De-Carbonization / DER Report for NYSRC Executive Committee Meeting 5/9/2025

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

- Energy Storage News: American Clean Power Report Recommends Energy Storage-Friendly Market Reforms to US Grid Operators
- NY Times: Here's What to Know About Rare Earth Minerals and Renewable Energy
- NY Times: Building the World's Biggest Plane to Help Catch the Wind
- Marine Technology News: Japan's First Megawatt-Scale Tidal Energy Turbine Hits Water
- Snapshots of the NYISO Interconnection Queue and Cluster Queue: Storage / Solar / Wind / Co-located

Energy Storage News:

American Clean Power Report Recommends Energy Storage-Friendly Market Reforms to US Grid Operators

This Article recounts how the clean energy trade body American Clean Power Association (ACP) has released a Report on Energy Storage Market Reforms for regional grid operators based on findings from the Brattle Group. The report covers various topics, including reforms targeted specifically towards the PJM interconnection, Midcontinent Independent System Operator (MISO) and the New York Independent System Operator (NYISO). The "Energy Storage Market Reform Roadmap" looks to the examples of the Electric Reliability Council of Texas (ERCOT) and California Independent System Operator (CAISO). The 84-page Full Analysis can be found here.

During the summer of 2024, Texas saw a historic electricity demand, and energy storage resources saved residents more than $700 million while keeping the power on. In California, energy storage reduced the risk of blackouts and brownouts, and the report notes its role in preventing a grid failure in 2022. Brattle says that energy markets, which have evolved to incorporate more energy storage, are seeing a myriad of benefits from the decision. Three key markets that could benefit from further incorporating energy storage are shown below:

PJM Reforms

According to Brattle, while storage can participate in PJM's capacity, energy and ancillary services markets, outdated rules keep it from competing on a level playing field. The current rules are designed for traditional generation assets and fail to factor in the opportunity cost of using energy or saving it for a higher-value period. Opportunity cost is the value of the best alternative use of a forfeited resource.

Brattle says that updating these rules are key for energy storage in PJM. This could be done through the concept of 'opportunity cost bidding' reform. This would involve enabling energy storage to include opportunity costs in its bids, which Brattle says would improve market efficiency in five key ways:

- Increased Reliability
- Optimized Dispatch
- Enhanced Market Efficiency
- Greater Flexibility
- Revenue Clarity

The 'Day-Ahead Uncertainty Product' would be a market tool that ensures sufficient availability to meet forecasted net demand. The tool includes a margin for uncertainty, and Brattle says it would benefit the grid overall by providing needed availability at a lower cost. PJM also lacks ramping products that can meet real-time flexibility needs. The group points to RTOs MISO, CAISO and SPP, which have implemented ramping products to better manage fluctuations and create a more resilient grid. Not including ramping products can lead to price volatility, higher uplift costs and an overall less efficient grid.

MISO Reforms

MISO is seeing a rising electricity demand that Brattle believes can be helped with energy storage. The Brattle Group says in the report that MISO's annual and peak load is expected to grow an annual 50GWh and 9GW by 2030. Michigan is planning to build approximately 2.5GW of storage by 2030, and Illinois is looking to target up to 15GW of storage over the next decade. Still, the region as a whole does lag in deployments when compared to others.

According to the report:
Since 2019, US energy storage deployment has grown 25x with almost 29GWs now connected to the grid, representing enough capacity to cumulatively power 22 million homes. In 2024, energy storage was the second most deployed resource, yet MISO lags other regional electric grids because of outdated market rules and restrictive modelling practices.

MISO is currently working to reform its Direct Loss of Load (DLOL) methodology and Loss of Load Expectation (LOLE) modelling. Reforms to the DLOL methodology aim to introduce a probabilistic analysis that evaluates resource performance during high-risk periods rather than averaging risks across a year. The LOLE metric estimates the probability of power shortfalls over an entire year. The report claims that the LOLE metric does not fully capture the impact of weather-driven variability, renewables, and demand shifts. It also claims that the DLOL methodology does not fully capture the true reliability contributions of energy storage. The report clarifies that MISO can better model and support energy storage deployment using an energy equity or capacity equity approach, as illustrated in the graphic below. This approach more accurately reflects the real-world performance of storage resources, enhancing grid resilience by aligning planning and resource adequacy requirements with actual system conditions.

