De-Carbonization / DER Report for NYSRC Executive Committee Meeting 12/10/2021

Contact: Matt Koenig (koenigm@coned.com)

The December 2021 edition of the De-Carbonization / Distributed Energy Resources (DER) Report includes the following:

- NERC issues Final Report on the February 2021 Cold Weather Outages
- NERC Winter Reliability Assessment
- National Offshore Wind Research & Development Consortium (Introduction and Symposium Review)
- NYISO Announcements: Strategic Plan, Winter Demand, and other articles
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located Storage

On November 16th, NERC announced the release of the FERC, NERC, and Regional Entity Staff Report on the February 2021 Cold Weather Outages in Texas and the South Central United States. A presentation of the preliminary findings was released in September 2021, and is available here.

The Final Report includes 28 formal recommendations that seek to prevent a recurrence of the failures experienced during the February 2021 cold weather event. These recommendations include important revisions to the NERC Reliability Standards surrounding generator winterization and gas-electric coordination. The report also encourages additional study of the ERCOT system's reliability issues, guidance on identification of natural gas infrastructure for protection from rolling blackouts, and additional ways to address natural gas fuel supply shortfalls during extreme cold weather events. Examples of these recommendations are summarized below:

Natural Gas Interdependency

- Congress, state legislatures and regulatory agencies with jurisdiction over natural gas infrastructure facilities require those natural gas facilities to implement and maintain cold weather preparedness plans
- FERC establish a forum for improving the reliability of the natural gas infrastructure necessary to support critical natural gas infrastructure loads
- Protect critical natural gas infrastructure from load shedding to avoid adversely affecting BES reliability
- Require Balancing Authorities' operating plans to prohibit use of critical natural gas infrastructure loads for demand response
- Separate the circuits that will be used for manual load shed from circuits used for underfrequency load shed (UFLS) and use the UFLS circuits only as a last resort

Balancing Authority

- Adjacent Reliability Coordinators, Balancing Authorities and Transmission Operators should perform bi-directional seasonal transfer studies, and sensitivity analyses that vary dispatch of modeled generation to load power transfers to reveal constraints that may occur, to prepare for extreme weather events spanning multiple Reliability Coordinator/Balancing Authority areas
- Ensure that generating units are not tripped by time-delay protection systems before the first step of underfrequency load shedding is deployed
- In performing near-term load forecasts, Balancing Authorities should analyze how intermittent generation affects their ability to meet the peak load

Additional recommendations cover topics such as cold weather impacts on mechanical and electrical components, utilization of weather forecasts to better predict electric demand, and increasing the ability to rotate rolling blackouts, amongst other recommendations. Unlike previously existing guidelines or recommendations, FERC and NERC can enforce these new standards through significant civil penalties authorized under the Federal Power Act. The new standards will come into effect on April 1, 2023.

NERC has published the 2021–2022 Winter Reliability Assessment (Announcement / Report / Infographic)
This latest edition of the annual assessment advises industry to ensure the readiness of operating plans to manage potential supply shortfalls and take proactive steps for generator readiness, fuel availability and sustained operations in extreme conditions.

Reliability risk factors include resource adequacy, encompassing reserve margins and scenarios to identify operational risk; fuel assurance; and preparations to mitigate reliability concerns. The report encourages industry to discuss their plans and preparations to ensure reliability for the upcoming winter period (December 2021–February 2022).

This year's assessment highlights two additional key findings for the upcoming winter season:

- Generator Owners are facing challenges in obtaining coal and oil fuels as supply chains are stressed.
- Responses to NERC's Level 2 Alert: Cold Weather Preparations for Extreme Weather Events indicate that operating plans for winter are in place, but generator resource availability could again suffer as a result of equipment failure or lack of fuel under severe winter conditions.

