Attachment #8.1
Return to Agenda

De-Carbonization / DER Report for NYSRC Executive Committee Meeting 6/9/2023

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The June 2023 edition of the De-Carbonization / Distributed Energy Resources (DER) Report includes the following items:

- NPCC DER Forum – 3 Presentations
    a. ISO-New England IEEE 2800-2022 Adoption Update
    b. IEEE 2800 - The New National Standard for Interconnection of IBRs to the Transmission Grid
    c. IEEE 2800-2022 Application for Inverter-Based Resource (IBR) Readiness
- NY Times: In Norway, the Electric Vehicle Future Has Already Arrived
- NY Times: EPA Proposes First Limits on Climate Pollution from Existing Power Plants
- NYISO Press Release and Blog Articles
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located

NPCC DER Forum – May 25th

Links to the NPCC DER Forum and meeting can be found here: Agenda, Recording, Draft Meeting Material
This meeting included three presentations on IEEE 2800, which are summarized on the following pages.

ISO-New England IEEE 2800-2022 Adoption Update, by Brad Marszalkowski of ISO-New England

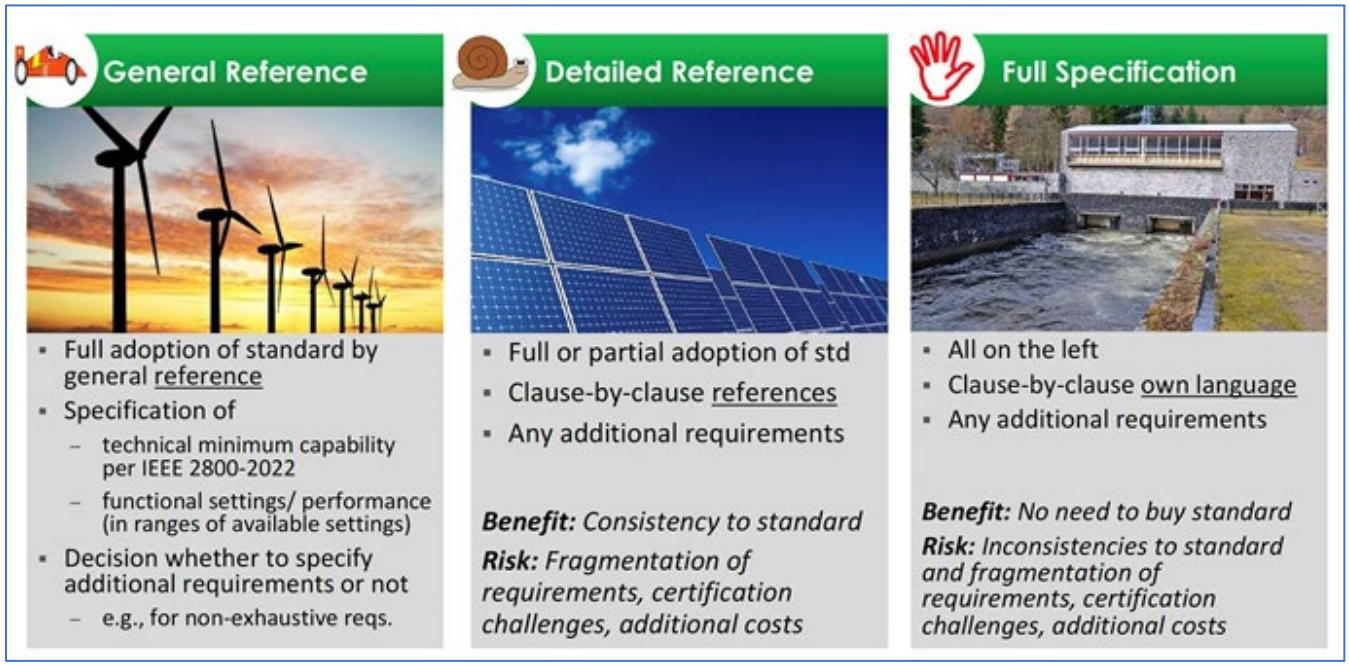
Now that IEEE 2800 has been published, the drafting of conformance procedures has commenced under IEEE P2800.2, entitled "Recommended Practice for Test and Verification Procedures for Inverter-Based Resources Interconnecting with Bulk Power Systems" (IEEE Link), and includes the following topical areas:

- SG1 – Overall Document
- SG2 – Type Tests
- SG3 – Design Evaluation
- SG4 – Commissioning Tests and As-Built Evaluations
- SG5 – Post Commissioning Model Validation, Monitoring, and Periodic Evaluations

Reasons for adopting IEEE 2800 include:

- Rapid growth of inverter-based resources in New England at both the transmission and sub-transmission levels
    - IBRs are software defined, so responses are programmed
    - Concerned with both local and system wide transient phenomena
    - Low system strength scenarios are becoming the norm
    - Can fill the gap between IEEE 1547-2018 (at the distribution level) and the transmission level
- Harmonizes technical minimum capability for Large Solar, Wind, and Storage Plants at the time of interconnection, including those connected via VSC-HVDC like offshore wind
    - Could create a "level playing field" for IBR developers, if adopted
    - Can streamline technical interconnection requirements
- Is consensus-based, voluntary IEEE performance standard
    - Developed by over 175 working group participants from transmission owners, OEMs, developers, and consultants
    - Successfully passed the industry peer review by 466 IEEE SA balloters (>94% approval, >90% response rate)

The image below from EPRI shows three possible IEEE 2800-2022 Adoption pathways, with benefits and risks:



For New England ISO, the adoption approach includes the following:

- Plan is to develop minimum performance specifications for newly interconnecting resources, using the IEEE Std2800
- Seek to implement performance requirements clause by clause, rather than wholesale adoption for now. Performance specifications will be added to multiple planning and operating documents
- In future, adoption of IEEE Std2800 by general reference, i.e., wholesale adoption, is possible
- Development of verification piece to follow in conjunction or after publication of IEEE P2800.2
  The interim approach will be to accept developer provided verification/validation in conjunction with conformity assessment performed by ISO-NE

EPRI Collaborative effort on Verifying Performance of IBR's has been established (under SPN#3002025832). The motivation for supporting this effort is that while leading IEEE standards like 2800 and 1547 have now firmly established capability and performance requirements for large inverter-based resources (IBRs), the testing and verification for the plant-level conformity remains a challenge. The goals of the collaborative include:

- Training and review of leading IEEE interconnection standards like IEEE 2800-2022 and international practices for conformity assessment
- Assess and determine improvements of participants' technical interconnection requirements, processes, and impact study approaches
- Recommend pre-commissioning conformity procedures like inverter type tests and plant-level design evaluation, with:
  - IBR unit capabilities checklist for the shorter-term adoption of IEEE 2800
  - Application of IBR unit and IBR plant models for the longer-term adoption per 2800.2
- Recommend post-commissioning conformity procedures like plant as-built installation and settings evaluation, commissioning tests, performance monitoring, and model validation
- Close coordination with the IEEE P2800.2 Working Group and associated Subgroups