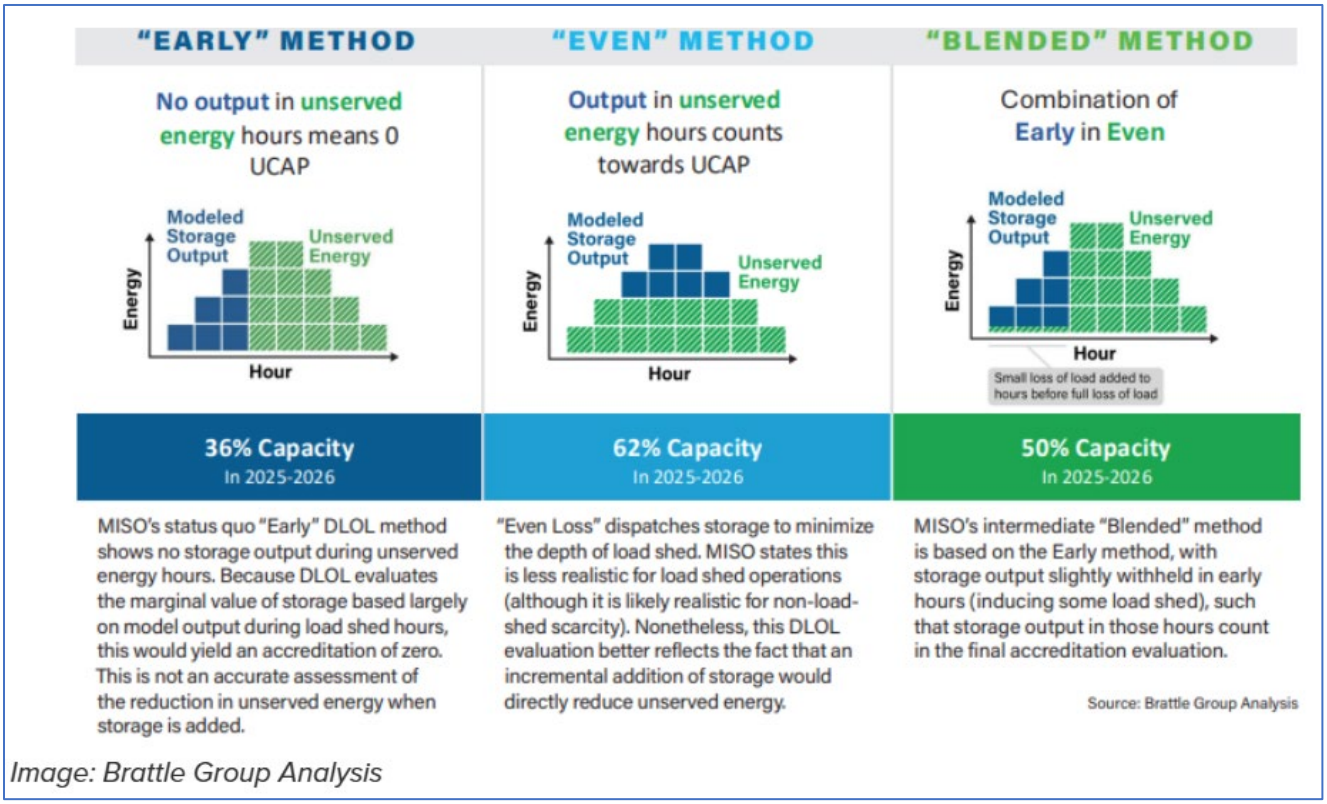


Image: Brattle Group Analysis

NYISO Reforms

NYISO's annual and peak load is expected to grow an additional 12GWh and 1GW by 2030. Like PJM, though, the region's market structures and rules were designed for traditional generation assets, creating barriers for energy storage. In NYISO, Brattle also recommends 'Day Ahead Uncertainty' and 'Ramp & Uncertainty' products.

