in New York's electric system, impacting how electricity is produced, transmitted, and consumed. The transition to a cleaner grid in New York is leading to an electric system that will be increasingly dynamic, decentralized, and reliant on weather-dependent renewable generation.
- Recent assessments reveal that reliability margins are shrinking. Electrification programs are increasing the demand for electricity and placing New York on a trajectory to be a winter-peaking system in the future. Largely in response to public policies, fossil fuel generators are retiring at a faster pace than new renewable supply is entering service. The potential for delays in construction of new supply and transmission, higher than forecasted demand, and extreme weather could threaten reliability and resilience of the New York grid.
- NYISO's reliability studies identified actionable reliability needs starting 2025 in New York City. The reliability need is primarily driven by a combination of forecasted increases in peak demand and the assumed unavailability of certain generation in New York City affected by state legislation and regulations promulgated by the New York State Department of Environmental Conversation, commonly known as the Peaker Rule, to limit emissions. Following a solicitation for proposed solutions to the reliability need, NYISO retained several plants in New York City that would have otherwise been deactivated to comply with the Peaker Rule. The NYISO's 2024 Reliability Needs Assessment (RNA), targeting completion in the fourth quarter of 2024, identifies transmission security violations of reliability criteria primarily driven by a combination of forecasted increases in peak demand, limited additional supply, and the assumed retirement of generation in New York City in response to state law and regulations.
- Driven by public polices, new supply, large loads, and transmission projects are seeking to interconnect to the grid at record levels. NYISO's interconnection process balances developer needs with grid reliability. Efforts are underway to make this process more efficient while protecting grid reliability. New transmission is being built, but more investment is necessary to support the delivery of offshore wind energy and to connect new resources upstate to downstate load centers where demand is greatest. Planning for new transmission to support offshore wind is underway in NYISO's Public Policy Transmission Planning Process.
- To achieve the mandates of the CLCPA, new dispatchable emission-free resources (DEFR) with the necessary reliability services will be needed to replace the capabilities and attributes of today's generation. These types of resources, which can achieve the necessary attributes by a combination of solutions, must be significant in capacity and have attributes similar to traditional generation plants, such as the ability to come on-line quickly, stay on-line for as long as needed, maintain the system's balance and stability, provide ERSs, and adapt to meet rapid, steep ramping needs. Such new emission-free supply is not yet available on a commercial scale.
- New wholesale electricity market rules are supporting the grid in transition. These markets are critical for a reliable transition. Wholesale electricity markets are open to significant investment in wind, solar, and battery storage as well as distributed energy resources. Demand management programs are also under development as a measure to facilitate achievement of CLCPA targets. By lowering the peak load and avoiding system buildout to serve the highest demand hour, fewer DEFRs will be needed and fewer fossil fuel-fired plants will be needed to meet lower peaks during the transition.

U.S. Department of Energy Releases Energy Storage Strategy and Roadmap

On December 20th, the U.S. Department of Energy (DOE) announced the release of its Draft Energy Storage Strategy and Roadmap (SRM), and update to the Energy Storage Grand Challenge (ESGC) Roadmap published in December 2020. This draft Energy Storage SRM updates the ESGC 2020 Roadmap (the original energy storage strategic plan) in consideration of the progress made across the energy storage sector since 2020, as well as to reflect DOE's recent activities in support of its energy storage mission and vision.

The draft Energy Storage SRM represents a significantly expanded strategic revision on the original ESGC 2020 Roadmap. This plan provides strategic direction and identifies key opportunities to optimize DOE's investment in future planning of energy storage research, development, demonstration, and deployment projects.

DOE also issued a Notice of Availability (NOA) in the Federal Register) seeking stakeholder input on the draft and how DOE could advance its energy storage activities to help ensure that the evolving electricity grid can accommodate diverse energy sources, including renewable and nuclear energy, and fossil fuels such as natural gas and coal.

