De-Carbonization / DER Report for NYSRC Executive Committee Meeting 8/9/2024

Contact: Matt Koenig (koenigm@coned.com)

The August 2024 edition of the De-Carbonization / Distributed Energy Resources (DER) Report includes the following items:

- NYISO Study Identifies Opportunities for Future Grid Investment
- Governor Hochul Announces Long-Duration Energy Storage Demo Using Fire-Safe Battery Technology
- NY Times: A Giant Offshore Wind Turbine Blade Breaks, Prompting Beach Closures
- EPRI Launches Effort to Accelerate Deployment of Grid-Enhancing Technologies (GETs)
- Renewable Energy World: The Shift to Grid-Forming Inverters is Underway. Here's What to Know
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located

NYISO Study Identifies Opportunities for Future Grid Investment

On July 25th, the New York Independent System Operator (NYISO) Announced the publication of the report entitled 2023-2042 System & Resource Outlook (The Outlook), which provides a wide-ranging assessment of future transmission and generation investment opportunities driven by economics and public policy.

Electricity demand is expected to increase by 50% - 90% over the study horizon, driven by electrification of housing and transportation sectors, and energy-intensive economic development projects. The report highlights that while historic levels of investment in the transmission system have been made, more is necessary to achieve public policy mandates. Additional voltage support facilities must also be added to the grid in upstate New York to fully employ the transmission facilities already in place, the study finds. Opportunities for further transmission investment in Western and Northern New York should be monitored as generation is developed in those regions.

The report examines a wide range of potential future system conditions and compares possible pathways to an increasingly greener resource mix. By simulating several possible future system configurations and forecasting the transmission constraints for each, the NYISO:

- Postulates possible resource mixes that achieve New York's public policy mandates, while maintaining reserve margins, and capacity requirements
- Identifies regions of New York where renewable or other resources may be unable to generate at their full capability due to transmission constraints
- Quantifies the extent to which these transmission constraints limit delivery of renewable energy to consumers
- Highlights potential opportunities for transmission investment that may provide economic, policy, and/or operational benefits

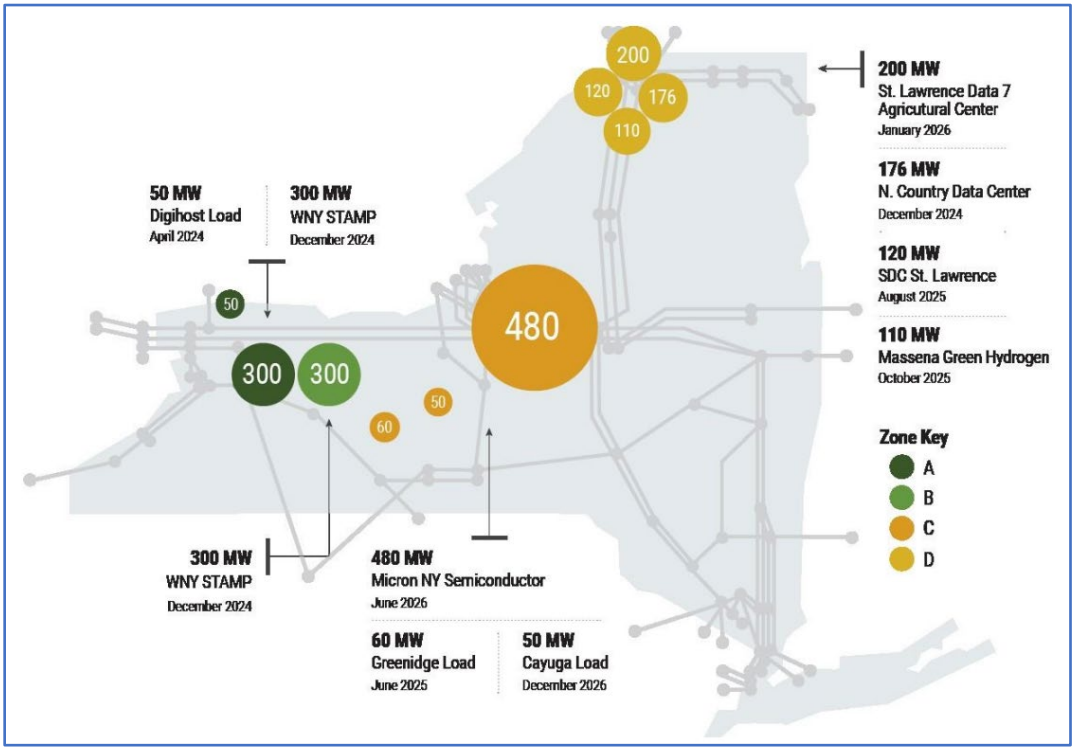
The report also finds that between 100 and 130 gigawatts (GW) of installed capacity will be needed to reliably meet forecasts in increased demand while also meeting the state's energy policy mandates. Of that total, at least 20 GW of dispatchable emission-free resources (DEFR) will be needed by 2040 to replace the current 25.3 GW of conventional fossil-based generation.