NERC has identified 3 regions of particular risk:

- Central United States: Peak demand or generator outages that exceed forecasts — at levels that have been experienced in previous winter events, such as the February 2021 Cold Weather Event — can be expected to cause energy emergencies in MISO, SPP and ERCOT this winter season.
- New England and California: New England's transportation infrastructure can be constrained when cold temperatures cause peak demand for both generation and consumer heating needs. New England competes for liquefied natural gas supply on the world market and unprecedented high liquefied natural gas demand is anticipated for this winter. California has limited storage and lacks redundancy in the supply infrastructure.
- Western United States and Canada: Continuing drought in the West has caused low hydro conditions and could reduce the supply of electricity available for transfer. Higher demand from more extreme temperatures in the Northwest could cause a shortfall. Low hydro conditions can reduce transfers needed to mitigate a wide-area cold weather event.

To reduce the risks of energy shortfalls on the grid this winter, NERC recommends the following:

- Grid operators, and Generator Owners / Operators should review the NERC Level 2 Alert and NERC's Generating Unit Winter Weather Readiness Guideline, taking recommended steps prior to winter.
- Balancing Authorities should poll their generating units for readiness level for normal and extreme conditions, giving consideration for unit weatherization as well as fuel supply risk.
- Balancing Authorities and Reliability Coordinators should conduct drills on alert protocols
- Distribution Providers and Load-Serving Entities should review non-firm customer inventories to ensure that no critical infrastructure loads (e.g., natural gas, telecommunications) would be affected.

National Offshore Wind Research and Development Consortium

The Department of Energy (DOE) established the National Offshore Wind R&D Consortium (NOWRDC) in 2018 to address research priorities for offshore wind as defined in the National Offshore Wind Strategy, which was developed jointly by DOE and the Department of the Interior's Bureau of Ocean Energy Management. DOE competitively selected the New York State Energy Research and Development Authority (NYSERDA) to administer the Consortium, with DOE and NYSERDA each providing $20.5 million to fund high-impact research projects that lower the costs of U.S. offshore wind. State agencies in Maryland, Virginia, Massachusetts, and Maine have since joined, resulting in a total investment of around $47 million. The Consortium's members include many of the major entities in the offshore wind industry.

More information on the NOWRDC and NYSERDA's participation can be found on these webpages:

Home Page
R&D Roadmap 3.0
NYSERDA Introduction to the Wind Consortium
NYSERDA Transmission and Offshore Wind
Video: Innovations in offshore Wind Solicitation 2.0 (20 minutes)

The Consortium issues competitive solicitations for offshore wind technology projects, guided by three core research and development areas to facilitate the development of the U.S. offshore wind industry:

- Offshore wind plant technology advancement
- Offshore wind power resource and physical site characterization
- Installation, O&M, and supply chain solutions

The Consortium is running a series of requests for proposals (RFPs) throughout the four years of federal funding. The first two RFPs have resulted in 40 projects receiving $28 million from the Consortium.

The first RFP, issued in 2019, is funding 20 projects across all three R&D core areas:

- Offshore wind plant technology advancement, which includes optimizing the performance of wind plants; reducing the costs of turbine support structures (e.g., foundations); developing innovative mooring and anchoring technologies for floating wind; and reducing the cost and risk associated with the transmission and distribution of electricity from offshore wind
- Offshore wind power resource and physical site characterization, which includes comprehensive wind resource assessment and the development of a met-ocean reference site
- Installation, operations &maintenance, and supply chain, which includes heavy lift vessel alternatives, offshore wind digitization through advanced analytics, and technology solutions to accelerate the U.S. supply chain.

The second RFP resulted in 20 more projects announced in 2021, including:

- 5 projects to enable large-scale turbines
- 4 projects to develop innovative support structures (including foundations and moorings) for very large fixed-bottom and floating offshore wind turbines to achieve economies of scale
- 3 projects that propose innovative solutions to supply chain and installation challenges including spiral welded towers, a self-positioning blade installation tool, and unmanned aerial devices for inspections
- 5 projects to support innovations in grid interconnection and transmission
- 3 technology development projects to mitigate use conflicts, including wildlife monitoring and radar interference.

