De-Carbonization / DER Report for NYSRC Executive Committee Meeting 8/11/2023

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

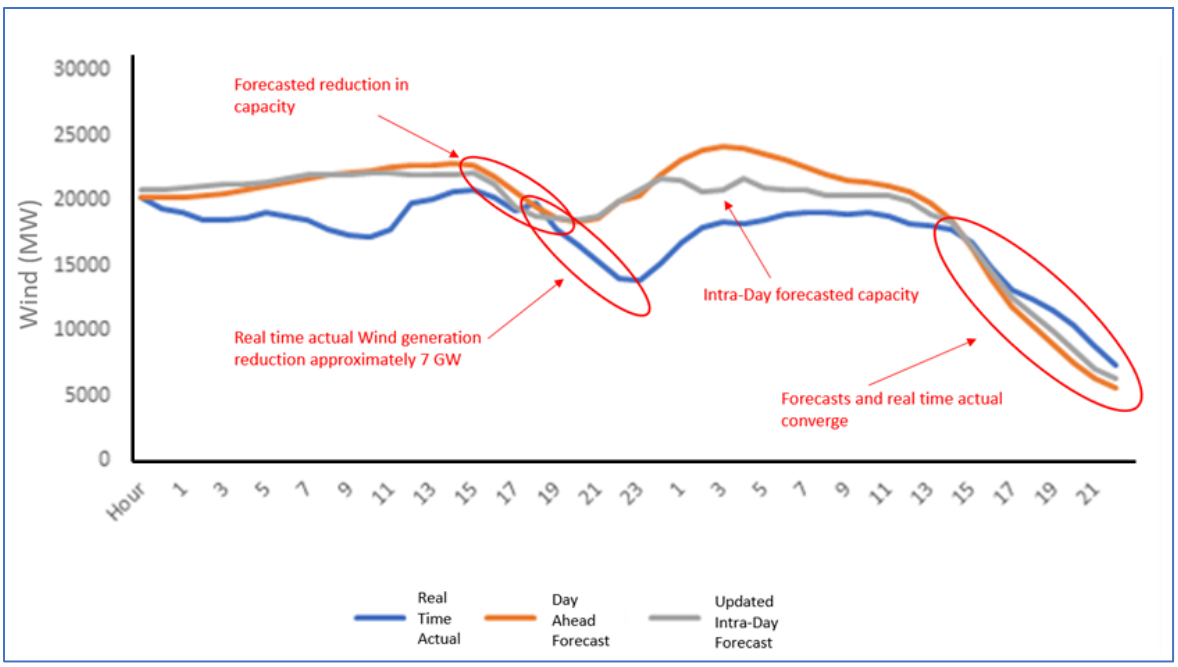
- NERC Reliability Vignette – Future Wind Planning Informed by Current Operating Experience
- FERC approves Order 2023 to reduce backlog of US generation projects
- EPRI Report on Carnegie Road Energy Storage System Failure Response, Recovery and Rebuild
- NY Times: It's Official: Stores Can No Longer Sell Most Incandescent Lights
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located

NERC Reliability Vignette – Future Wind Planning Informed by Current Operating Experience