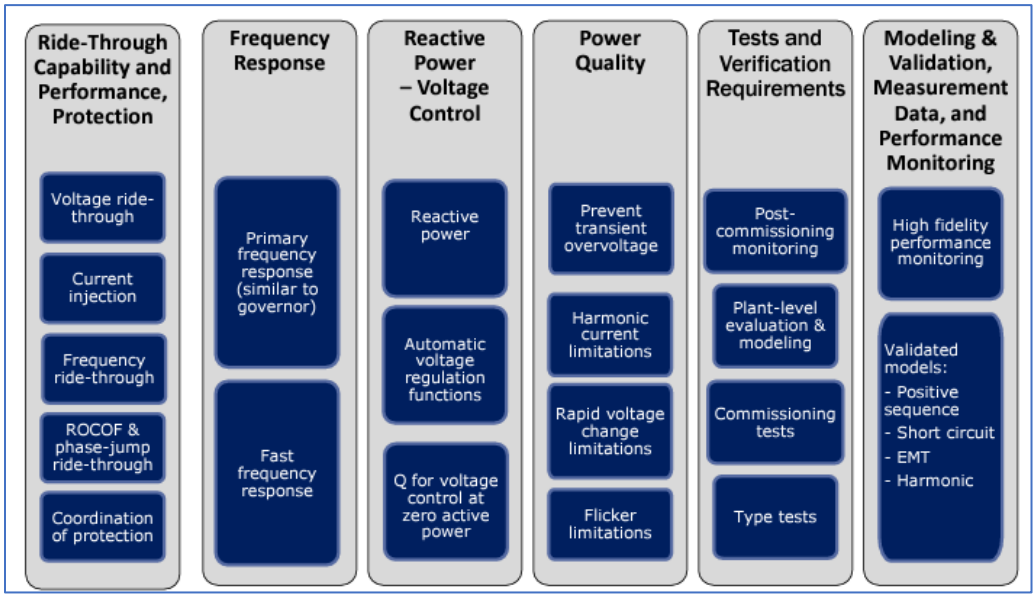
IEEE 2800 - The New National Standard for Interconnection of Inverter-Based Resources (IBRs) to the Transmission Grid, presented by Reigh A. Walling

Several events in Texas and California over the last two years have demonstrated IBR performance problems, which have highlighted reliability issues of concern to both FERC and NERC. The regulating authorities are looking to the ISOs, RTOs and utilities to incorporate the IEEE-2800 Standard (in whole or through reference) to address these concerns.

The Standard looks to harmonize interconnection requirements for all facilities that interconnect to the transmission grid via IBR's, including large solar, wind and energy storage categories. It was completed and approved in February, 2022, and adoption processes are now underway by many Reliability Coordinators and ISOs / RTOs, including the NPCC.

The scope of IEEE 2800 covers all resources connected to the transmission system via power electronic interface (e.g., inverters). It includes VSC-HVDC that connects other IBR to the transmission system but excludes HVDC within or between transmission systems. It is a plant performance standard setting minimum requirements, and not set out to be a prescriptive design standard or an equipment standard.

IEEE 2800 Technical Minimum Capability Requirements are shown in the matrix below:



Within the Test and Verification category, challenges include:

- Most IEEE 2800 requirements are at the Point of Metering (PoM) or Point of Interconnection (POI)
- The entire plant cannot be taken to a test lab
- Field tests can rarely include major disturbances

To resolve some of these challenges, the approach will incorporate:

- Type testing of individual IBR units and IBR supplemental devices, primarily for model validation
- Design evaluation –extensive use of simulation studies
- As-built installation evaluation –make sure what is there is that which was studied
- Commissioning tests –to the extent possible and permissible
- Post-commissioning model validation - update models based on commissioning results
- Post-commissioning performance monitoring
- Periodic tests to verify conformance and validity of models

Within the category of Modeling Data Requirements, IEEE 2800 requires IBR plant owner to provide the TSO with verified plant level models covering each of these areas:

- Power flow
- Positive-sequence dynamic (user written or generic)
- Short circuit
- Electromagnetic transient (EMT)
- Harmonics

The models will be used for performance compliance evaluation and future studies, so the availability of verified models will be increasingly critical to planning and operating the grid as IBR penetration increases. The modeling requirement will be ongoing, as each IBR owner will be responsible to update models following any facility modifications, including control firmware changes.

The proposed adoption process for IEEE 2800 by the NYSRC will be included in their proposed Reliability Rule 151 (PRR 151). The rule will require the adoption of IEEE 2800 by reference with certain exclusions, slight modifications, and clarifications, and will be applicable to projects in the I/C study phase for the 2024 Class Year.

IEEE 2800-2022 Application for Inverter-Based Resource (IBR) Readiness, by Shayan Rizvi, Senior Engineer at NPCC Reliability Assessment and Performance Analysis

System issues that can be attributed to IBRs include momentary cessation, unexpected tripping, oscillations, and voltage ride-through capabilities, prompting the need for the implementation of IBR standardization. In response NERC IRPS has generated a series of guidelines, white papers and technical reports covering these events, their root causes, and methods to improve response.