The NOWRDC held a 3-day Symposium from November 8th through 10th. Each day featured a theme based on the above pillars with project panels, and keynote speakers. Project panels consist of presentations from each of the 40 offshore wind projects that NOWRDC has funded. These projects focus on a range of technical areas within offshore wind and ultimately are aimed at lowering the overall levelized cost of energy for offshore wind in the US. The Agenda can be found here, along with links to videos and slides of each presentation. Presentations links are also shown below:

Monday Morning (Innovations in Manufacturing and Installation)	
Technical Validation of U.S. Flagged Barges as a "Feeder" solution for the Offshore Wind Industry	Link
Self-Installing Concrete Gravity-Base Substructure (Elisa Technology) - Sizing for 15 MW Turbines	Link
Self-Positioning Single Blade Installation Tool	Link
Tri Suction Pile Caisson	Link
Vibratory Installed Bucket Foundations for Fixed Foundation Offshore Wind Towers	Link

Monday Afternoon (Wind Farm Level Design Optimization)	
Radar-Based Wale Optimization of Offshore Wind Farms	Link
Computational control co-design approach for offshore wind farm optimization	Link
Impact of low-level jets on Atlantic coast offshore wind farm performance	Link

Tuesday Morning (Characterizing Wildlife and Physical Site Data)	
A Validated National Offshore Wind Resource Dataset with Uncertainty Quantification	Link
Developing a MetOcean Reference Station for Offshore Wind Energy Research	Link
Oceanographic High Frequency Radar Date Preservation in Wind Turbine Interference Mitigation	Link
Right Wind: Resolving Protected Species Space-Use Conflicts in Wind Energy Areas	Link
Technology Needs for Scientifically Robust Wildlife Monitoring and Adaptive Management	Link

Tuesday Afternoon – (Grid and Transmission Integration)	
Enabling Condition Based Maintenance (CBM) for Offshore Wind	Link
Survival Modeling for Offshore Wind	Link
DC Collection and Transmission for Offshore Wind Farms	Link
Advanced Methods for Evaluating Grid Stability in HVAC and HVDC Offshore Wind Power Plants	Link
Maximizing Electrical System Benefits of Offshore Wind Energy in S Oregon and N California	Link
Shared Landfall and Onshore Cable Infrastructure for Cable Colocation Feasibility Study	Link
Transmission Expansion Planning Models for Offshore Wind Energy	Link

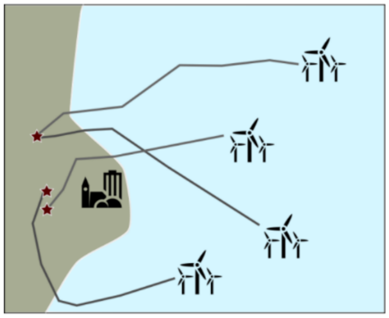
Wednesday Morning (Floating Support Structures and Mooring Systems)	
Application of Novel Offshore Oil & Gas Platforms to the Support of Large Wind Turbines	Link
Dual-Functional Tuned Inverter Damper for Enhanced Semi-Sub Offshore Wind Turbine	Link
Evolved spar concrete substructure for floating offshore wind (TELWIND technology)	Link
Triton Systems Innovative Offshore Wind Anchoring System	Link

Wednesday Afternoon (Moored Technology for Floating Offshore Wind)	
Demonstration of Shallow-Water Mooring Components (ShallowFloat)	Link
Development of Taut-synthetic Mooring Line Systems for Floating 15MW+ Wind Turbines	Link
Shared mooring systems for deep-water floating wind farms	Link
Techno-Economic Mooring Configuration and Design for floating offshore wind turbines	Link

The presentations on Grid and Transmission Integration were of particular relevance, and highlights are covered on the next 2 pages:

Shared Landfall and Onshore Cable Infrastructure for Cable Colocation Feasibility Study Link

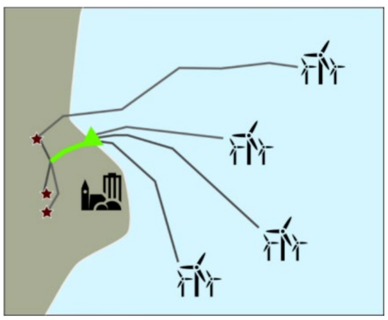
Problems and Challenges of Current Process:



Example of cable routing for multiple projects with the status quo (source: this project)

- `Under the current development environment in the US, each project is responsible for identifying its own export cable route from the project to its onshore grid interconnection point.
- `There are a limited number of landfall and onshore route corridors due to coastal communities, existing infrastructure, and environmentally sensitive areas.
- `This causes conflicts between projects. First projects take the best landfall and onshore route locations, and this results in increased project
- Costs and schedules for later projects.