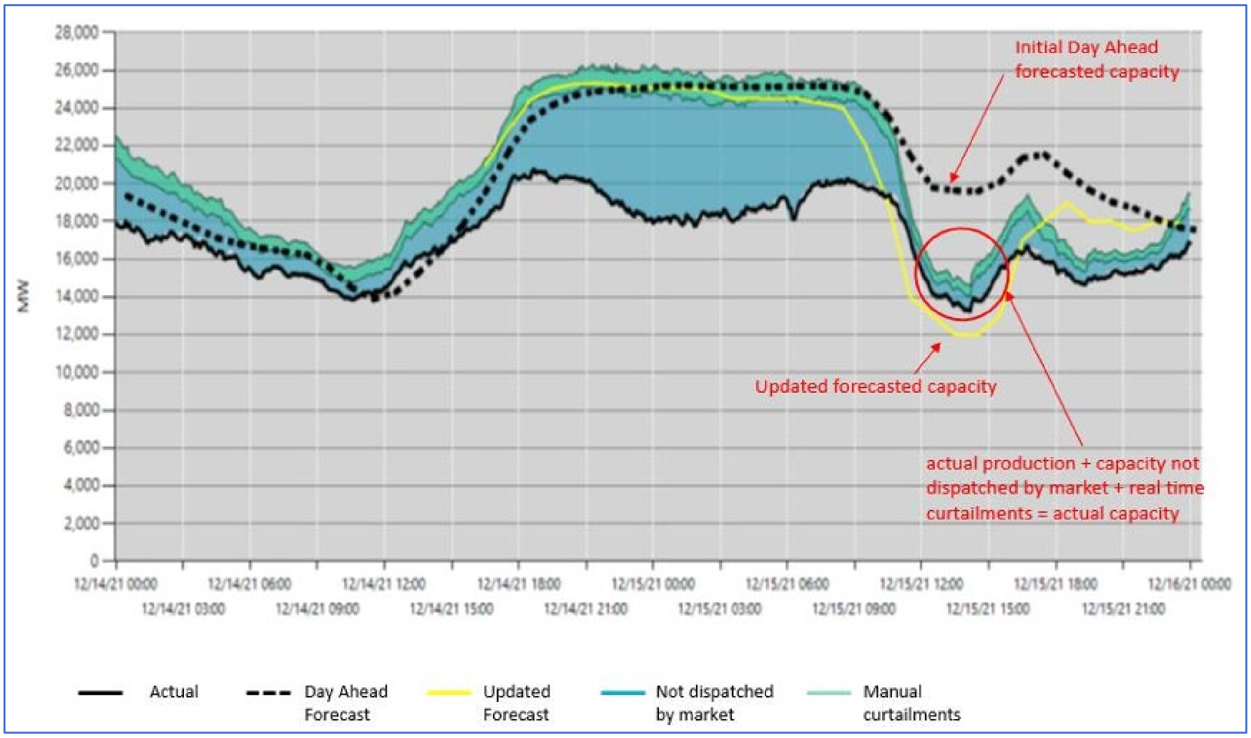
This operating incident presented by the NERC Event Analysis, Reliability Assessment and Performance Analysis Group identified resource balancing needs that should be considered in the future planning of high-wind generation systems. A severe storm with high winds impacted the footprint of two regional independent system operators. The operating organizations experienced transmission outages and high-speed wind cut-outs for a portion of the day. Loss of load and generation did not reach a significant reliability risk threshold. However, system operating challenges during the incident demonstrated the potential for future resource shortages, provided a dependency on wind generation.

During the incident for Operating Entity 1, the peak reduction of wind generation was approximately 7,000 MW. The reduction in wind generation is attributed to two causes: high speed wind cut-outs, along with transmission constraints caused by a large number of 69 kV and 161 kV line outages throughout the operating area. During the incident for Operating Entity 2, the peak reduction of wind generation was approximately 6,000 MW. This reduction was attributed to a combination of high-speed cut-outs and curtailments due to market redispatch and transmission congestion outages.

The image below shows the actual vs. forecasted reduction in wind capacity for Operating Entity 1.



The image below shows the actual vs. forecasted reduction in wind capacity for Operating Entity 2.



As the BPS progresses to a carbon free/reduced carbon generation model, wind generation will produce a greater percentage of the total energy output at any given time. High-wind scenarios like those described in this document could result in higher generation losses. Consequently, more extensive/comprehensive planning and operating ability is required to manage these losses. In addition, there will be less dispatchable / flexible generation available in this type of scenario. Related items for consideration include:

- Adequate transmission and dispatchable/flexible generation resources are needed to support operator flexibility as the number of variable resources increase.
- Natural-gas-fired generation is the current and near-future primary balancing resource, so it is imperative to ensure a reliable and flexible natural gas delivery and transportation system.
- Batteries are expected to perform as dispatchable resources in the future (alongside hydrogen-based or other dispatchable clean fuels that may emerge). If batteries are to play a significant role, then adequate amounts of battery energy storage systems must be available to assist operators in managing the system during these types of incidents.
- An alternative option to batteries for managing these scenarios could be geographically dispersed generation reserves with appropriate transmission facilities. This would enable generation not impacted by a high wind event to be dispatched to the area experiencing losses.
- Probabilistic composite planning methods for generation and transmission loss will be necessary to plan for generation reserve amounts and locations.
- Generation forecasting will also be critical for evaluating conditions during storm / high-wind events.
- As this incident demonstrates, the maintaining of continuous forecasting updates will provide more precise information and improve operator preparation and response times for these events.