FERC has proposed the creation of a new Functional Registration under Section 500 and Appendices 5A and 5B of the NERC Rules of Procedure (ROP) to be identified as Generator Owner – Inverter-Based Resource (GO-IBR), and will include the owners of the following:

- Owners of IBRs which have aggregate nameplate capacity of less than or equal to 75 MVA and greater than or equal to 20 MVA interconnected at a voltage greater than or equal to 100 kV
- Owners of IBRs which have aggregate nameplate capacity of greater than or equal to 20 MVA interconnected at a voltage less than 100 kV

FERC has stated that the GO-IBR workplan should include:

- An explanation of how NERC will modify its processes to address unregistered IBRs (whether by working with stakeholders to change the BES definition, a change to its registration program, or some other solution) within 12 months of approval of the work plan, and
- Implementation milestones ensuring that owners and operators meeting the new registration criteria are identified within 24 months of the approval date of the work plan, and
- Implementation milestones ensuring that owners and operators meeting the new registration criteria are registered and thereby required to comply with applicable Reliability Standards within 36 months of the approval date of the work plan.

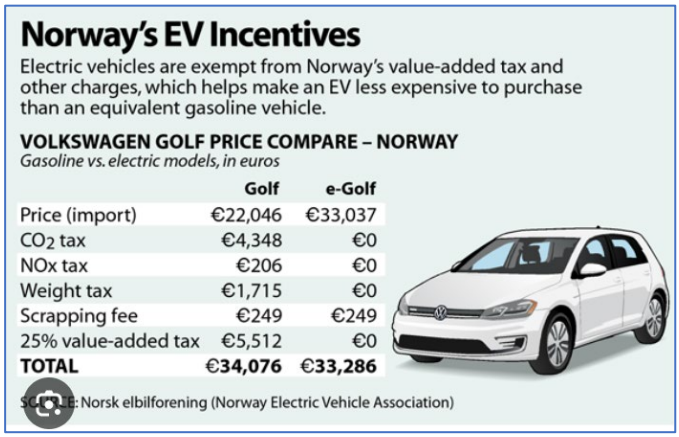
NY Times: In Norway, the Electric Vehicle Future Has Already Arrived

This article was published on May 8th, and describes how Norway has been able to advance their national deployment of electric vehicles to the point where 80 percent of last year's new-car sales were electric, putting the country at the vanguard of the shift to battery-powered mobility. It has also turned Norway into an observatory for figuring out what the electric vehicle revolution might mean for the environment, workers and life in general. The country will end the sales of internal combustion engine cars in 2025.

Norway's experience suggests that electric vehicles bring benefits without the dire consequences predicted by some critics. There are problems, of course, including unreliable chargers and long waits during periods of high demand. Auto dealers and retailers have had to adapt. The switch has reordered the auto industry, making Tesla the best-selling brand, and marginalizing established carmakers like Renault and Fiat.

Norway began promoting electric vehicles in the 1990s to support Think, a homegrown electric vehicle start-up that Ford Motor owned for a few years. Battery-powered vehicles were exempted from value-added and import taxes and from highway tolls. The policies put Norway more than a decade ahead of the United States. By contrast, the Biden administration aims for 50 percent of new-vehicle sales to be electric by 2030, a milestone Norway passed in 2019.

The air in Oslo, Norway's capital, is measurably cleaner. The city is also quieter as noisier gasoline and diesel vehicles are scrapped. Oslo's greenhouse gas emissions have fallen 30 percent since 2009. But there is still a problem in which Oslo's air has unhealthy levels of microscopic particles generated partly by the abrasion of tires and asphalt. Electric vehicles, which account for about one-third of the registered vehicles in the city but a higher proportion of traffic, may even aggravate that problem.



Electric vehicles are part of a broader plan by Oslo to reduce its carbon dioxide emissions to almost zero by 2030. Oslo is also targeting construction, the source of more than a quarter of its greenhouse gas emissions. Contractors bidding on public projects have a better chance of winning if they use equipment that runs on electricity or biofuels.