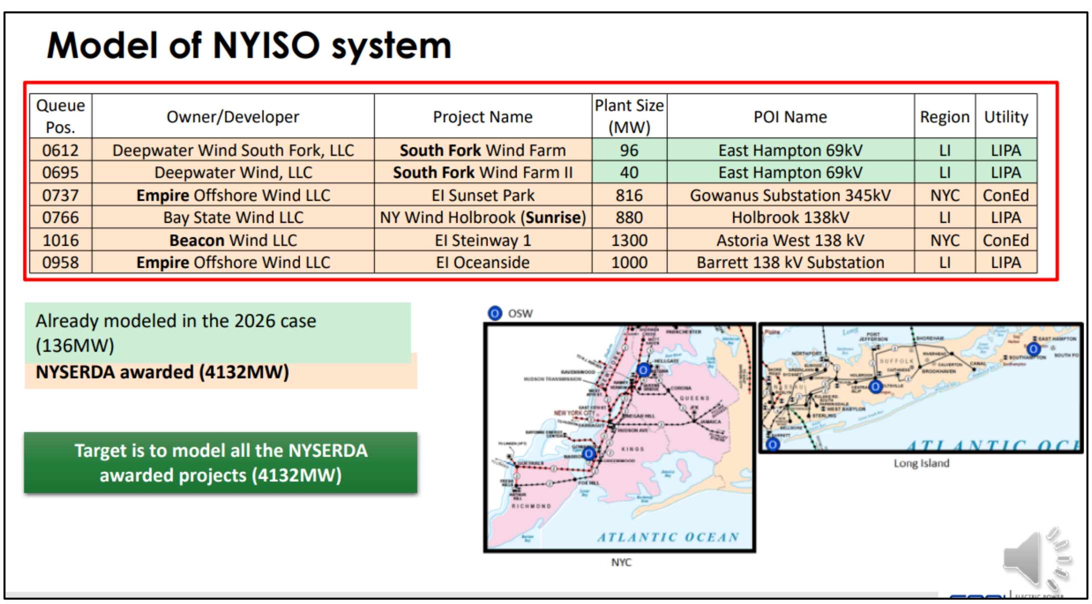
Benefits of Shared Resources:



- Shared landfall & onshore cable infrastructure
- Pre-built infrastructure at landfall and onshore that
- Facilitates installation of multiple sets of cables
- Onshore cable tunnels through major thoroughfares
- Similar to existing urban electricity T&D systems

Advanced Methods for Evaluating Grid Stability in HVAC and HVDC Offshore Wind Power Plants Link

The main objective of this project is to develop an advanced tool for modeling, stability analysis and testing mitigations for dynamic stability problems in power systems with high shares of offshore wind power interconnected with onshore grid via HVAC or HVDC submarine transmission connected to strong and weak points of interconnections in NY and MD power grids.

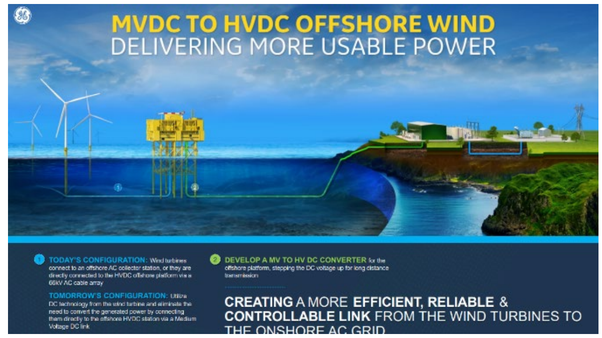


Model of NYISO system

Queue Pos.	Owner/Developer	Project Name	Plant Size (MW)	POI Name	Region	Utility
0612	Deepwater Wind South Fork, LLC	**South Fork** Wind Farm	96	East Hampton 69kV	LI	LIPA
0695	Deepwater Wind, LLC	**South Fork** Wind Farm II	40	East Hampton 69kV	LI	LIPA
0737	**Empire** Offshore Wind LLC	EI Sunset Park	816	Gowanus Substation 345kV	NYC	ConEd
0766	Bay State Wind LLC	NY Wind Holbrook (**Sunrise**)	880	Holbrook 138kV	LI	LIPA
1016	**Beacon** Wind LLC	EI Steinway 1	1300	Astoria West 138 kV	NYC	ConEd
0958	**Empire** Offshore Wind LLC	EI Oceanside	1000	Barrett 138 kV Substation	LI	LIPA

DC Collection and Transmission for Offshore Wind Farms Link

Replacing the AC-based interim connections at the site of Offshore Wind Farms with MVDC – HVDC connections.