The report notes that future DEFR technologies could include (but are not limited to), long-duration batteries, small modular nuclear reactors, hydrogen-powered generators, and fuel cells. No DEFR technology is currently available at a commercial scale. It also notes that research, development, and construction lead times of DEFRs may extend beyond the state policy timelines, which may require existing generation to remain in operation to maintain system reliability.

Key Findings:

Demand:

- Electric energy consumption is projected to increase significantly in response to the economic development and decarbonization energy policies. The resources and transmission system necessary to meet the changing energy demand needs to evolve accordingly.
- Siting large loads in electrical proximity to renewable resources, or siting resources near large loads, may benefit both the loads and the resources, particularly if located upstream of known constraints.



Resources:

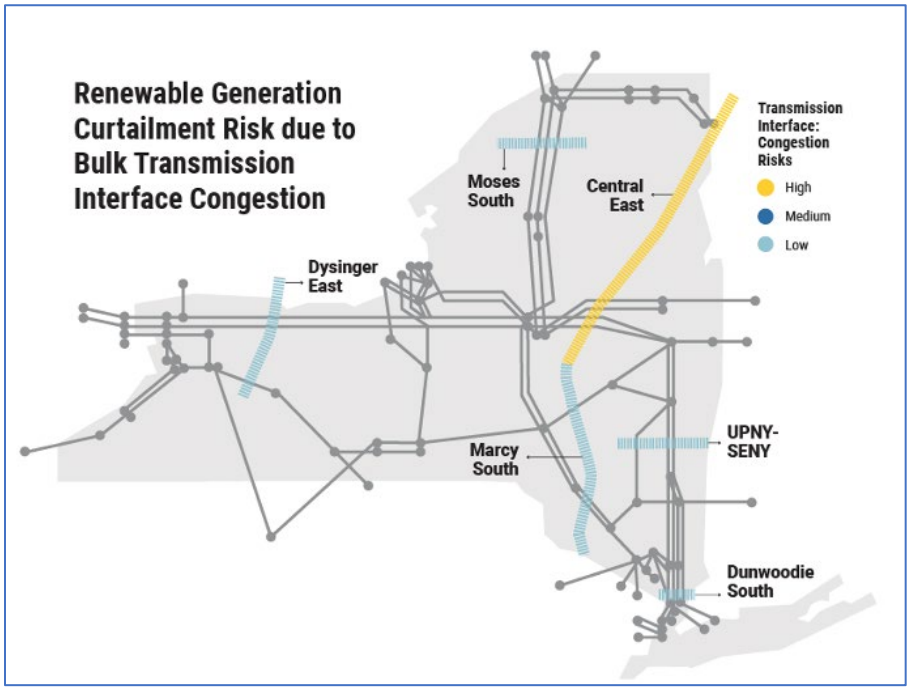
- Dispatchable emission-free resources must be developed to provide the capacity, energy, and other essential grid services required to achieve the policy mandate for a zero-emissions grid by 2040.
- New York will require three times the capacity of the current New York generation fleet to meet projected future electricity demands.
- The coordination of new generator additions and existing generator retirements is essential to maintain the reliability of the New York power system while simultaneously pursuing achievement of CLCPA.
- Uncertainty in siting new renewable generation could lead to delays in or inefficient expansion of the transmission and distribution systems.

Transmission:

- Historic levels of investment in the transmission system are happening but more will be needed.
- Actionable expansion opportunities: Additional dynamic reactive power support must be added to the grid in upstate New York to alleviate congestion and fully utilize the transmission capability of the Central East interface
- Opportunities for further transmission investment in Western and Northern New York should be monitored as resources are developed in those regions
- Planning energy exchange with neighboring systems is becoming more complex and will be increasingly so in the future as each system transitions to more decarbonized systems

Recommendations and Observations:

- Transmission constraints are no longer a major impediment to achievement of the 70% renewable energy by 2030 (70x30) policy mandate as recent transmission and distribution projects facilitate high energy deliverability of renewables. The timely construction of the identified transmission projects to enable the integration of renewable energy resources by 2030 is vital to the policy's achievement.