Elsewhere, Norway's power grid has held up fine even with more demand for electricity. It helps that the country has abundant hydropower. Even so, electric vehicles have increased the demand for electricity modestly, according to calculations by the E.V. Association, and most owners are charging cars at night, when demand is lower and power is cheaper.

Electric vehicles are creating jobs in other industries. In Fredrikstad, 55 miles south of Oslo, a former steel plant has become a battery recycling center. Workers, including some who worked at the steel plant, dismantle battery packs. A machine then shreds the packs to separate plastic, aluminum and copper from a black mass that contains crucial ingredients such as lithium, nickel, cobalt, manganese, and graphite.

Additional Information can be found at these sites:

- Forbes: Why Norway Leads in EVs and the Role Played by Cheap Renewable Electricity
- EV Norway: Norwegian EV Policy

NY Times: EPA Proposes First Limits on Climate Pollution from Existing Power Plants

This New York Times Article provides details of the May 11th announcement by the Biden administration for the first regulations to limit greenhouse pollution from existing power plants, capping an unparalleled string of climate policies that, taken together, could substantially reduce the nation's contribution to global warming. The proposals are designed to effectively eliminate carbon dioxide emissions from the nation's electricity sector by 2040. The regulations governing power plants come on the heels of these other Biden administration plans:

- Cut tailpipe emissions by speeding up the country's transition to electric vehicles
- Curb methane leaks from oil and gas wells
- Reduce the use of a planet-warming chemical (Hydrofluorocarbons or HFCs) in refrigerants

Together with the 2022 Inflation Reduction Act, which is pouring more than $370 billion into clean energy programs, the actions would catapult the United States to the forefront of the fight to constrain global warming.

The government is not mandating the use of equipment to capture carbon emissions before they leave the smokestack, a nascent and expensive technology. Rather, it is setting caps on pollution rates, which power plant operators would have to meet. They could do that by using a different technology or, in the case of gas plants, switching to a fuel source like green hydrogen, which does not emit carbon.

The nation's 3,400 coal- and gas-fired power plants currently generate about 25 percent of greenhouse gases produced by the United States, pollution that is dangerously heating the planet.

The new rules on power plants would lower emissions by 617 million tons between 2028 and 2042, according to the EPA. Adding the other proposed EPA regulations would bring the total amount of eliminated emissions to 15 billion tons by 2055 — roughly the amount of pollution generated by the entire United States economy over three years. Several analyses have projected that the Inflation Reduction Act will cut emissions by at least another billion tons by 2030.

That could put the nation on track to meet Mr. Biden's pledge that the United States would cut its greenhouse gases in half by 2030 and stop adding carbon dioxide to the atmosphere altogether by 2050, although analysts point out that more policies will need to be enacted to reach the latter target.

This action would be required from all major industrialized countries, scientists say, to keep average global temperatures from increasing by 1.5 degrees Celsius (2.7 degrees Fahrenheit), compared with preindustrial levels. Beyond that point, the effects of catastrophic heat waves, flooding, drought, crop failure and species extinction would become significantly harder for humanity to handle. The planet has already warmed by an average of 1.1 degrees Celsius.

EPA officials say the proposed regulations are designed to offer flexibility to industry. For example, coal plants that are already scheduled to retire before 2032 may not have to install new pollution controls like carbon capture technology. About a quarter of operating coal-fired power plants are already scheduled to retire by 2029, according to the Energy Information Administration.

While the proposed rules would increase costs for power plant operators, the EPA estimates that limiting pollution from smokestacks would produce a net economic benefit of up to $85 billion by 2042 through improved public health from lower levels of soot and sulfur dioxide, which also spew from coal-fired power plants.

By 2030, the proposed standards would prevent about 1,300 premature deaths, more than 800 hospital and emergency room visits, more than 300,000 cases of asthma attacks, 38,000 school absences and 66,000 lost workdays, according to the EPA

in some ways, the EPA regulation is designed to speed up changes that are already underway in the energy industry. Coal, the dirtiest fossil fuel, is in decline — no new coal plants have been built in the United States in the last decade. In the same time frame, the cost of wind and solar power has plummeted, and electricity generation from wind turbines and solar panels has more than tripled. Wind now generates more than 10 percent of the nation's electricity, and solar power now generates about 3 percent and is growing fast. As a result, planet-warming pollution from power plant smokestacks has dropped by about 25 percent in the last decade, absent any direct regulation.