Risks and Challenges:

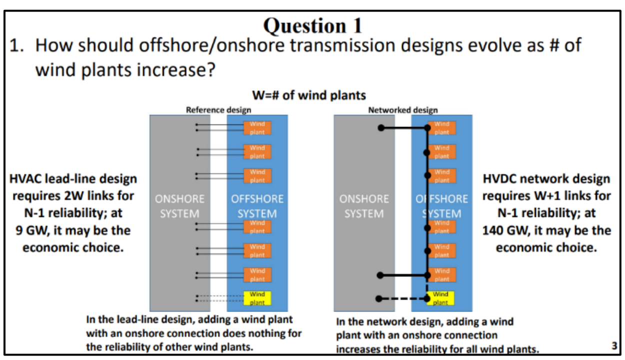
- DC-DC converters in MV/HV applications – cost, efficiency, reliability
- Fault handing in DC systems
- Adoption of offshore turbines with DC output
- Availability of MV DC cables
- General acceptance of the DC architecture in the US

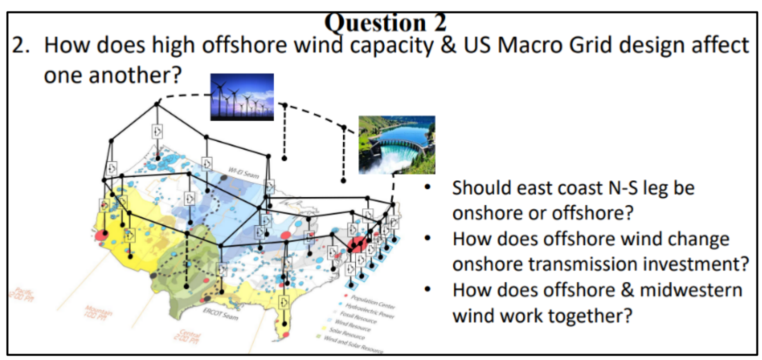
Potential Benefits:

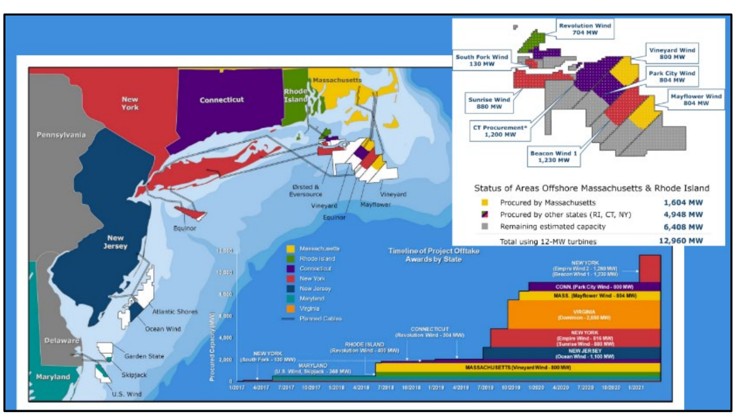
- Enable deep-water and higher power wind farms to be economically viable
- MVDC/HVDC platform uses only one single stage power conversion, eliminating the need for extra stages of voltage transformation, thereby reducing losses and cost. Cost of cables and platforms can be reduced.
- Can be extended to a multi-terminal DC networked system in future
- Potential to reduce offshore wind LCOE and accelerate the development of larger offshore wind plants (>1GW), especially for the eastern interconnection.