New York State has set an ambitious goal to deploy 6 GW of energy storage by 2030, a cornerstone of its clean energy agenda. To support this objective, the state developed the Energy Storage Roadmap, outlining strategies to expand storage capacity and remove deployment barriers. New York introduced several programs, including tolling agreements, index credits, and other incentives to create stable revenue streams for storage projects, enabling their participation in capacity markets and grid services.

Collectively, these programs aim to accelerate storage deployment, strengthen grid resilience, and facilitate greater renewable energy integration. NYSERDA reports that deploying energy storage in the state could generate over 30,000 jobs and deliver approximately $2 billion in energy cost savings for businesses and families.

A 'Day Ahead Uncertainty' product would ensure sufficient resources are available on the next day to meet net demand forecasts and include a margin for uncertainty. By providing needed availability at lower cost, storage enhances the overall efficiency of the generation fleet, reduces excessive cycling of baseload fossil generators, reduces unneeded renewables curtailment, and ensures grid stability during periods of high demand.

The Ramp & Uncertainty product would be designed to manage fast, short-term fluctuations in net load. By quickly responding to short-term load changes, storage reduces reliance on slower, less flexible resources, ensuring the grid remains stable. This prevents inefficient cycling and ultimately reduces excessive renewable curtailment, improving efficiency.

Recommended Enhancements for the NYISO Current Design:

Increase Operating Reserve Demand Curve Maximum Value Above the Current $750/MWh Threshold to reflect system value in scarcity conditions and ensure price signals incentivize resource availability.

Comprehensively address the need for availability to meet day-ahead forecasts for net demand, by addressing the "physical energy gap" between cleared day-ahead physical supply and forecasted demand (due to insufficient purchases and/or virtual supply) either through procurement of additional 30-minute reserves, or via the NYISO-proposed 60-minute capability and 4-hr duration reserve product to more cost effectively meet system needs.

Include expected ramp in market procurement. While these reliability needs are already met through NYISO's multi-interval dispatch, they are not necessarily appropriately priced and can lead to the need for out-of-market payments and insufficient incentive for flexibility.

Increase Demand Curve Maximum Value Above the Current $40/MWh Threshold demand curve to reflect high system value of incremental reserves during times of high up-ramps (which will deplete available reserves in subsequent intervals).

NY Times: Here's What to Know About Rare Earth Minerals and Renewable Energy

This New York Times Article explains that for the world is to succeed in its efforts to slow global warming, it will need a suite of other rare earth elements and minerals that many of us first heard about recently when China announced export controls that would effectively cut off the global supply of seven rare earths. China's export ban, part of the country's retaliation for President Trump's steep new tariffs, has exposed the extent to which the global energy transition depends on raw materials produced by China. It's not just rare earths. China supplies more than half of the 50 minerals the U.S. government has deemed critical to national security and the economy. Among those critical minerals are lithium, cobalt and nickel, components of the rechargeable batteries that power electric vehicles and store energy on the grid when the weather is unfavorable for wind and solar generation. China refines or mines significant portions of the world's supply of all three, and Chinese companies have acquired major stakes in mineral-rich countries: nickel in Indonesia, cobalt in the Democratic Republic of Congo, lithium in Zimbabwe.

"China's influence over critical mineral supply chains is far greater than trade data alone suggests," said Krista Rasmussen, director of natural resource security at C4ADS, a research organization based in Washington that has traced Chinese companies hidden ownership of Indonesian nickel refineries. "Chinese firms exert substantial control across nearly every stage of the supply chain."

Some critical minerals are far more abundant than rare earths, and American mining companies have been engaged for years in extracting them domestically and around the world, though at a fraction of the scale of Chinese companies. Mr. Trump has sought to increase American access to certain critical minerals through deals with Ukraine and Congo, and there are deposits in Canada and Greenland.

Rare earths, on the other hand, have narrower supply chains and are often more difficult to extract, requiring more cumbersome processes to separate them from other minerals. The United States has just one operational rare earth mine, in Mountain Pass, Calif., which produces around 15 percent of global rare earths.

China's rare earths export ban applies to all countries, not just the United States, meaning the U.S. will be unable to acquire the banned commodities through intermediaries. U.S. companies have stockpiled rare earth inventories that can tide them over, but they will not last forever, said Pavel Molchanov, an analyst at Raymond James who specializes in the mineral trade. "If we are still having this conversation six-plus months from now, that's when we would begin to get worried about physical shortages," Molchanov said, "but not right now."