Additional information can be found at the EPA Website here:

- EPA Proposes New Carbon Pollution Standards for Fossil Fuel-Fired Power Plants to Tackle the Climate Crisis and Protect Public Health
- Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants
- Fact Sheet: Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants – Proposed Rule

Features from the NYISO Press Release Page include the following news item:

NYISO Announces New Solar Generation Record

The New York Independent System Operator reported that New York set a new record for solar generation on Thursday, May 18. During the noon hour that day, a combination of behind-the-meter (BTM) solar and front-of-the-meter (FTM) solar generated 3,330 megawatts (MW). BTM accounted for 3,200 MW and FTM accounted for 130 MW. Together, BTM and FTM solar provided approximately 20 percent of New York's electricity demand during this hour. That's enough to supply electricity to between 2.7 million and 3.4 million homes. The actual peak load on the bulk power system for May 18 was 16,166 MW

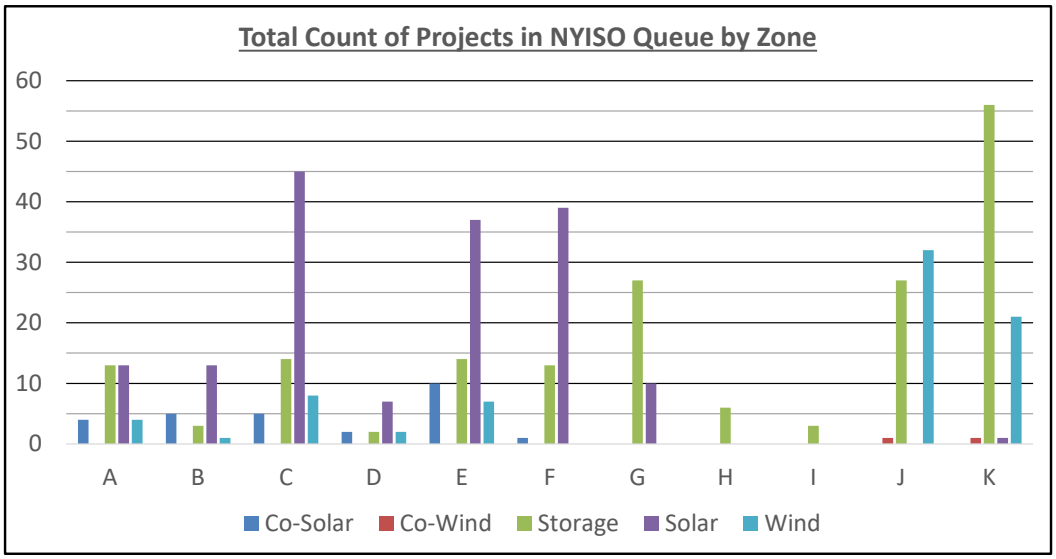
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

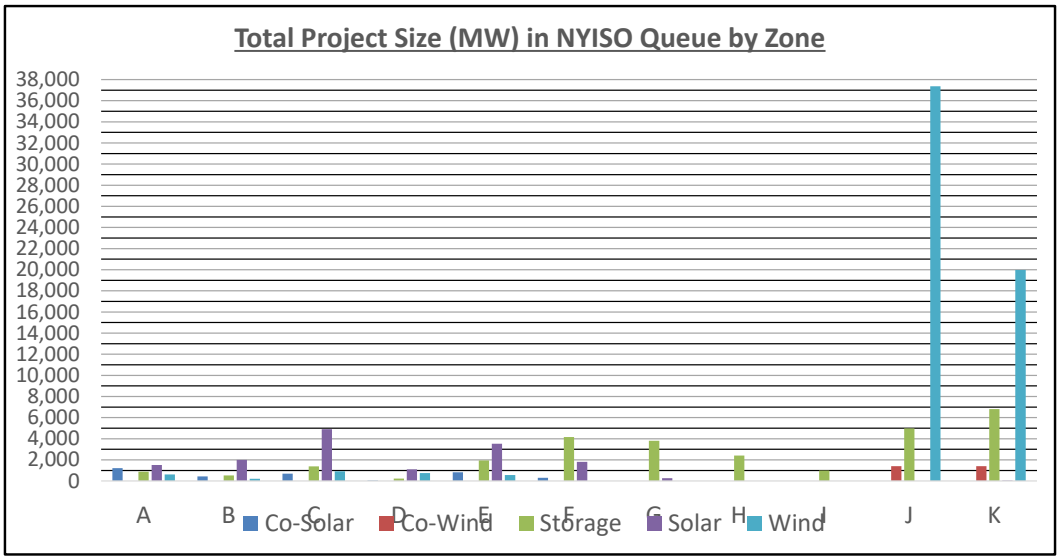
The intent is to track the growth of Energy Storage, Wind, Solar and Co-Located Storage (Solar and Wind now in separate categories) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on May 22nd, and representing the Interconnection Queue as of April 30th. Note that 6 projects were added, and 16 were withdrawn during the month of April.