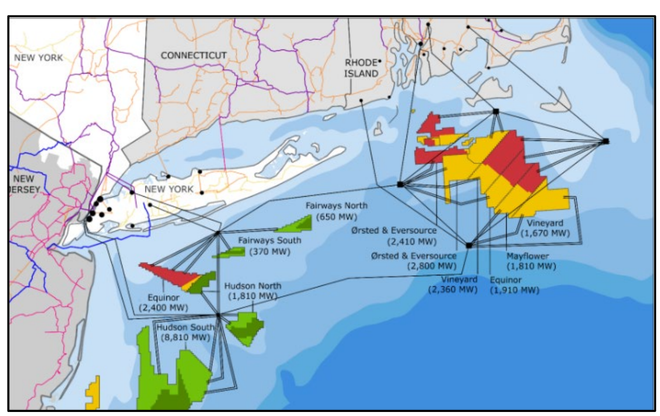
Transmission Expansion Planning Models for Offshore Wind Energy Link

Concepts for interconnected Offshore Wind Farms to support efficiencies and reduce land-based costs.









NYISO: Announcements on the Blog Page of the NYISO Website:

NYISO Released 2021 Strategic Plan (Press Release / Report / Executive Summary)
The New York Independent System Operator (NYISO) today released its 2021 Strategic Plan which discusses how the NYISO is uniquely positioned for the rapid transformation of the wholesale electric power grid. The plan provides solutions to enable the integration of new resources and facilitate the difficult transition away from fossil power generation. Objectives include:

- Leadership in Reliability
- Excellence in Execution
- Leader in Application of Technology
- Robust System Planning
- Leader in Market Design & Performance
- Authoritative Source of Information on Key Issues

Press Release: New York's Electric Grid Prepared to Meet Winter Demand
In this statement, the NYISO forecasts that peak demand for winter 2021-22 will reach 24,025 MW. The forecast represents an increase of 1,483 MW over last winter's peak of 22,542 MW, but is 0.7 percent below the 10-year average winter peak of 24,203 MW. The NYISO's extreme winter weather scenario analyses evaluate numerous types of conditions and shows that peak demand could increase to as much as 26,230 MW. New York's all-time winter peak was set in January 2014, during multi-day polar vortex conditions that pushed demand to 25,738 MW. Key takeaways for the 2021-22 winter season include:

- Operations is monitoring regional fuel supplies as indications are these could be limited in supply this winter. US Energy Information Administration (EIA) indicates oil inventories both regionally and throughout the United States are below historical values.
- Seasonal and weekly fuel surveys indicate oil and dual-fuel capability generation have sufficient start-of-winter oil inventories (but lower than past years' inventories).
- Operations has surveyed most generating stations to discuss past winter operations, preparations for the upcoming winter, including last dual-fuel operation, cold-weather preventative maintenance, fuel procurement arrangements, and fuel switching capabilities.
- Operations coordination of transmission and generation maintenance outages helps mitigate the reliability impact of such outages during extreme cold weather periods.

Article: NYISO Participation in GridEx (Nov 16th-17th)
Every two years, the nation's largest grid security exercise, GridEx, is conducted by the North American Electric Reliability Corporation (NERC). GridEx is a grid security simulation that takes place across North America, allowing utilities and organizations such as the NYISO to test their response to and recovery from simulated, coordinated, cyber and physical security threats and incidents. About 60 NYISO staff participated, including staff from IT and Operations at NYISO. In addition, members of NYISO's corporate communications team were engaged in crisis exercises. As a result, participants can practice and improve responses to security events, communication channels between participants, and apply lessons learned to improve response plans. Additional information can be found at the NERC GridEx Fact Sheet, along with the FERC Announcement of the GridEx Conclusion.

Article: the NYISO Environmental Advisory Council (EAC)
The EAC began shortly after the NYISO's founding, nearly two decades ago, to consider environmental policies, market rules, planning concepts, and grid operations. The EAC is a panel of energy and environmental experts that serves as a forum to discuss the environmental consequences and implications of the NYISO's efforts.

EAC guidance helps determine NYISO direction for the future grid based on energy trends and public policy changes. The EAC also helps provide environmental considerations such as market design, system operations and reliability, and grid planning. Members typically have backgrounds in economic and environmental issues in academia, government, or as industry experts in areas combining the environment and the energy industry.