FERC approves Order 2023 to reduce backlog of US generation projects

The Federal Energy Regulatory Commission issued a sweeping final rule aimed at easing a nationwide backlog of clean energy and storage resources seeking to interconnect to the US power grid. The rule, called Order 2023, is the first major change to FERC's interconnection requirements in two decades. The draft final rule (RM22-14) was approved unanimously at the agency's July 27 monthly open meeting. It is designed to ensure that power generation projects closest to commercial operation are prioritized in a way that also weeds out more speculative projects from clogged interconnection queues.

Order 2023 adopts a "first-ready, first-served" cluster study approach for examining what grid upgrades may be needed to safely bring a generator or storage project online, which replaces the practice of evaluating projects on a first-come, first-served basis. The rule also raises financial commitments for interconnection customers seeking to enter and stay in the queue. Interconnection customers must pay increased study deposits, meet more stringent site control requirements, and pay commercial readiness deposits as part of that process. In addition, project developers will face penalties if they withdraw their requests from the interconnection queue.

As with the proposed rule, transmission providers will have 150 days to complete the cluster studies and 150 days for a restudy. The final rule also did not modify a 90-day facilities study timeline, which can be extended to 180 days upon request. The rule imposes firm deadlines and establishes penalties if transmission providers do not complete interconnection studies on time. Penalties for delayed cluster studies are $1,000 per business day, rising to $2,000 per business day for cluster restudies or affected systems studies that go beyond their deadlines. Facilities studies that are behind schedule will face penalties of $2,500 per business day.

The rule would require transmission providers to allow more than one generating facility to co-locate on a shared site and share a single interconnection request. From the technical perspective, the rule sets modeling and "ride-through" requirements for new nonsynchronous generators (IBRs) to bolster grid reliability.

Transmission providers must also evaluate specific alternative technologies in their cluster studies. The final rule expanded the list of those technologies from five to eight. During the July 27 meeting, Commissioner Allison Clements said those technologies are:

- Static synchronized compensators
- Static var compensators
- Advanced power flow control devices
- Transmission switching
- Synchronous condensers
- Voltage Source Converters
- Advanced conductors
- Tower Lifting

To ease the transition to the new rule, FERC will allow interconnection customers that already have facility study agreements with transmission providers to do a transitional serial study or transitional cluster study. Project developers already in the queue but that do not have a facilities study agreement will also be eligible for a transitional cluster study.

Links:

- FERC Fact Sheet: Improvements to Generator Interconnection Procedures and Agreements
- FERC Order 2023: RM22-14-000. Filed 07/28/23
- FERC News Release: FERC Transmission Reform Paves Way for Adding New Energy Resources to Grid
- FERC Staff Presentation: Improvements to Generator Interconnection Procedures and Agreements
- S&P Global Market Intelligence: FERC Approves Historic Rule to Clear Backlog of US Generation projects
- Utility Dive: FERC Issues rule to Speed Grid Connections for Storage, Renewables, and other generators Amid 2TW Backlog

EPRI Report on Carnegie Road Energy Storage System Failure Response, Recovery and Rebuild

This report conveys the lessons learned from the Carnegie Road energy storage system (ESS) failure event, including aspects of emergency response, root cause investigation, and the redesign and rebuild process. EPRI has established a Battery ESS (BESS) Failure Event Database as a resource to the industry to further document and understand the nature of BESS failures in the industry.

The Carnegie Road BESS was first energized in December 2018 and commissioned in May 2019. The BESS is located in Liverpool, UK and connected to the Scottish Power Energy network at 33 kV. It includes three containerized battery enclosures within the site footprint.

In the early morning hours of September 15, 2020, an explosion occurred at the Carnegie Road energy storage site, followed by a fire that consumed one of three energy storage enclosures. The failure occurred in Container 1 of 3. The images below show bowing of the container walls because of pressure buildup within, dislocation of the air conditioning units that were attached to the top of the container, and severe charring from the fire. These impacts are the result of extreme temperature exposure. Pools of hardened aluminum were found at the base of the racks and below the container, suggesting that the fire temperatures exceeded 660°C (1221°F)

Ørsted and MFRS had worked together to develop an Emergency Response Plan (ERP) prior to the fire incident. Unfortunately, the information about the site and proper emergency response actions was not disseminated to local fire crews, resulting in lack of preparedness and confusion when the first crews arrived on-site. It was not until the event was escalated within MFRS that a senior officer was able to instruct fire crews on the proper response strategy, saving Container 2.