- Every incremental advancement towards policy achievement matters on the path to a greener and reliable grid in the future; not just at the critical milestone years, such as 2030 and 2040. Beyond the zero-emissions grid mandate by 2040, demand will continue to increase as multisectoral electrification continues to meet the CLCPA energy mandates to achieve 85% greenhouse gas emission reduction below 1990 levels by 2050. The need for new generation resources will continue well beyond 2040, while the new solar and wind resources will become less effective at meeting peak load after a significant amount of capacity is built.
- This Outlook identifies the following notable transmission expansion opportunities:
  - Central East Interface – act on installing dynamic reactive power support
  - Western New York/Southern Tier – monitor bulk transmission expansion to accommodate future renewable generation and/or dispatchable emission-free resource development
  - Northern New York – monitor bulk transmission expansion to accommodate future renewable generation and/or dispatchable emission-free resource development

Appendices are listed below:

- Appendix A: Production Cost Model Benchmark
- Appendix B: Production Cost Assumptions
- Appendix C: Capacity Expansion Assumptions
- Appendix D: Modeling & Methodologies
- Appendix E: Renewable Profiles and Variability
- Appendix F: Dispatchable Emission-Free Resources
- Appendix G: Production Cost Model Results
- Appendix H: Capacity Expansion Model Results
- Appendix I: Transmission Congestion Analysis
- Appendix J: Renewable Generation Pockets
- Appendix K: Capacity Expansion Model Sensitivities

Governor Hochul Announces Long-Duration Energy Storage Demonstration Using Fire-Safe Battery Technology

Governor Kathy Hochul today announced that New York State will receive U.S. Department of Energy (DOE) funding for a long-duration energy storage demonstration project that will use fire-safe battery technology. The technology can be used in urban and rural settings to demonstrate a stable energy supply during periods of high demand and in extreme weather conditions. Today's announcement supports the Climate Leadership and Community Protection Act goals and marks progress to achieve a nation-leading six gigawatts of energy storage by 2030.

The project will be developed by the New York Power Authority (NYPA), Rockland County-based Urban Electric Power (UEP) and Electric Power Research Institute (EPRI) with an installation at Westchester County's Grasslands Reservation in Valhalla and another at the State University of New York's (SUNY) Oneonta campus.

The project has been selected to receive funding by the DOE with the intent to catalyze impactful long-duration energy storage (LDES) demonstration projects capable of delivering electricity for 10-24 hours, surpassing the conventional short-duration systems that lithium-ion can typically support. The funding award of more than $6.5 million will cover half of the $13.1 million project cost and was made possible through the Infrastructure Investment and Jobs Act.

The Power Authority, the nation's largest state utility, has demonstrated expertise in clean energy technologies and will be partnering with UEP, a battery manufacturer based in Pearl River, to help LDES systems overcome the technical and institutional barriers to achieve wider adoption. EPRI, an independent, non-profit energy research and development (R&D) organization, is providing technical and industry expertise and guidance on technology readiness, safety assessment, test protocol development, techno-economic analysis, operations plan, and the community benefits plan.

The technology is being installed at two regionally diverse sites in New York State to demonstrate viability in varying geographical settings for different load characteristics. Each system will be 300 kilowatts with 12 or more hours of operation and offer the potential for reducing electric bills through demand charge reduction from peak shaving. The SUNY Oneonta project will also support a forthcoming on-site solar project, helping to achieve the campus' long-term clean energy plans. The exact site location on each campus will be determined as part of the first phase of work. Construction will begin in 2026 and the facilities will be operational in 2028.

According to the DOE, today's energy storage technologies are not sufficiently scaled or affordable to support the broad use of renewable energy on the electric grid. Cheaper long-duration energy storage can increase grid reliability and resilience so that clean, reliable, affordable electricity is available to everyone. The selected projects will also help achieve DOE's nationwide goal of reducing storage costs by 90 percent within the decade and demonstrating the potential for creating long-term, high-quality jobs in clean energy manufacturing, installation, and maintenance.