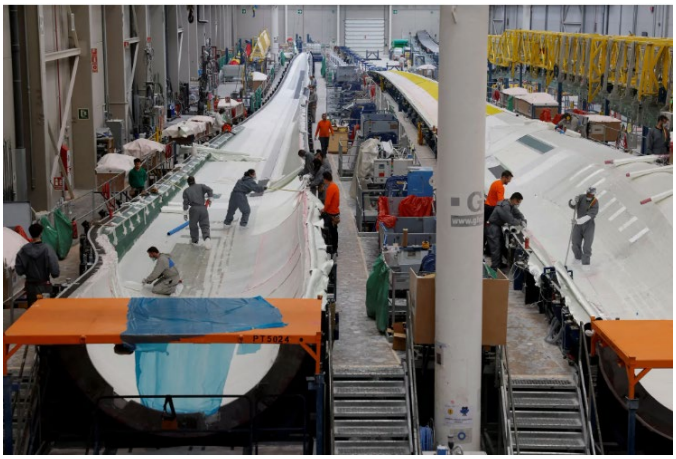
Right: A rare earth mine in the Inner Mongolian Autonomous Region of China.

NY Times: Building the World's Biggest Plane to Help Catch the Wind

This New York Times Article describes how Radia, a Colorado-based company, wants to build enormous aircraft to transport giant wind turbine blades. For almost a decade, Radia, a company based in Boulder, Colo., has been working on the development of the world's largest plane, one that it said would have a dozen times the cargo volume of a Boeing 747. Radia's WindRunner aircraft would solve a crucial problem for the wind power industry. Giant wind turbine blades are more efficient, but often can't be easily shipped across aging roads and bridges. Radia's goal is for the WindRunner to be rolled out before the end of the decade.

Below Left: A rendering of the Radia WindRunner aircraft, with its front open as a large white wind turbine is being placed into its cargo bay. Once built, it would transport large wind turbine blades directly to wind power sites.

Below right: Workers build wind turbine blades at the Nordex blades factory in Lumbier, Spain. The size of wind turbine blades is expected to increase in the coming years, according to Radia



Mark Lundstrom, Radia's chief executive officer has stated that the biggest wind turbines allow wind projects to generate energy more consistently. "Larger wind turbines have a key advantage: They can operate at lower speeds and, as a result, can be deployed in more areas across the country" Lundstrom said. "Longer blades can also catch more wind. The entire country benefits from cheaper energy. This includes a number of red states that could disproportionately benefit from wind power. Moving larger wind turbines is so tough that some developers have had to build roads specifically for wind projects. The tunnels are too narrow, the bridges are too low, and the roads can be too tight to make turns when transporting these massive parts. To help with this, the WindRunner would have the ability to land on dirt."

The wind industry faces other issues, too. Developers could be constrained by the availability of construction cranes big enough to build very large turbines, said Stephen Maldonado, a wind energy research analyst at Wood Mackenzie, a research firm. Bigger turbines could also further incite local opposition to wind energy. "At the end of the day, I think building bigger only works if you're able to build it at all," Maldonado said.

And that size problem is also expected to only get worse: Some wind turbine blades today can span around 230 feet, but they're expected to grow to more than 330 feet in the coming years, according to Radia. Outside of the wind industry, the plane could also be used to aid the military or other businesses that could now start thinking truly big. "There's an entire other classification of big things that have not yet been invented," Lundstrom said, "because the engineers of the world, and the product development people of the world, don't even try to invent bigger things if they know that they can never be transported."

Marine Technology News: Japan's First Megawatt-Scale Tidal Energy Turbine Hits Water

This Article recounts how Proteus Marine Renewables (PMR) has deployed the AR1100 tidal turbine in Japan, which became the country's first ever megawatt-scale grid connected tidal energy system. Installed in the Naru Strait, the turbine will generate 1.1 MW of clean energy, accelerating the decarbonization of the Goto Islands' electricity supply and advancing Japan's renewable energy transition.