Lack of preparedness or awareness on how to fight lithium-ion battery fires is a sentiment that is echoed by fire departments across the globe. They were not aware of the nature of the facility, the related hazards, and the proper response. First responders must understand the potential hazards and come prepared with proper personnel protective equipment (PPE) and monitoring equipment to keep themselves, the local community, and the environment safe.

Anecdotally, EPRI has heard of firefighters responding to structure fires unaware of the presence of lithium-ion batteries and handling batteries without high-voltage gloves, boots, or other protective gear. The health effects from lithium-ion battery fire exposure are not well understood, but EPRI has heard of firefighters developing temporary respiratory aggravation and skin rashes.

The Carnegie Road BESS failure was a first-of-a-kind event in the UK. There were many unknowns and no clear guidance on how to proceed. Out of an abundance of caution, the investigation team agreed on a no-entry strategy to avoid putting people at risk. All assessments, measurements, and samplings were conducted from outside the container.

EPRI chose to use the publicly available report from the Energy Storage Integration Council (ESIC) entitled Energy Storage Reference Fire Hazard Mitigation Analysis as the starting point. This report identifies concerns of fire and thermal runaway propagation as well as gaps in suitable defense measures (or mitigation barriers).

The initial communication by the fire service's watch manager that a "large refrigeration unit" was on fire raises concern over first responder preparedness. Ørsted had worked with the fire service to develop an ERP months before the failure incident, making them both aware of the system and trained for an emergency. The Communication error at the time of the event was rectified, and the fire service responded appropriately to the incident. There are little data on the environmental, health, and safety effects of exposure to a battery fire or water used in firefighting. Research suggests that Hydrofluoric Acid (HF) can be found in the battery smoke plume and firewater. Having a containment or mitigation plan can help protect residents, bystanders, and the environment from the potentially harmful effects of exposure.

Post-event recovery was particularly challenging in this case because of a lack of visibility and guidance on how to safely approach and disassemble a damaged system with an unknown amount of stranded energy. There is no clear solution for discharging stranded energy in a controlled manner, especially in damaged systems with exposed energized materials. Having a post-incident plan can educate and guide recovery teams, maintain a safe working environment, and provide a potential schedule for project recovery.

The root cause analysis was inconclusive but suggested that cell internal failure was a potential contributor to the battery system fire. Detecting and correcting an internal defect of a closed battery cell is impossible post-production, and it is extremely difficult to prevent or control a related failure when the defect is unknown. Visiting the cell manufacturing facility and reviewing the quality control practices is an option for trying to mitigate cell manufacturing defects. A more feasible approach to mitigating an internal cell failure is to engineer safety into the broader system, including enhanced control features within the facility's Battery Management System, gas detection, ventilation, suppression, and the inclusion of deflagration panels to direct any explosive forces up rather than out.

EPRI's BESS safety-specific resources include white papers and reports on thermal runaway and associated explosion and environmental hazards, the BESS Failure Event Database, and an Explosion hazard calculator (Freely available to funding members). Resources under development through EPRI's Fire Protection and Mitigation research include battery fire plume modeling, design trade-off analyses, emergency response plans and other first responder resources, a database for technologies that improve system safety, and more.

NY Times: It's Official: Stores Can No Longer Sell Most Incandescent Lights

This Article highlights the new energy efficiency rules that took effect Tuesday, shoppers in the United States will no longer be able to purchase most incandescent bulbs, marking the demise of a technology patented by Thomas Edison in the late 1800s. Taking their place are LED lights, which have already transformed America's energy landscape.

The new efficiency standard announced by the Biden administration requires light bulbs to meet a minimum standard of producing 45 lumens per watt. (A lumen is a measurement of brightness, and incandescent bulbs typically produce far less than that per watt.) An accompanying rule change applies the new standards to a wider universe of light bulbs. See Federal Register - Energy Conservation Program: Definitions for General Service Lamps)

"Energy-efficient lighting is the big energy story that nobody is talking about," said Lucas Davis, an energy economist at the Haas School of Business, part of the University of California, Berkeley. "Going from an incandescent to an LED is like replacing a car that gets 25 miles per gallon with another one that gets 130 m.p.g.," he said.