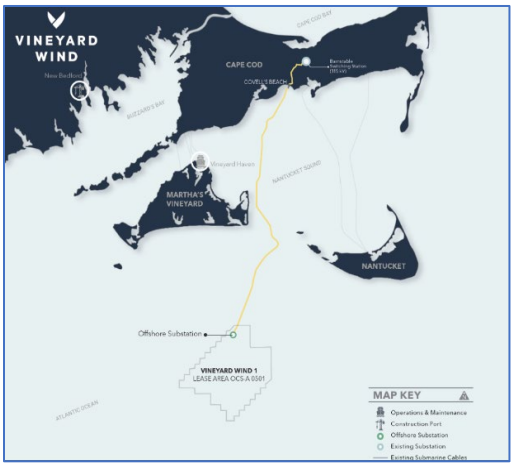
The projects will demonstrate the viability of UEP's zinc manganese dioxide batteries in large-scale and long-duration energy storage systems. The battery components are low-cost and largely domestically available raw materials that can be readily provided through existing supply, and more than 75 percent of UEP's raw material vendors are based in the U.S. The batteries have the same chemistry as household batteries and are expected to show comparable performance to lithium-ion batteries without the inherent safety and supply chain issues.

Construction of the battery facilities is expected to begin in 2026 and they are expected to become operational in 2028.

NY Times: A Giant Offshore Wind Turbine Blade Breaks, Prompting Beach Closures

This Article reports on the July 13th blade damage event at the Vineyard Wind Offshore Wind site, the country's second large-scale offshore wind farm, located 14 miles off the coast of Martha's Vineyard, Mass. It's still under construction but the first turbines began generating electricity in February. Since the event, debris from a damaged wind turbine blade has been washing up on the shores of Nantucket, Mass., prompting the closure of several beaches to swimmers and spurring an investigation into what caused the mishap.

The companies behind the project, Avangrid and Copenhagen Infrastructure Partners (CIP), plan to install a total of 62 turbines by the end of the year that could, at full strength, produce 800 megawatts of electricity, or enough to power more than 400,000 homes. The GE Vernova Haliade-X turbines being installed at Vineyard Wind are enormous, featuring 351-foot-long blades that can reach heights taller than the Eiffel Tower.



The damaged blade appeared to experience a break approximately 65 feet from its root, Craig Gilvarg, the communications director for Vineyard Wind, said in an email. The blade was still undergoing testing at the time. The company quickly recovered three large pieces from the ocean, he added, and "nearly the entirety of the blade remains affixed to the turbine and has not fallen into the water."

It is unclear what caused the blade to break, but green and white debris as well as sharp fiberglass shards have been washing up on shore, and the Nantucket Harbormaster announced on Tuesday that six beaches on the south side of the island would be closed to swimmers. No injuries were reported. Note beaches were re-opened on July 17th, four days after the incident.

In a statement, the developers of Vineyard Wind said they had deployed two teams to Nantucket to pick up the nontoxic fiberglass fragments and would patrol the beaches for additional debris, which would typically be less than one square foot in size. A safety perimeter had also been set up in the waters around the damaged turbine. The companies said that while the fiberglass debris was not hazardous to people, they recommended that beachgoers not try to pick up pieces on their own.

GE Vernova, the manufacturer of the turbines used at Vineyard Wind, said in a statement that it had launched an investigation into the cause of the damage. The incident comes at a turbulent time for the nascent offshore wind industry. Several proposed wind farms off the coasts of Connecticut, Massachusetts, New Jersey and New York have been canceled or postponed over the past few years as inflation and rising interest rates have upended the economics of the projects. While many Northeastern states are still trying to build offshore wind farms, seeing the technology as their best option for generating emissions-free power, the projects have sometimes faced intense opposition from fishing groups and local homeowners.

Vineyard Wind was the second large commercial offshore wind farm in the United States to begin generating electricity, after the nearby South Fork Wind project, which began producing power in December.