Building on the success of the AR500 pilot project in 2021, where a 500 kW device operated in the Naru Strait maintaining a 97% turbine availability, Proteus signed an equipment supply and works contract with Kyuden Mirai Energy (KME) in November 2022 to upgrade the device to 1.1 MW capacity. Leveraging its modular architecture, Proteus enhanced its existing turbine's performance and efficiency by integrating advanced pitch and yaw systems, along with other improvements to achieve a 1.1 MW rating.

The AR1100 tidal turbine features a horizontal-axis rotor with three advanced composite blades, designed for optimal efficiency in tidal currents. The blade angles are independently controlled by electromechanical pitch systems housed in the turbine hub, allowing real-time control for maximum energy capture while minimizing hydrodynamic loads. The device incorporates a drivetrain which transmits the mechanical power extracted at the rotor through to a permanent magnet generator. A state of the art electrically actuated, hydraulic locking yaw mechanism is used to rotate the nacelle so that the rotor faces the oncoming tidal flow as it reverses direction four times a day. The tidal turbine is mounted on a gravity-based support structure and connected to shore via a subsea cable, transmitting power directly to an onshore station, where it is converted for grid distribution.

Related Article: Offshore Energy: MayGen Tidal Turbine Delivers Highest-Ever Output Since Installation

PMR has also confirmed that the AR1500 tidal turbine deployed at the MeyGen site in Scotland exported 372 MWh of electricity in March 2025, marking the turbine's highest monthly output since it began operations in 2017. According to PMR, the turbine achieved an average availability of 95% across the first quarter of 2025.

While Series-2 units, including the AR3000, are in development, the continued output from the 2017-installed Series-1 AR1500 demonstrates the long-term potential of tidal technology in contributing to the renewable energy mix, PMR noted. The AR1500 is an active pitch, full yaw, horizontal axis tidal turbine with a rated power output of 1.5 MW achieved at flow rates of three meters per second. While Series-2 units, including the AR3000, are in development, the continued output from the 2017-installed Series-1 AR1500 demonstrates the long-term potential of tidal technology in contributing to the renewable energy mix, PMR noted.

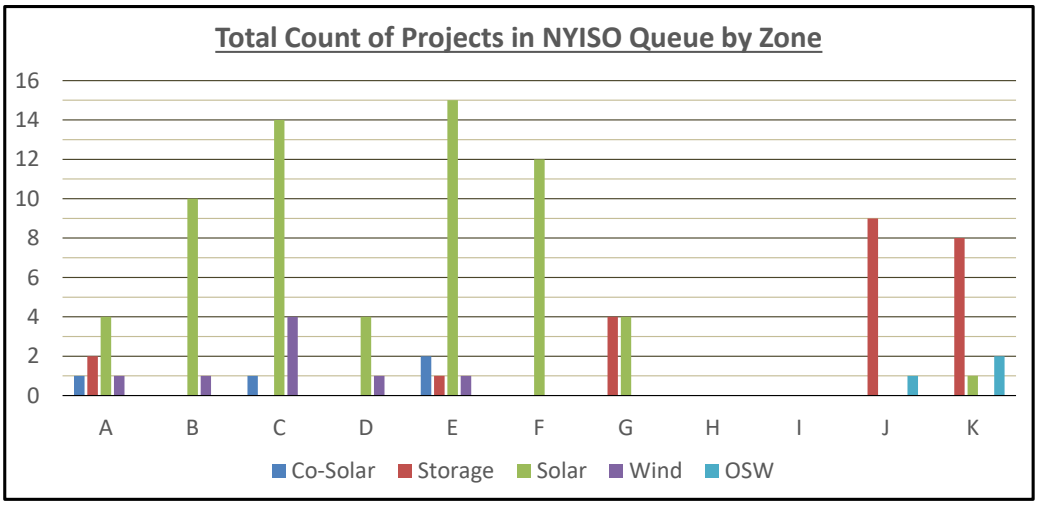
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