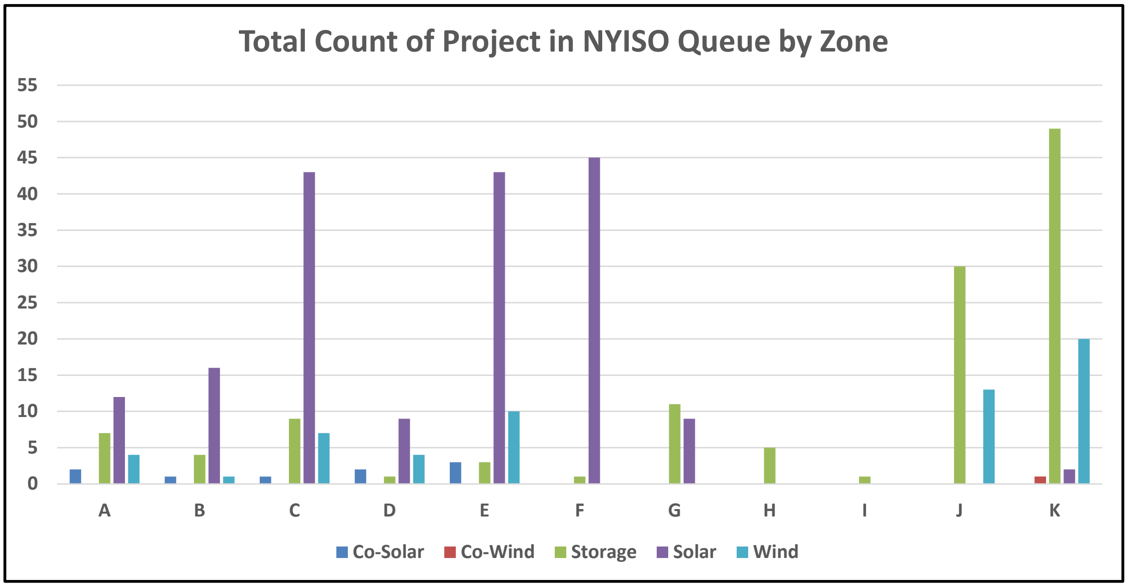
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

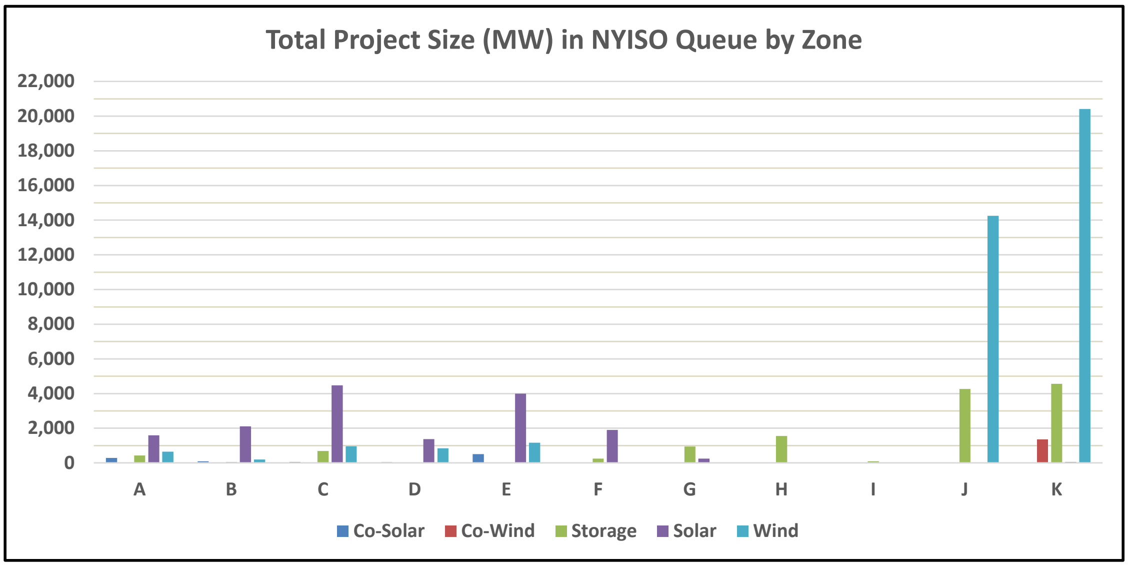
The intent is to track the growth of Energy Storage, Wind, Solar and Co-Located Storage (Solar and Wind now in separate categories) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on November 21st, and representing the Queue as of October 31st. Note that 29 projects were added, and 4 were withdrawn during the month of September. Results are tabulated below and shown graphically on the next page.

