De-Carbonization / DER Report for NYSRC Executive Committee Meeting 10/10/2024

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

- Canary Media: Solar and Batteries are Helping Texas Weather Heat Waves. Here's How
- New York Times Articles on Data Center Growth Driving Alternate Resource Development:
  - Three Mile Island Plans to Reopen as Demand for Nuclear Power Grows
  - Hungry for Clean Energy, Facebook Looks to a New Type of Geothermal
- Brattle Report: Utility Ownership of New Renewables in New York State
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located

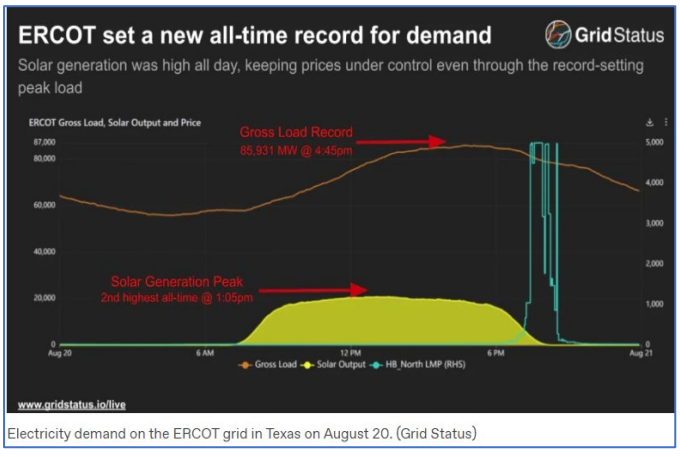
Canary Media: Solar and Batteries are Helping Texas Weather Heat Waves. Here's How

This Article describes how the ERCOT grid is benefitting from the use of energy storage during recent heat waves. The Texas power grid has broken new records throughout this summer, in terms of how much electricity it has had to deliver as residents cranked up their air conditioners, and for how much it has used solar power with batteries to keep grid emergencies at bay. Last August, temperatures soared into the triple digits across the state, causing demand to surge on the grid operated by the Electric Reliability Council of Texas (ERCOT).

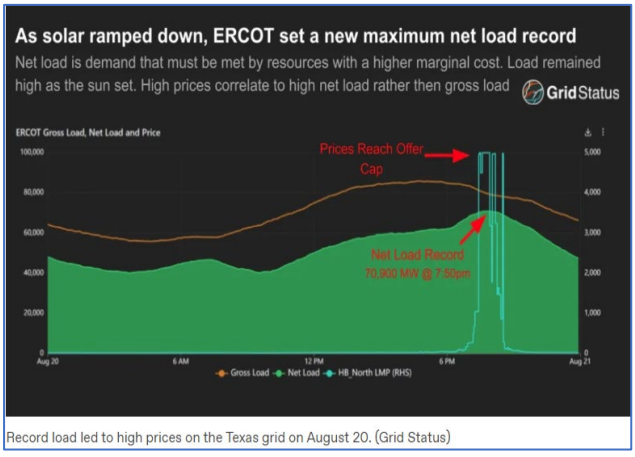
On August 20th, ERCOT set a new record for peak demand on its state-spanning power grid of 85,931 megawatts, edging out the 85,612 MW record set 10 days prior, according to data from Grid Status, a startup that collects and shares grid data from across the country. Luckily for the 22 million power customers reliant on ERCOT's grid, solar power generation also hit a near-record level of 20,799 MW on August 20, just below the 20,832 MW record set two days before. The solar power kept the supply matched to demand throughout the midday hours. Because solar is the cheapest source of electricity on the grid today, wholesale electricity prices remained low.

Then the sun started to go down and solar began to fade away. As temperatures were still high, air-conditioner use didn't wane. At 7:50 p.m. last Tuesday, ERCOT hit another record: 70,900 MW of "net load," a measure of the moment in the day when available generation capacity, minus solar and wind power, is furthest out of alignment with demand, forcing the grid to dispatch the highest-cost marginal resources.

Those marginal resources include fossil-gas-fired peaking plants (contracted expressly for the purpose), as well as data centers, factories, and other big customers being paid to limit their energy use to reduce demand. As ERCOT dispatched and depleted those resources, energy prices quickly spiked to reach their cap of $5,000 per megawatt-hour, as shown by the turquoise lines on the two charts below.