Additional Links:
Utility Dive: Vineyard Wind 1 Halts Operations After Blade Breaks, Scatters Debris Along Nantucket
CNN: The Broken Wind Turbine Near Nantucket Was 'Highly Unusual and Rare.' But It Wasn't the First
Video Links: CBS News Boston, WBZ Boston, WJAR Boston

EPRI Launches Effort to Accelerate Deployment of Grid-Enhancing Technologies

EPRI has announced the launch a new initiative to spur research and facilitate deployment of Grid-Enhancing Technologies (GETs), which can promote efforts to increase the capacity, efficiency, reliability, or safety of existing transmission lines. GETs are hardware and/or software that can reduce congestion costs and improve integration of renewables while increasing capacity and reliability. According to the U.S. Department of Energy, GETs can defer or reduce the need for significant investment in new infrastructure projects and increase the use of renewables by maximizing the capacity of the current infrastructure.

EPRI's Grid-Enhancing Technologies for a Smart Energy Transition (GET SET) Initiative aims to support the testing and demonstration of technologies to learn and share lessons for operational cost reductions, life expectancy, and reliability. GET SET is focused on four potentially high-impact technologies that can increase capacity for transmission:

- Dynamic Line Ratings (DLR) provide transmission ratings that accurately reflect real-time conditions.
- Advanced Conductors use new and existing materials to increase the thermal capacity of power lines.
- Link to Advanced Conductor Specification Guide
- Advanced Power Flow Control (PFC) can actively change the way power flows through the transmission lines.
- Topology Optimization is software that analyzes the transmission network that can increase total network flows, lower costs, and maintain reliability of the system.

An example from the Overview of Advanced Power Flow Control (APFC) Use Cases:

APPLICATION	DESCRIPTION
Congestion Reduction	APFCs can redirect power flow from overloaded lines to alternate circuits, effectively reducing congestion costs.
Operational Resilience	They offer dynamic solutions for managing contingency events during grid operations.
System Stress Alleviation	By redistributing power flows, APFCs optimize the use of existing infrastructure, thereby minimizing system stress.
Mitigation of Unscheduled flows	APFCs address unscheduled flows—discrepancies between contracted and actual power flows due to network impedance—which can cause congestion and limit transactions. They could maintain line flow within specified limits, mitigating loop flow effects.
Enforcement of Contractual Flows	These controllers could ensure that power flows along designated transmission paths adhere to contractual agreements.
Dynamic Stability Enhancement	With the ability to modify the effective line impedance on tie-lines, APFCs could improve dynamic stability by dampening power oscillations.
Renewable Energy Integration	APFCs could facilitate the swift integration of renewable energy sources by unlocking grid capacity through flow redistribution.
Adaptive Expansion Solutions	Modular and scalable APFCs can help attain more flexible and adaptable transmission solutions that can accommodate future system conditions or unforeseen situations with less capital investment while maintaining reliability.
Maintenance and Construction Mitigation	APFCs could be rapidly deployed as cost-effective interim solutions to maintain reliability during critical transmission project delays or mismatches in project initiation timelines.
Synergy with other GETs	Complementing technologies like Dynamic Line Ratings and Topology Optimization, APFCs could enhance grid utilization and expedite grid development.

Learn more about EPRI's GET SET initiative here.

Renewable Energy World: The Shift to Grid-Forming Inverters is Underway. Here's What You Need to Know

This Article describes how Researchers at the Pacific Northwest National Laboratory (PNNL) and their collaborators have created new models meant to allow power system engineers to evaluate how a new technology, the grid-forming inverter, would work on the grid to improve grid stability.

The new models, REGFM_A1 (Technical Report) and REGFM_B1 were developed by PNNL in collaboration with multiple inverter manufacturers, software vendors, and power system planners. They were recently approved by the Western Electricity Coordinating Council (WECC), making these models the first industry-approved, publicly available grid-forming inverter models that are integrated into utilities' everyday simulation tools used worldwide, such as Siemens PSSE or Power World Simulator, among others.

The integrations give transmission planners access to the models to perform planning studies, especially for those studies where vendor-specific models are unavailable. The models represent two mainstream grid-forming technologies used in the industry: droop control and virtual synchronous machine control.

The effort was conducted under the Universal Interoperability for Grid-Forming Inverters Consortium (UNIFI), a $25 million initiative launched by the Department of Energy (DOE) Solar Energy Technologies Office (SETO) and Wind Energy Technologies Office (WETO) in 2021.

Inverters currently on the grid are known as grid-following, meaning they control the current of electricity. As the nation moves towards a fully decarbonized grid by 2035, more and more coal and gas power plants will retire. To preserve the grid's stability, researchers have begun developing grid-forming inverters, which aim to control voltage rather than current. They also enable automated control coordination with other inverters and synchronous machines on the grid, to help enhance system stability.