With the new rules in place, the Department of Energy expects Americans to collectively save nearly $3 billion a year on their utility bills. In the past, the higher expense of LEDs placed them at a competitive disadvantage, but the prices for LED bulbs have fallen rapidly to near parity with incandescents.

Over the next three decades, the rules will also cut carbon dioxide emissions by 222 million metric tons the Energy Department said, which it compared to the emissions from 28 million homes in one year. LEDs have other advantages. Consumers can expect less running to the store for new bulbs or teetering on foot ladders to replace them: LED light bulbs last 25 to 50 times longer than their incandescent counterparts.

Europe is a step ahead, having phased out incandescent lights in 2012. In 2021, the European Union said it would also ban all fluorescent lighting next month. Environmental groups and experts have long pushed for a phaseout of fluorescent lights, which are less efficient than LED lights and contain mercury, a toxic metal.

In the United States, compact fluorescent lights - the bulbs made up of a swirl of fluorescent tubing - meet the new efficiency rules. Few are still sold, however, and separate efficiency standards proposed but not yet enacted by the Biden administration could soon effectively ban those, too.

Here is a list of incandescent bulbs that can remain on the market:

- Appliance lamps such as fridge and oven lights
- Black lights
- Bug lamps
- Colored lamps
- Infrared lamps
- Left-handed thread lamps
- Plant lights
- Flood lights
- Reflector lamps
- Showcase lamps
- Traffic signals
- Other specialty lights, including marine lamps and odd-sized bulbs

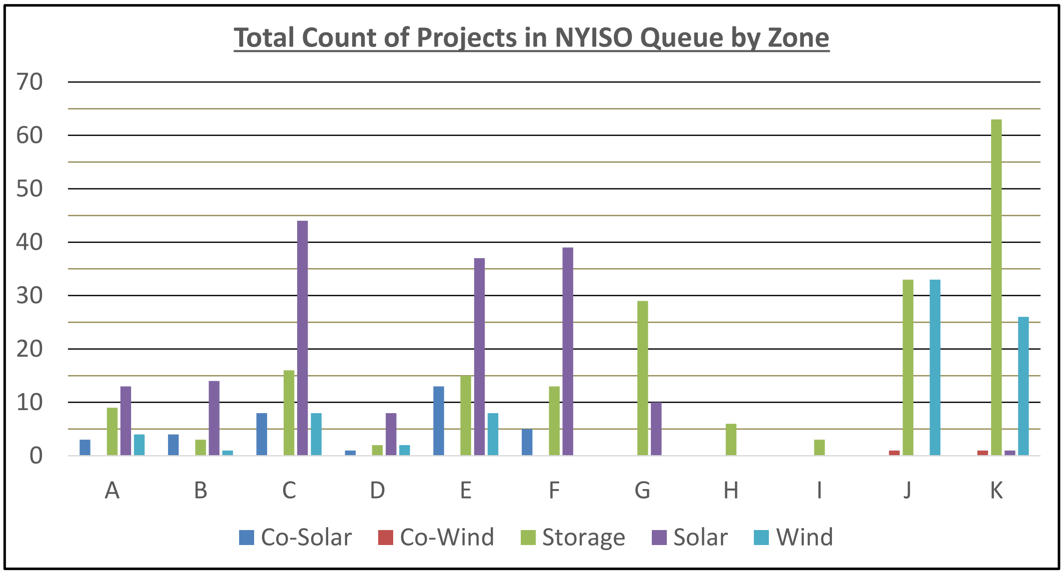
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