By way of history: In January 2020, DOE launched the Energy Storage Grand Challenge (ESGC) to facilitate a department-wide strategy to accelerate the development, commercialization, and use of next-generation energy storage technologies and sustain American global leadership in energy storage. In December 2020, the DOE released the ESGC Roadmap, the Department's first comprehensive energy storage strategy to develop and domestically manufacture energy storage technologies that can meet all U.S. market demands by 2030.

The draft Energy Storage SRM is structured as follows:

- Section 1 of this SRM presents the mission and vision driving DOE's energy storage activities across various DOE programs and offices. The mission identifies the purpose of DOE's coordinated energy storage efforts while the vision describes the desired end-state for this SRM.

- Section 2 describes the strategic approach and high-level direction for DOE's energy storage research, development, demonstration, and deployment (RDD&D) activities that establishes the blueprint for DOE's energy storage roadmap (Section 5). The roadmap provides more tactical direction, informed by the mission, vision, and strategic approach.

- Section 3 presents an overview of the types of DOE activities that support DOE's Energy Storage SRM. Activities include not only conventional research activities, but also those efforts that are foundational and crosscutting in support of the mission and vision of the SRM as well as stakeholder engagements. Representative activities are identified in the appendix.

- Section 4 describes the portfolio of energy storage technologies and highlights opportunities for future DOE investment based on the current landscape of technologies and use cases.

- Section 5 describes the path forward to achieve the strategic objectives and vision of this Energy Storage SRM. This section highlights DOE activities to facilitate technology innovation and deployment, to empower decision-makers, and to strengthen collaboration throughout the energy storage ecosystem.

- Finally, Section 6 summarizes anticipated outcomes and next steps over the next decade as DOE works to implement this Energy Storage SRM.

NY Times: The New Climate Gold Rush: Scrubbing Carbon from the Sky

This Article describes corporate and national efforts to develop and establish Carbon Scrubbing facilities. As countries around the world continue to pump planet-warming pollution into the skies, driving global temperatures to record levels, the financial world is racing to fund the emerging field of carbon dioxide removal, seeking both an environmental miracle and a financial windfall.

The technology, which did not exist until a few years ago, is still unproven at scale. Yet, it has a uniquely alluring appeal. Stripping away some of the carbon dioxide that is heating up the world makes intuitive sense. And with a small but growing number of companies willing to pay for it, investors are jockeying to be first movers in what they believe will inevitably be a big industry that is necessary to help fight global warming. Companies working on ways to pull carbon dioxide from the air have raised more than $5 billion since 2018, according to the investment bank Jefferies. Before that, there were almost no such investments.

More than 1,000 big companies have pledged to eliminate their carbon emissions over the next few decades. As part of those efforts, more corporations are starting to pay for carbon dioxide removal. This year, Microsoft, Google, and British Airways were among the companies that committed a total of $1.6 billion to purchase removal credits.

That figure was up from less than $1 million in 2019, according to CDR.fyi, a website that tracks the carbon dioxide removal industry. Next year, industry executives believe companies could spend up to $10 billion on such purchases. In a recent report, McKinsey estimated the market could be worth as much as $1.2 trillion by 2050.

While huge sums of money are being dedicated to the nascent field, these projects will not have a meaningful effect on global temperatures anytime soon. There are a few dozen facilities operational today, including ones in Iceland and California. But the biggest of these can capture only a sliver of the greenhouse gases that humans produce in one day. Even if hundreds more such plants were built, they would not come close to counteracting even one percent of annual carbon dioxide emissions.

Instead, many scientists and activists say the most effective way to combat global warming is to rapidly phase out oil, gas and coal, the burning of which is heating the planet.

Below Left: The 1Pointfive Company's "Stratos" carbon capture plant under construction in Ector County, Texas. Commercial operation is expected in mid-2025.

Below Right: The Mammoth Climeworks facility, the largest operational direct air capture facility in the world, in Hellisheidi, Iceland.