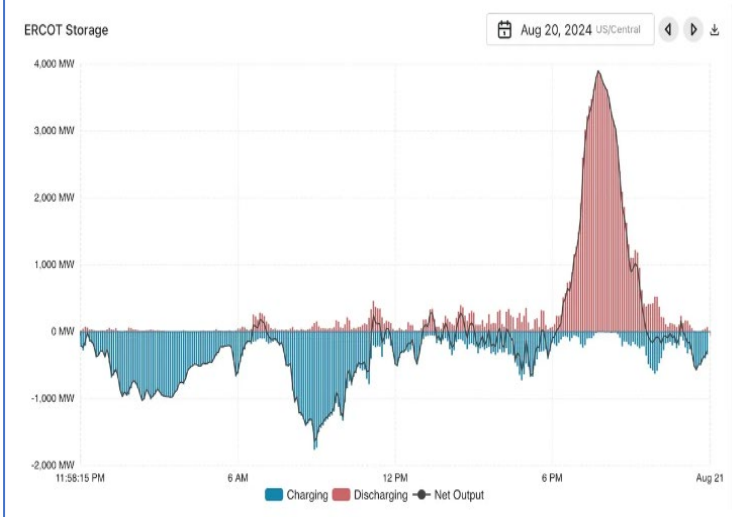
Electricity demand on the ERCOT grid in Texas on August 20. (Grid Status)



Record load led to high prices on the Texas grid on August 20. (Grid Status)

But just as they had during similar heat-driven grid peaks over the spring and summer, the batteries that had been storing up solar power throughout the day came to the rescue, and presumably earned a healthy profit for it.

Energy storage discharged to the grid hit its own record of 3,927 MW at 7:35 pm on August 20th, well above the prior record of 3,283 MW just the day before. As a result, ERCOT was able to avoid resorting to options like sending out emergency power conservation alerts to customers, or the measure of last resort, requiring utilities to institute "rolling outages," or turning off entire sections of the grid one after another to force down demand.



Batteries discharged in the evening to save the day. (Grid Status)

Last week, ERCOT's physical responsive capability, which is the capacity for power plants to spin up and customers to shut down at a moment's notice, had been approaching the threshold that could require ERCOT to consider implementing rolling outages. Instead, batteries swooped in and restored stability. What makes this more noteworthy is that Texas has become the leading state for wind, solar, and now battery deployments without any state-level clean-energy mandates driving that deployment.

California also saw enormous growth in solar power and batteries ease the heat-wave-driven grid stresses that had led to rolling outages in August 2020 and emergency conservation measures in September 2022. But that growth has been driven by decades of state clean-energy policy. In Texas, by contrast, ERCOT's competitive power-market structure and permissive grid interconnection rules have allowed clean resources to outcompete their fossil-fueled rivals. Texas topped the country for wind power in 2020, beat out California as the top state for utility-scale solar in 2023, and may out-deploy California on utility-scale battery systems this year.

All told, zero-carbon power from wind, solar, and nuclear accounted for 47% of the power delivered on ERCOT's grid in the first quarter of 2024, up from 40% throughout 2023. This shift has been driven almost entirely by utility-scale solar and batteries economically outcompeting fossil-fueled power plants. Solar and batteries have continued to expand even as Texas lawmakers last year pushed through a series of policies in support of fossil-fueled power plants. Those policies include a $5 billion low-interest loan program, which recently drew 72 applications seeking $24 billion to build as much as 38 gigawatts of new fossil-gas-fired power plants. They also include a plan to create a "performance credit mechanism" that would pay gas-fired generators more money for being available during grid emergencies.

But gas-fired power plants aren't always able to be available during such emergencies. Solar and batteries filled in gaps in gas-fired generation last spring, when a heat wave coincided with many power plants being offline for annual maintenance. And sometimes fossil-fueled power plants fail to come online or are forced to reduce their power output, particularly at times of extreme heat and extreme cold, which can cause operational problems.