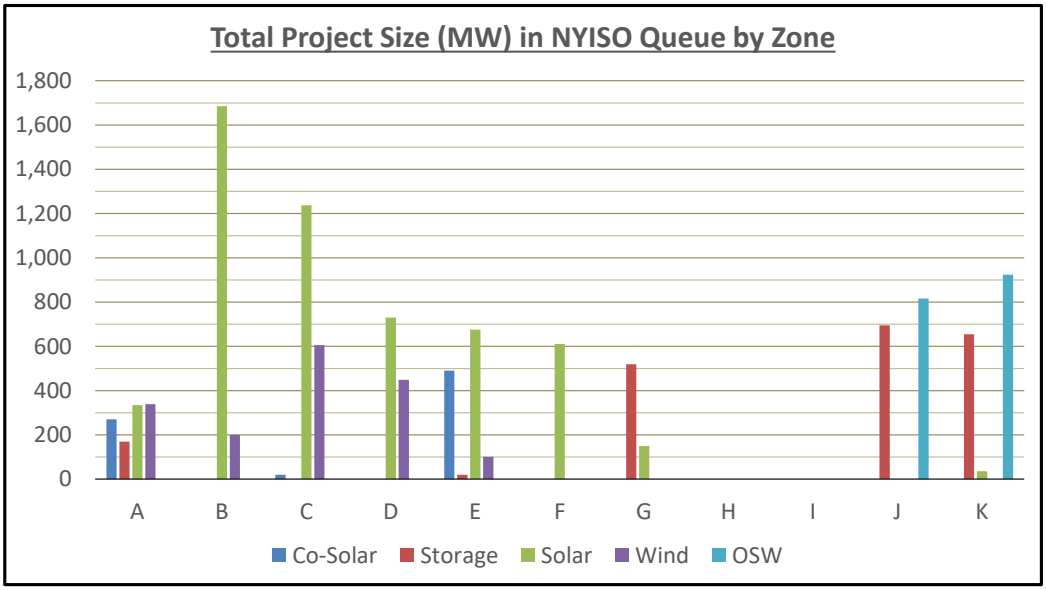
The intent is to track the growth of Co-Located Solar / Storage, Energy Storage, Solar, Wind, and Offshore Wind (OSW) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on April 17th, and representing the Interconnection Queue as of March 31st. Note that six projects were added, and 14 were withdrawn during the month of March.

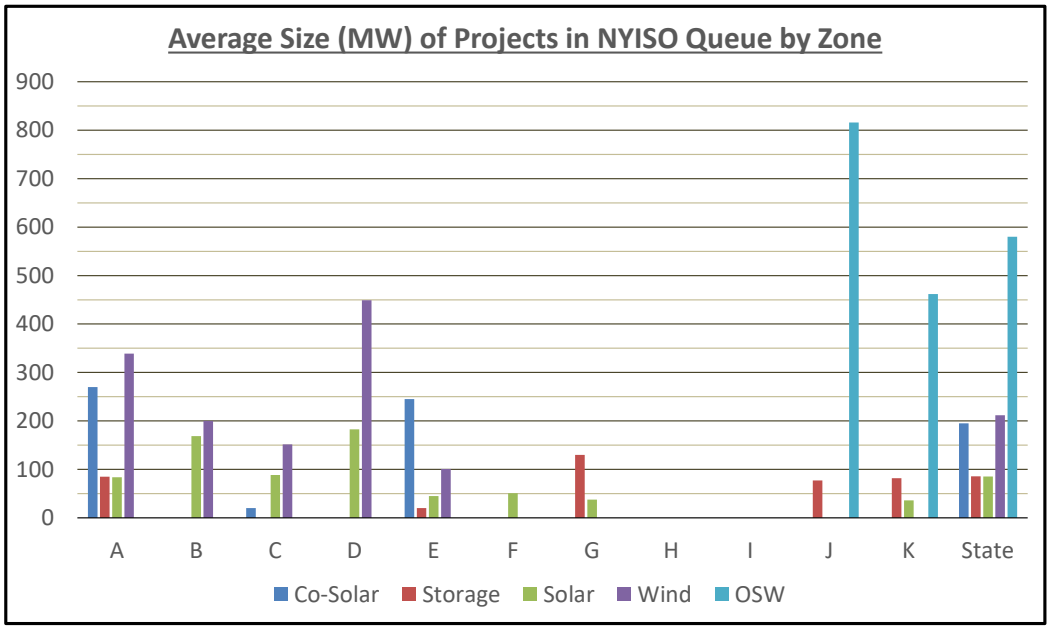
Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	1	2	4	1	
B			10	1	
C	1		14	4	
D			4	1	
E	2	1	15	1	
F			12		
G		4	4		
H					
I					
J		9			1
K		8	1		2
State	4	24	64	8	3