Carbon dioxide removal is the most developed form of what is known as geoengineering, a broad set of speculative technologies designed to manipulate natural systems in order to cool the planet. In the past several years, as climate change has worsened, such ideas have moved from the stuff of science fiction into the mainstream.

Other proposed plans include changing the chemistry of the world's rivers and oceans to absorb more carbon dioxide, genetically altering bacteria to reduce greenhouse gas emissions from agriculture, and reflecting sunlight away from Earth by brightening clouds or spraying sulfur dioxide into the stratosphere. But it is carbon dioxide removal that is attracting the big money.

Investors believe that, while the impact on temperatures may be negligible in the short term, the industry will start to make a difference as global emissions fall and the technology becomes more powerful. Decades from now, even if the world is able to completely eliminate all new greenhouse gas emissions, many experts, including the Intergovernmental Panel on Climate Change, a scientific body convened by the United Nations, believe it will still be necessary to remove some carbon dioxide from the atmosphere to reduce global temperatures.

Critics argue that carbon dioxide removal is a dangerous distraction that will perpetuate the behavior that is causing the climate crisis. But for now, neither investors nor customers are shying away. A group of companies including Stripe, H&M, J.P. Morgan, and Meta have banded together to make more than $1 billion in purchase commitments for carbon dioxide removal. Other companies including Airbus, Equinor and Boeing have pledged to pay for the service, too. Some companies are trying to offset their emissions. Some see value in helping to develop a new industry they might one day profit from. And some say they are simply trying to do the right thing.

The U.S. government is supporting the industry. The Inflation Reduction Act more than tripled the tax credit for capturing and storing carbon removed directly from the atmosphere, to $180 per ton. The bipartisan infrastructure law signed by President Biden in 2021 included $3.5 billion for the creation of four demonstration projects.

Executives don't believe that the carbon dioxide removal industry will be knocked off course by President-elect Donald J. Trump, who has called climate policies a "scam" and has said he wants to roll back many of Biden's climate initiatives. Last month, Senator Lisa Murkowski, Republican of Alaska, and Senator Michael Bennet, Democrat of Colorado, introduced legislation that would create additional tax incentives for the carbon dioxide removal industry.

Yet even as enthusiasm for the technology grows, there is not nearly enough supply to meet the demand. Only 4 percent of all purchases have been fulfilled, according to CDR.fyi.

Pulling greenhouse gases out of the air is also expensive. Today, it can cost as much as $1,000 per ton to capture and sequester carbon dioxide. Many analysts say the price would need to drop to around $100 a ton for the industry to take off.

Svante, one of many Canadian companies in the industry, has received more than $570 million from small venture firms as well as big energy companies like Chevron. Climeworks, a Swiss company that has already built the largest operational direct air capture facility in the world in Iceland, has raised more than $800 million from investors including Singapore's sovereign wealth fund and venture capitalists. As with any industry, many start-ups are likely to fail for every one that hits it big. But to investors, that is a risk worth taking.

Washington Post: These (Flow Batteries) Could Harness the Wind and Sun to Replace Coal and Gas

This Article (Guest subscription required) describes flow batteries are making their debut in big real-world projects. The Hokkaido Electric Power Network (HEPCO Network) is deploying flow batteries, a type of battery that stores energy in hulking tanks of metallic liquid. Inside a sprawling two-story warehouse, HEPCO Network is storing electricity in 130 gleaming steel and plastic tanks. They can stockpile enough energy to power more than 27,000 Japanese homes for four hours. Each 10,000-gallon tank holds tiny particles of the metal vanadium, which float around in water. This metallic soup holds the key to hoarding energy in massive quantities.

Sumitomo Electric, the company that built the Hokkaido plant, has also built flow batteries in Taiwan, Belgium, Australia, Morocco, and California. Hokkaido's flow battery farm was the biggest in the world when it opened in April 2022 — a record that lasted just a month before China built one that is eight times bigger and can deliver as much energy as an average U.S. natural gas plant.