Last fall, WECC released a report looking at how grid-forming inverters could maintain the frequency stability of the grid during times of stress, such as a sudden loss of generation. Using the new model, the report found that as more renewable generators come online, grid-forming inverters can significantly improve the system frequency response compared to the use of conventional grid-following inverters.

On a smaller scale, system operators at the Electric Reliability Council of Texas (ERCOT) recently applied the model in a Project to show that grid-forming technology can better support the connection of renewable sources in "weak" power grids, which typically refer to remote rural areas far away from energy generators.

The Wheatridge Renewable Energy Facility in Eastern Oregon is planned to become the first development of its scale in North America to combine wind and solar generation with battery storage using grid forming technology. This renewable power plant is funded by the SETO Solar and Wind Grid Services and Reliability Demonstration Program, and is expected to be in service by 2026,. The facility combines a 300-MW wind farm, a 50-MW solar facility, and a 30-MW energy storage system. If successful, this will be the first bulk power system-connected, grid-forming hybrid power plant in the United States.

Midcontinent Independent System Operator (MISO), the Midwest's bulk power grid and wholesale market operator, recently proposed a framework that would require developers and asset owners to deploy batteries that incorporate grid-forming inverter technology as opposed to grid-following controls.

The plan, which MISO includes several functional capability and performance requirements defining voltage source characteristics, as well as required simulation tests to demonstrate grid-forming characteristics and stable control responses. MISO said it is only targeting software enhancements and the plan would not require hardware upgrades.

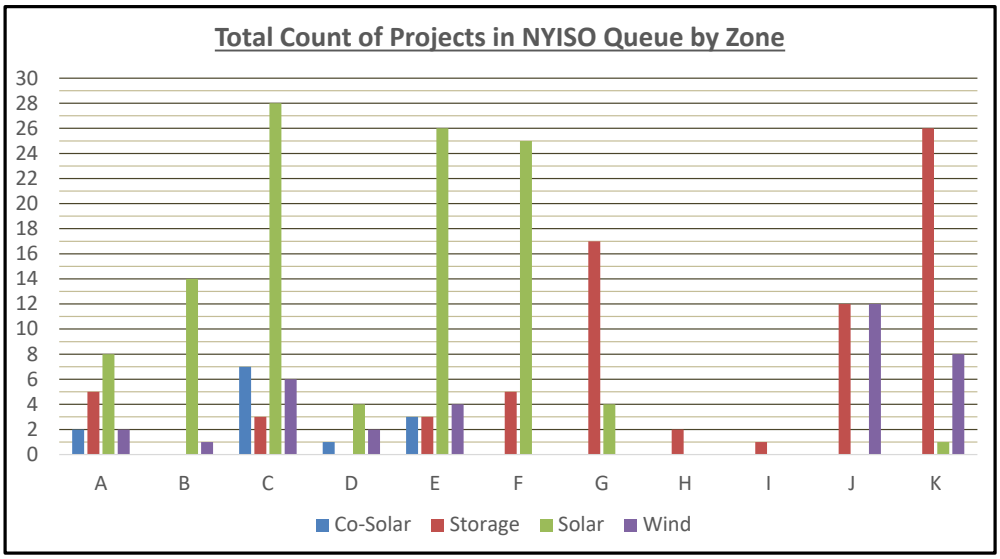
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