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	20		1,238	606	
D			730	449	
E	490	20	676	101	
F			611		
G		519	150		
H					
I					
J		695			816
K		655	36		924
State	780	2,059	5,461	1,695	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	20		88	151	
D			183	449	
E	245	20	45	101	
F			51		
G		130	38		
H					
I					
J		77			816
K		82	36		462
Grand Total	195	86	85	212	580


Total Count of Projects in NYISO Queue by Zone
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)

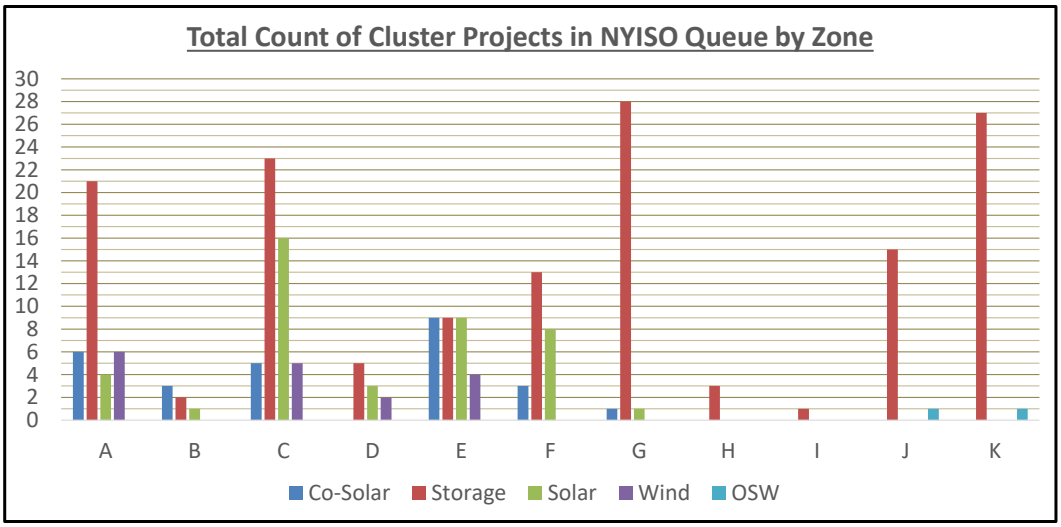
The intent is to track the growth of the Cluster-based projects, including Co-Located Solar and Wind / Storage, Energy Storage, Solar, Wind, and Offshore Wind (OSW) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on April 18th.

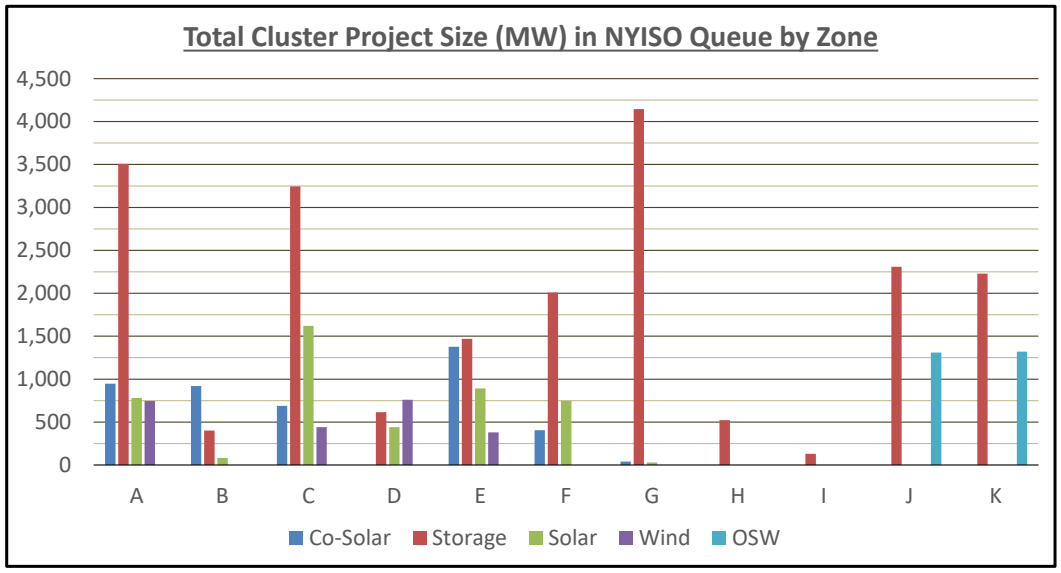
Note that within the Cluster Queue, there are currently 238 projects totaling 34,513 MW. This represents a drop of 5 projects, totaling 2,730 MW from the previous month. A total of 133 projects representing 40,970 MW are listed as having been withdrawn to date.