Thermal outages for coal, gas, and nuclear power plants were 20% higher than ERCOT's forecasts during the heat wave, and 30% higher on August 20. But the biggest change from last summer to this summer is that Texas has increased its solar production from 13 GW to 21 GW and has roughly doubled its battery capacity over the past 12 months. Last year, the grid operators issued eleven such calls for conservation compared to none this year. The biggest difference has been the significant growth in both solar and storage.

NY Times: Three Mile Island Plans to Reopen as Demand for Nuclear Power Grows

This Article describes the events and background associated with Constellation Energy's announcement on September 20th that it had signed its largest ever power purchase agreement with Microsoft.

Microsoft, which needs tremendous amounts of electricity for its growing fleet of data centers, has agreed to buy as much power as it can from the plant for 20 years. Constellation plans to spend $1.6 billion to refurbish the reactor that recently closed and restart it by 2028, pending regulatory approval. The deal will create about 3,400 jobs and bring in more than $3 billion in state and federal taxes, according to the company. It also said the agreement will add $16 billion to Pennsylvania's GDP. The plant is expected to reopen in 2028. It will be renamed the Crane Clean Energy Center in honor of Chris Crane, who died in April and served as the CEO of Constellation's former parent company.

Three Mile Island became shorthand for the risks posed by nuclear energy after one of the plant's two reactors partly melted down on March 28, 1979, when one of the plant's two reactors' cooling systems malfunctioned. The other reactor kept operating safely for decades until finally closing, for economic reasons, five years ago. The reactor that will be reopened to power Microsoft's data centers was not involved in the accident.

Until recently, the U.S. nuclear industry seemed to be in permanent decline. Electric utilities closed 13 reactors between 2012 and 2022 in the face of competition from cheap natural gas and growing wind and solar power. With energy demand spiking and fears of climate change rising, states and businesses are reconsidering nuclear power, which can produce electricity around the clock without emitting greenhouse gases that heat the planet. Congress recently approved a tax credit aimed at keeping existing nuclear reactors running for years to come. In California, lawmakers reversed a decision to shut down the Diablo Canyon nuclear plant. In Michigan, Holtec International is looking to restart the Palisades nuclear plant, which closed in 2022.

It's no easy feat to reopen a nuclear reactor that has been mothballed for years. Constellation workers have been inspecting the closed reactor at Three Mile Island for the last 20 months, checking for signs of corrosion or decay. The company would need to replace the reactor's main power transformer as well as restore its turbines and cooling systems. It also needs about 600 workers to staff the plant. When Three Mile Island shut down in 2019, most of its employees were sent by Constellation to other states. Many are now eager to return.

In addition, restarting the reactor will require U.S. Nuclear Regulatory Commission approval following a comprehensive safety and environmental review, as well as permits from relevant state and local agencies. Additionally, through a separate request, Constellation will pursue license renewal that will extend plant operations to at least 2054

If restored, the reactor would have a capacity of 835 megawatts, enough to power more than 700,000 homes. It will remain unaffected by the other reactor that melted down in the 1970s, known as Unit 2, which is currently in the process of being dismantled.

One recent poll found that 57% of Pennsylvania residents supported reopening Three Mile Island "as long as it does not include new taxes or increased electricity rates. However, some people remain opposed to any restart. In August, about a dozen protesters stood outside the plant's gates to protest the potential reopening, holding up signs commemorating the accident and recalling how residents were forced to evacuate after the partial meltdown, which caused no casualties but triggered widespread panic.

Tech companies like Microsoft and Amazon have shown an increasing interest in nuclear power as they struggle to meet the growing energy demands of artificial intelligence. Data centers need power 24 hours a day, which wind and solar power alone can't provide. But many tech firms also have ambitious targets for fighting climate change and prefer not to use electricity produced by burning coal or gas.

Just a handful of recently retired reactors in the United States could plausibly be brought back online, however. That includes Three Mile Island, the Palisades plant in Michigan and the Duane Arnold plant in Iowa. The rest are too far along the process of decommissioning, experts said.