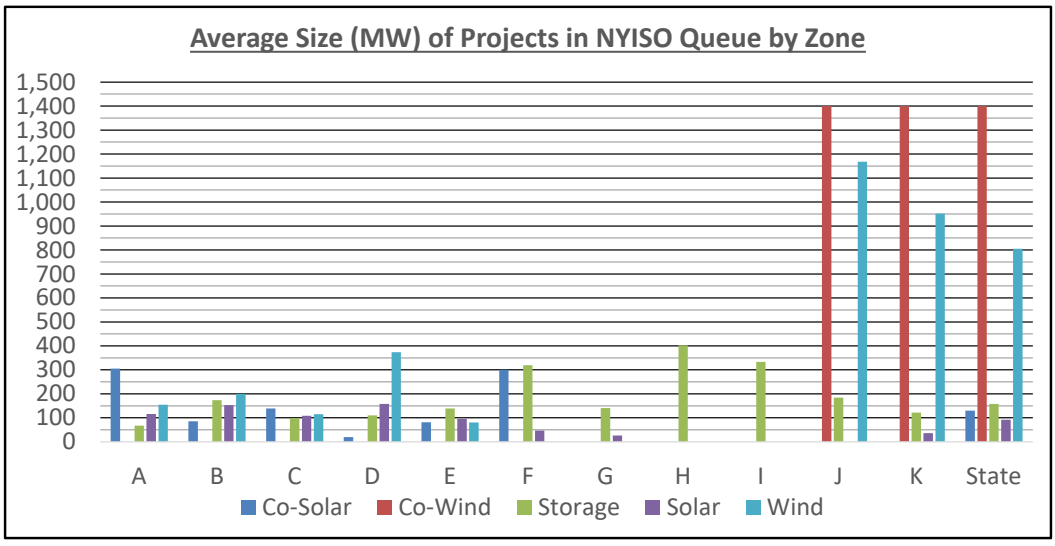
Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	4		13	13	4
B	5		3	13	1
C	5		14	45	8
D	2		2	7	2
E	10		14	37	7
F	1		13	39	
G			27	10	
H			6		
I			3		
J		1	27		32
K		1	56	1	21
State	27	2	178	165	75

Total Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	1,220		878	1,508	618
B	428		520	1,995	200
C	695		1,386	4,896	921
D	40		220	1,107	747
E	817		1,944	3,531	565
F	300		4,156	1,821	
G			3,802	263	
H			2,416		
I			1,000		
J		1,400	4,978		37,366
K		1,400	6,805	36	19,974
State	3,499	2,800	28,105	15,156	60,392

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	305		68	116	155
B	86		173	153	200
C	139		99	109	115
D	20		110	158	374
E	82		139	95	81
F	300		320	47	
G			141	26	
H			403		
I			333		
J		1,400	184		1,168
K		1,400	122	36	951
State	130	1,400	158	92	805


Total Count of Projects in NYISO Queue by Zone
60
50
40
30
20
10
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
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
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
1,500
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
Co-Wind
Storage
Solar
Wind