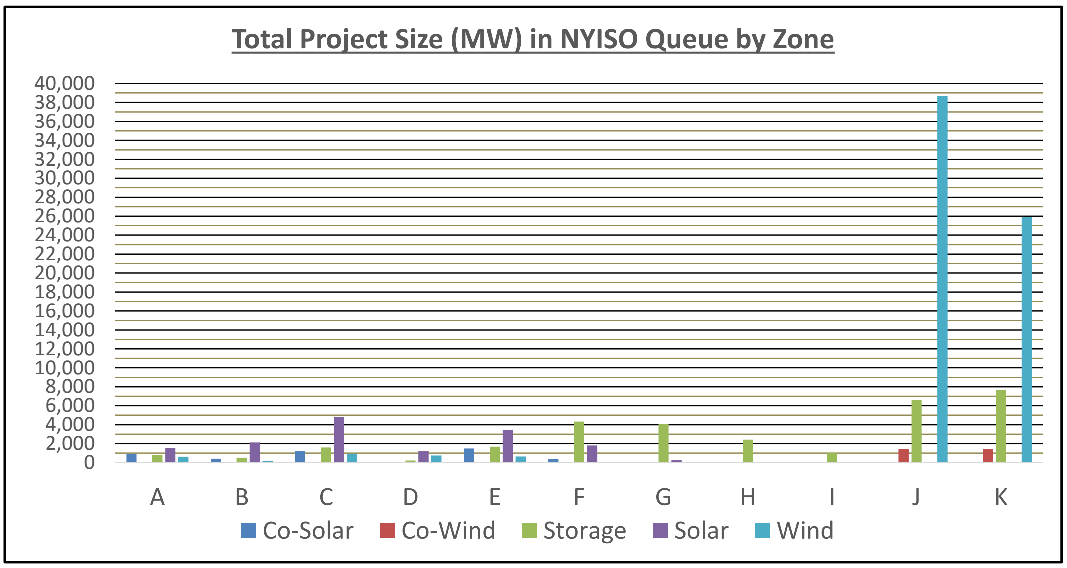
The intent is to track the growth of Energy Storage, Wind, Solar and Co-Located Storage (Solar and Wind) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on July 24th, and representing the Interconnection Queue as of June 30th. Note that 14 projects were added, and 9 were withdrawn during the month of June.

Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	3		9	13	4
B	4		3	14	1
C	8		16	44	8
D	1		2	8	2
E	13		15	37	8
F	5		13	39	
G			29	10	
H			6		
I			3		
J		1	33		33
K		1	63	1	26
State	34	2	192	166	82

Total Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	920		801	1,508	618
B	408		520	2,125	200
C	1,195		1,599	4,798	921
D	20		220	1,202	747
E	1,492		1,684	3,451	645
F	380		4,340	1,821	
G			4,082	263	
H			2,416		
I			1,000		
J		1,400	6,605		38,661
K		1,400	7,638	36	25,924
State	4,415	2,800	30,904	15,204	67,716

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	307		89	116	154
B	102		173	152	200
C	149		100	109	115
D	20		110	150	374
E	115		112	93	81
F	76		334	47	
G			141	26	
H			403		
I			333		
J		1,400	200		1,172
K		1,400	121	36	997
State	130	1,400	161	92	826


Total Count of Projects in NYISO Queue by Zone
70
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
40,000
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
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G
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I
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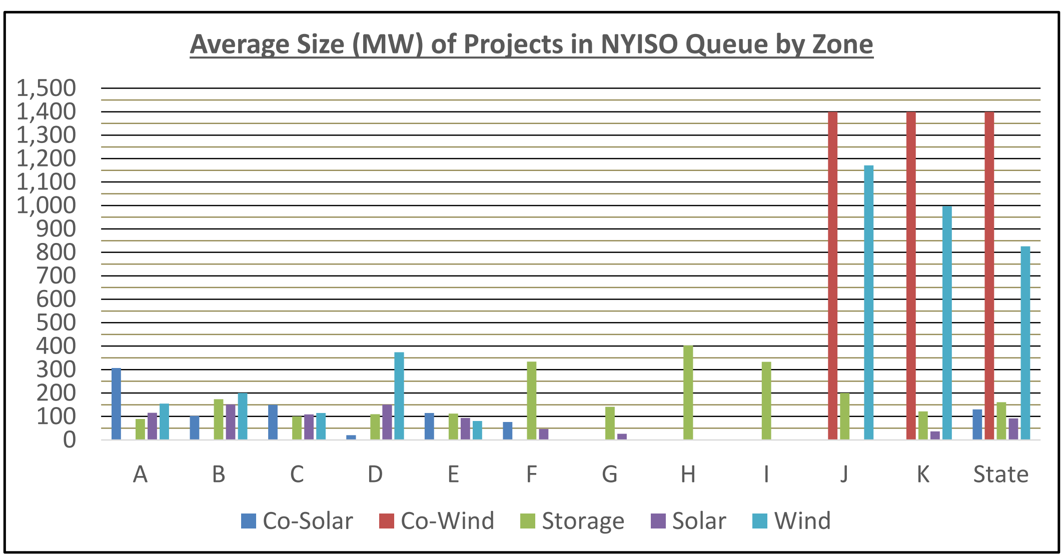
K
Co-Solar
Co-Wind
Storage
Solar
Wind


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