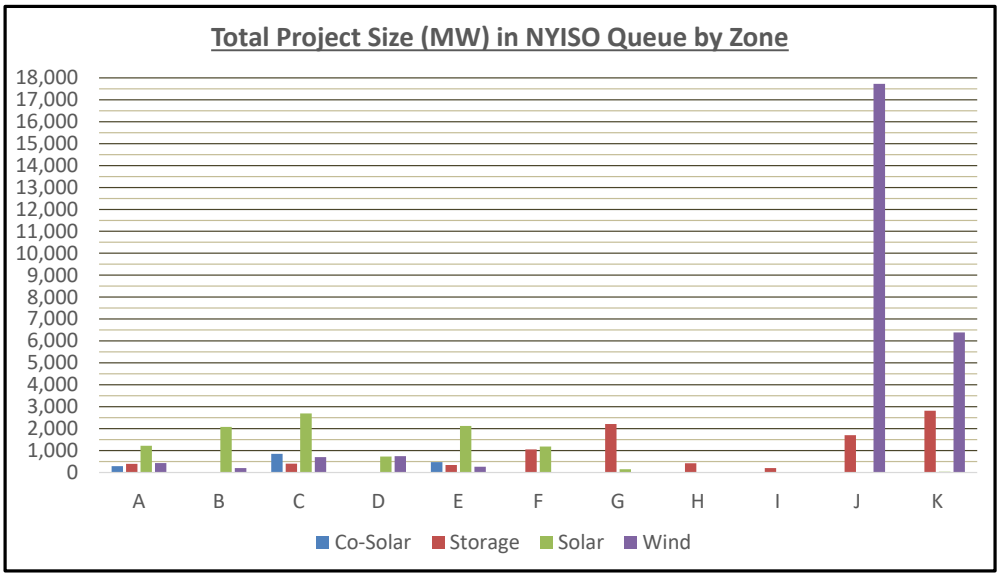
The intent is to track the growth of Energy Storage, Wind, Solar and Co-Located Storage (Solar and Wind) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on July 20th, and representing the Interconnection Queue as of June 30th. Note that 23 projects were added, and 7 were withdrawn during the month of June.

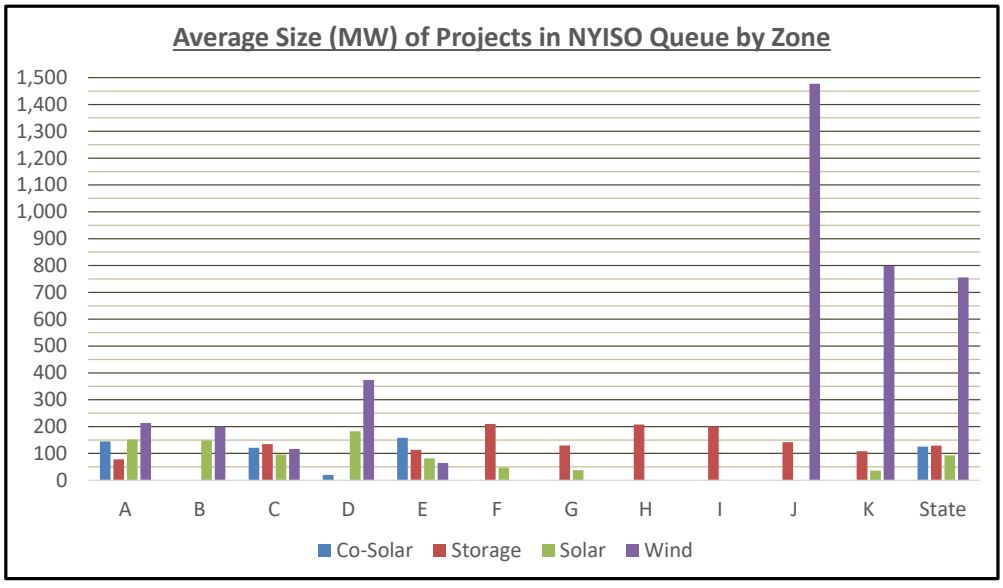
Total Count of Projects in NYISO Queue by Zone				
Zone	Co-Solar	Storage	Solar	Wind
A	2	5	8	2
B			14	1
C	7	3	28	6
D	1		4	2
E	3	3	26	4
F		5	25	
G		17	4	
H		2		
I		1		
J		12		12
K		26	1	8

Total Project Size (MW) in NYISO Queue by Zone				
Zone	Co-Solar	Storage	Solar	Wind
A	290	390	1,215	427
B			2,075	200
C	845	405	2,696	701
D	20		730	747
E	475	340	2,121	258
F		1,050	1,181	
G		2,209	150	
H		416		
I		200		
J		1,703		17,726
K		2,820	36	6,390

Average Size (MW) of Projects in NYISO Queue by Zone				
Zone	Co-Solar	Storage	Solar	Wind
A	145	78	152	214
B			148	200
C	121	135	96	117
D	20		183	374
E	158	113	82	64
F		210	47	
G		130	38	
H		208		
I		200		
J		142		1,477
K		108	36	799
State	125	129	93	756


Total Count of 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


Total Project Size (MW) in NYISO Queue by Zone
18,000
17,000
16,000
15,000
14,000
13,000
12,000
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
Storage
Solar
Wind


Average Size (MW) of Projects in NYISO Queue by Zone
1,500
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