Vanadium is a shape-shifter. If you add or remove electrons from its atoms the element's electrical charge will become more positive or negative, and its color changes from purple to green, blue, and yellow. The metal's rainbow color palette led Swedish chemist Nils Gabriel Sefstrom to name the element after Vanadis, the Scandinavian goddess of beauty. Vanadium's ability to change its charge is what makes it so useful in a battery.

All of these tanks are lined up in pairs. One tank holds vanadium with a more positive charge, while the other tank holds vanadium with a more negative charge. Every tank is hooked up to a set of pipes that pump the vanadium into battery cells stacked in cabinets on the second floor. Vanadium flows through each battery cell on either side of a membrane — which is why it's called a flow battery.

Flow batteries are designed to tap giant tanks that can store a lot of energy for a long time. To boost their storage capacity, all you have to do is build a bigger tank and add more vanadium. That's a big advantage: By contrast, there's no easy way to adjust the storage capacity of a lithium-ion battery - if you want more storage, you have to build a whole new battery.

The flow batteries in this plant are designed to store energy for about four hours of use, which is on par with lithium-ion batteries. But Sumitomo Electric says it expects future projects will aim to double that duration to eight to 10 hours. That's about what they'd need to last overnight when solar panels are dormant, or to fill in the gaps between gusts of wind.

One major barrier to building more of these battery farms is finding enough vanadium. Three-quarters of the world's supply comes as a by-product from 10 steel mills in China and Russia. Australia, South Africa, and the United States also produce vanadium, but in much smaller quantities. Mines that have been proposed could boost supply. And some flow battery start-ups are trying to sidestep the vanadium problem entirely by using different materials that are easier to buy. The other hurdle is their up-front cost. Vanadium flow batteries are at least twice as expensive to build as lithium-ion batteries, Rodby said, and banks are hesitant to lend money to fund an unfamiliar technology.

But experts say flow batteries can be cheaper in the long run because they're easier to maintain and last longer. "A lithium-ion battery might have to be replaced after 10 years, but there really is no finite lifetime for a flow battery in the way there is for lithium-ion," said Kara Rodby, a battery analyst at the investment firm Volta Energy Technologies. Sumitomo Electric President Osamu Inoue said his company guarantees its flow batteries will last 20 years, but the vanadium inside can be reused forever in future batteries. The company's oldest commercial batteries have been running for 11 years so far.

Just outside the building that houses the gleaming floor-to-ceiling tanks, Sumitomo has built a new version of its flow batteries, this time tucking all of their components into shipping containers. That makes them faster and cheaper to build than the $100 million indoor demonstration plant next door.

Having a stable grid allows Hokkaido to keep building more renewable energy, bringing it closer to its goal of cutting power plant emissions to zero by 2050. The flow batteries sitting in the shipping containers outside Sapporo paved the way for HEPCO Network to add 15 new wind farms around Hokkaido. The turbines generate about 3 percent of the island's electricity without pollution.

Experts say the world will need to build many more batteries like these to stay on track to cut greenhouse emissions to zero by 2050. Over the next six years, utilities will have to build 35 times as many batteries as there are today to soak up all extra renewable energy that will come online, according to the International Energy Agency.