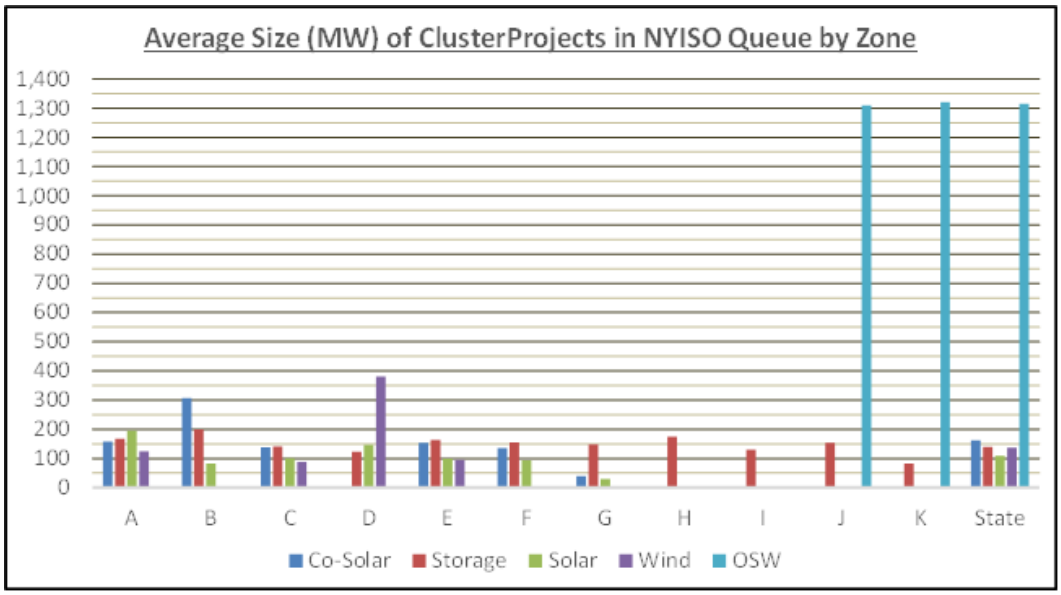
Total Count of Cluster Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	6	21	4	6	
B	3	2	1		
C	5	23	16	5	
D		5	3	2	
E	9	9	9	4	
F	3	13	8		
G	1	28	1		
H		3			
I		1			
J		15			1
K		27			1
State	27	147	42	17	2

Total Cluster Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	947	3,508	780	746	
B	920	400	83		
C	690	3,245	1,621	442	
D		615	440	760	
E	1,378	1,469	893	380	
F	405	2,009	747		
G	40	4,146	30		
H		524			
I		130			
J		2,309			1,310
K		2,228			1,321
State	4,379	20,582	4,593	2,328	2,631

Average Size (MW) Cluster Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	158	167	195	124	
B	307	200	83		
C	138	141	101	88	
D		123	147	380	
E	153	163	99	95	
F	135	155	93		
G	40	148	30		
H		175			
I		130			
J		154			1,310
K		83			1,321
State	162	140	109	137	1,316


Total Count of Cluster Projects in NYISO Queue by Zone
30
28
26
24
22
20
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 Cluster Project Size (MW) in NYISO Queue by Zone
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
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
Storage
Solar
Wind
OSW