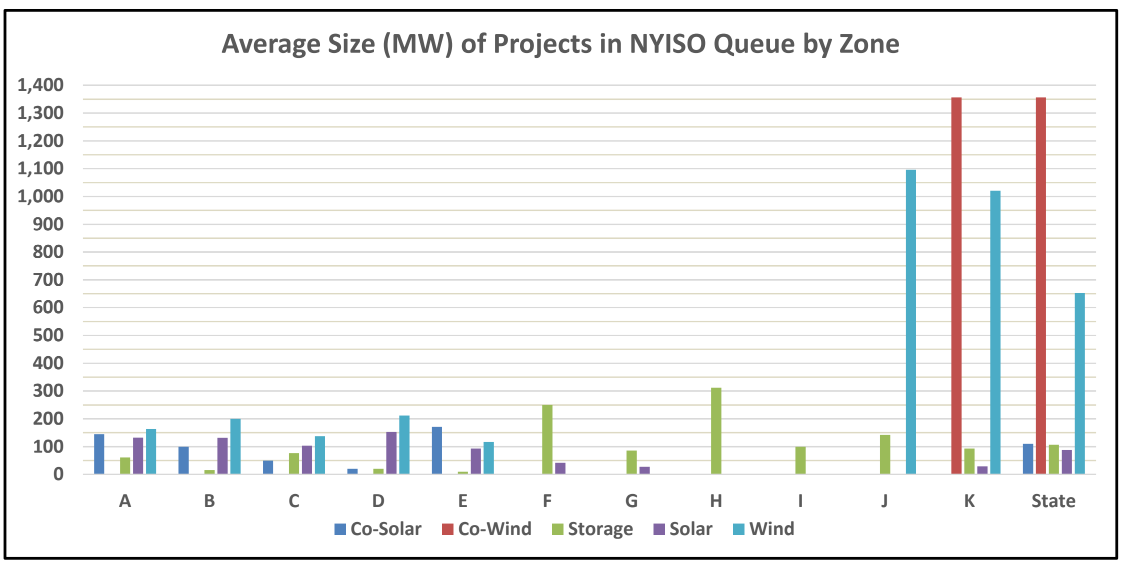
Total Count of Project in NYISO Queue by Zone					
Zone	**Co-Solar**	**Co-Wind**	**Storage**	**Solar**	**Wind**
A	2		7	12	4
B	1		4	16	1
C	1		9	43	7
D	2		1	9	4
E	3		3	43	10
F			1	45	
G			11	9	
H			5		
I			1		
J			30		13
K		1	49	2	20
State	9	1	121	179	59

Total Project Size (MW) in NYISO Queue by Zone					
Zone	**Co-Solar**	**Co-Wind**	**Storage**	**Solar**	**Wind**
A	290		430	1,590	652
B	100		61	2,113	200
C	50		689	4,475	960
D	40		20	1,377	847
E	513		30	3,995	1,165
F			250	1,897	
G			947	250	
H			1,560		
I			100		
J			4,262		14,248
K		1,356	4,566	59	20,418
State	993	1,356	12,915	15,754	38,491

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	**Co-Solar**	**Co-Wind**	**Storage**	**Solar**	**Wind**
A	145		61	132	163
B	100		15	132	200
C	50		77	104	137
D	20		20	153	212
E	171		10	93	117
F			250	42	
G			86	28	
H			312		
I			100		
J			142		1,096
K		1,356	93	29	1,021
State	110	1,356	107	88	652


Total Count of Project in NYISO Queue by Zone
55
50
45
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


Total Project Size (MW) in NYISO Queue by Zone
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Co-Wind
Storage
Solar
Wind


Average Size (MW) of Projects 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