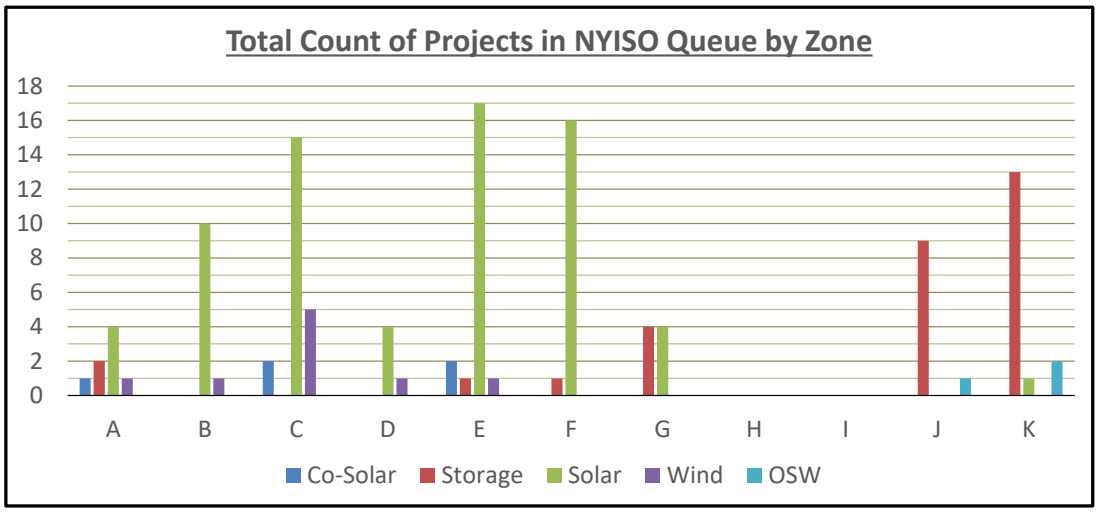
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

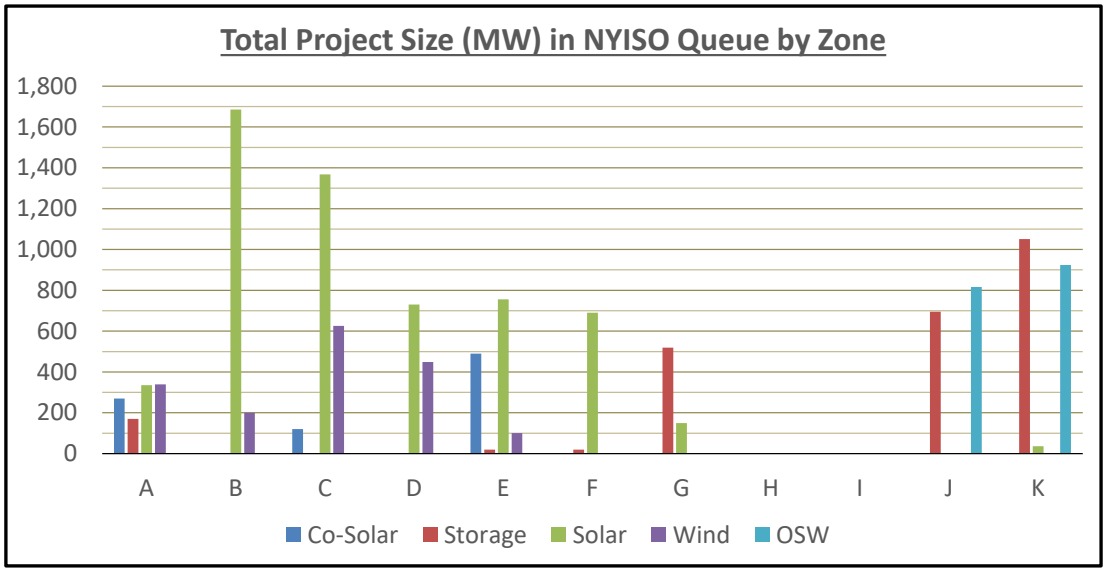
The intent is to track the growth of Co-Located Solar / Storage, Energy Storage, Solar, Wind, and Offshore Wind (OSW) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on December 20th, and representing the Interconnection Queue as of November 30th. Note that only one project was added, and 15 were withdrawn during the month of November.

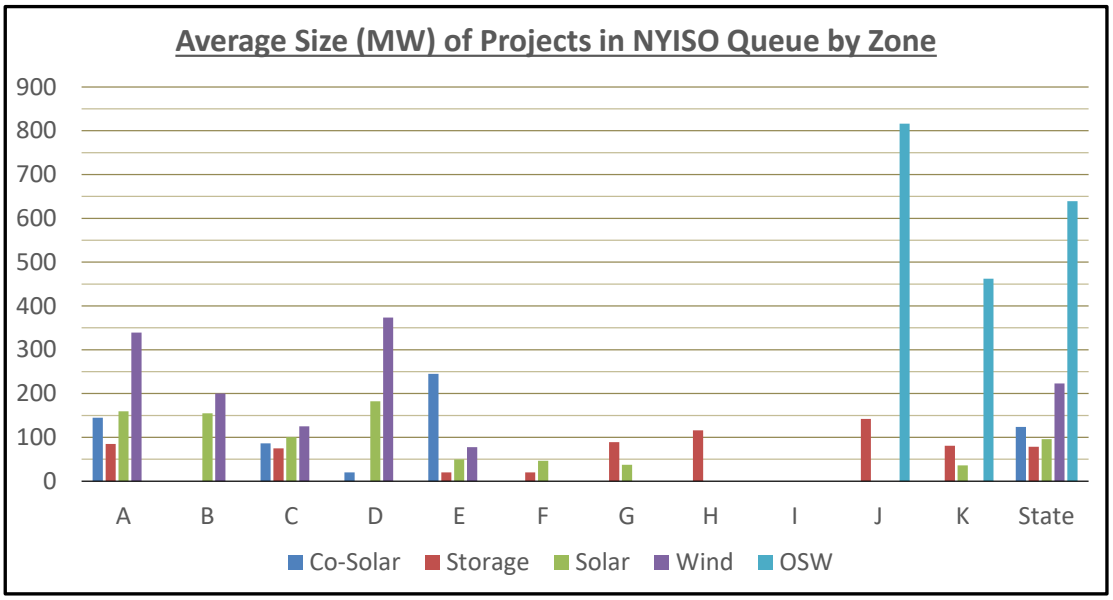
Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	1	2	4	1	
B			10	1	
C	2		15	5	
D			4	1	
E	2	1	17	1	
F		1	16		
G		4	4		
H					
I					
J		9			1
K		13	1		2
State	5	30	71	9	3

Total Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	270	170	335	339	
B			1,685	200	
C	120		1,368	626	
D			730	449	
E	490	20	756	101	
F		20	691		
G		519	150		
H					
I					
J		695			816
K		1,051	36		924
State	880	2,475	5,750	1,715	1,740

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	270	85	84	339	
B			169	200	
C	60		91	125	
D			183	449	
E	245	20	44	101	
F		20	43		
G		130	38		
H					
I					
J		77			816
K		81	36		462
State	176	82	81	191	580


Total Count of Projects in NYISO Queue by Zone
18
16
14
12
10
8
6
4
2
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Storage
Solar
Wind
OSW


Total Project Size (MW) in NYISO Queue by Zone
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Storage
Solar
Wind
OSW


Average Size (MW) of Projects in NYISO Queue by Zone
900
800
700
600
500
400
300
200
100
0
A
B
C
D
E
F
G
H
I
J
K
State
Co-Solar
Storage
Solar
Wind
OSW

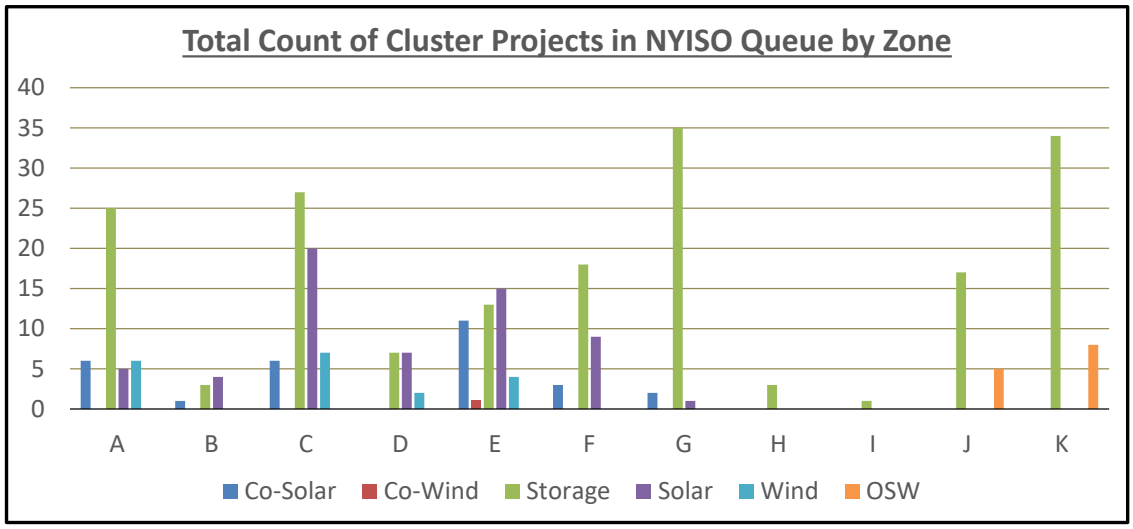
Cluster Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

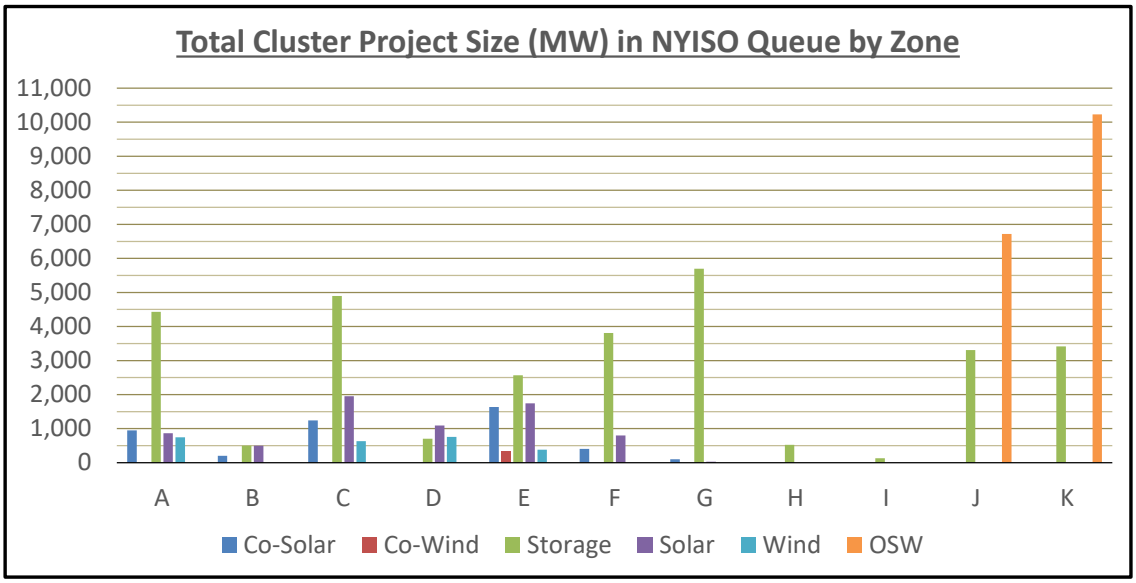
The intent is to track the growth of the Cluster-based projects, including Co-Located Solar and Wind / Storage, Energy Storage, Solar, Wind, and Offshore Wind (OSW) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on December 20th, and representing the Interconnection Queue as of November 30th. Note that in the Cluster Queue, there are currently 309 projects, totaling 62,604 MW. A total of 67 projects totaling 14,323 MW are listed as having withdrawn.

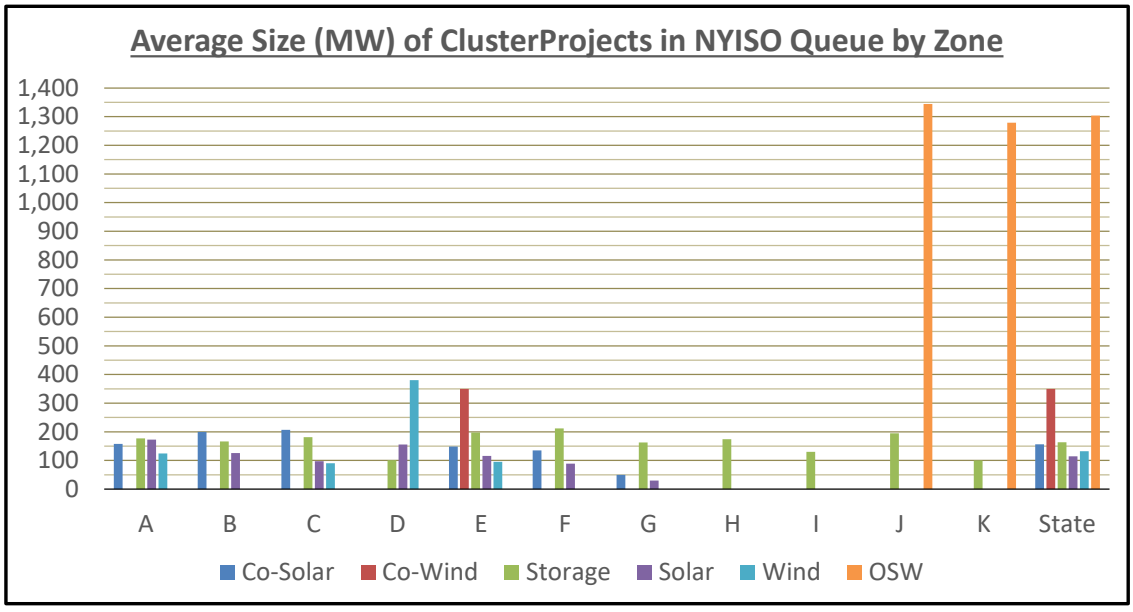
Total Count of Projects in NYISO Cluster Queue by Zone						
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind	OSW
A	6		25	5	6	
B	1		3	4		
C	6		27	20	7	
D			7	7	2	
E	11	1	13	15	4	
F	3		18	9		
G	2		35	1		
H			3			
I			1			
J			17			5
K			34			8
State	29	1	183	61	19	13

Total Project Size (MW) in NYISO Cluster Queue by Zone						
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind	OSW
A	947		4,428	865	746	
B	200		500	503		
C	1,240		4,897	1,954	633	
D			705	1,090	760	
E	1,638	350	2,569	1,742	380	
F	405		3,809	797		
G	99		5,695	30		
H			524			
I			130			
J			3,309			6,720
K			3,417			10,230
State	4,528	350	29,982	6,981	2,519	16,950

Average Size (MW) of Projects in NYISO Cluster Queue by Zone						
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind	OSW
A	158		177	173	124	
B	200		167	126		
C	207		181	98	90	
D			101	156	380	
E	149	350	198	116	95	
F	135		212	89		
G	50		163	30		
H			175			
I			130			
J			195			1,344
K			101			1,279
State	156	350	164	114	133	1,304


Total Count of Cluster Projects in NYISO Queue by Zone
40
35
30
25
20
15
10
5
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Co-Wind
Storage
Solar
Wind
OSW


Total Cluster Project Size (MW) in NYISO Queue by Zone
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Co-Wind
Storage
Solar
Wind
OSW


Average Size (MW) of ClusterProjects in NYISO Queue by Zone
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
A
B
C
D
E
F
G
H
I
J
K
State
Co-Solar
Co-Wind
Storage
Solar
Wind
OSW