About Constellation:

A Fortune 200 company headquartered in Baltimore, Constellation Energy Corporation (Nasdaq: CEG) is the nation's largest producer of clean, carbon-free energy and a leading supplier of energy products and services to businesses, homes, community aggregations and public sector customers across the continental United States, including three fourths of Fortune 100 companies. With annual output that is nearly 90% carbon-free, our hydro, wind and solar facilities paired with the nation's largest nuclear fleet have the generating capacity to power the equivalent of 16 million homes, providing about 10% of the nation's clean energy. We are further accelerating the nation's transition to a carbon-free future by helping our customers reach their sustainability goals, setting our own ambitious goal of achieving 100% carbon-free generation by 2040, and by investing in promising emerging technologies to eliminate carbon emissions across all sectors of the economy.

Hungry for Clean Energy, Facebook Looks to a New Type of Geothermal

This New York Times Article (August 26) describes how Big Tech companies across the United States are struggling to find enough clean energy to power all the data centers they plan to build. Now, some firms are betting on a novel solution: harvesting the heat deep beneath the Earth's surface to create emissions-free electricity, using drilling techniques from the oil and gas fracking boom.

Meta, the company that owns Facebook, has announced an agreement with a start-up called Sage Geosystems to develop up to 150 megawatts of an advanced type of geothermal energy that would help power the tech giant's expanding array of data centers. Sage will use fracking techniques similar to those that have helped extract vast amounts of oil and gas from shale rock. But rather than drill for fossil fuels, Sage plans to create fractures thousands of feet beneath the surface and pump water into them. The heat and pressure underground should heat the water to the point where it can be used to generate electricity in a turbine, all without the greenhouse gases that are causing global warming.

Sage has already drilled a test well in South Texas to demonstrate its approach. The startup now aims to build its first large-scale power plant at a yet-to-be-determined location east of the Rocky Mountains, with the first phase coming online by 2027. The deal is the latest sign of growing excitement for new types of geothermal power that could provide enormous amounts of emissions-free electricity around the clock and complement more variable sources like wind and solar power.

Google has partnered with Fervo Energy, a prominent geothermal start-up, to build a 5-megawatt pilot plant in Nevada that has already begun supplying power to the grid. The two companies recently reached a deal to supply much more geothermal power in the years ahead to Google's data centers. Fervo is also building a 400-megawatt plant in Utah that will sell electricity to utilities in Southern California and is expected to come online starting in 2026.

Tech firms are facing an urgent need for more electricity, as growing interest in artificial intelligence has triggered a data center boom. An EPRI study estimated that data centers could consume 9% of U.S. electricity by 2030, up from 4 percent today. Data centers typically need power 24 hours a day, which wind turbines and solar panels alone can't provide. At the same time, many technology companies have promised to reduce their planet-warming emissions and face pressure not to rely on fossil fuels like coal or gas. So they are exploring technologies that can run around the clock, like nuclear or geothermal.

The United States has enough geothermal energy to power the entire country. Some are trying to unlock it by using techniques from the fracking boom. Geothermal power has been around for decades, but these plants were limited to places where underground hot water reservoirs were close to the surface. Only a few locations have the right geology for this, such as parts of California or Iceland, which is why geothermal currently provides only 0.4% of America's electricity.

In February, Fervo said it had already reduced drilling times by up to 70% in just one year. The Department of Energy estimates that geothermal resources could provide 90,000 megawatts of U.S. electric capacity by 2050, if technologies keep improving, a twentyfold increase from today. Still, next-generation geothermal energy gets significantly less federal funding than other technologies like hydrogen fuels or nuclear power, in part because it has only recently emerged as a promising energy source. That means support from climate-conscious tech companies could be crucial as geothermal start-ups navigate the risks of getting early projects built.

Related article: New York Times – August 28, 2023: Tools Born From Fracking Fuel Geothermal Rush

Brattle Report: Utility Ownership of New Renewables in New York State

This Whitepaper (Also see Press Release) was prepared by Brattle for Con Edison. It examines the potential impacts on electric customers as New York works to add large amounts of renewable resources over the next decade in order to achieve the state's energy and climate goals. The report examines the pros and cons for supplementing the state's current private ownership model for renewable energy with utility ownership.

Currently, the state's procurement of new renewables is achieved through New York State Energy Research and Development Authority (NYSERDA) contracts and New York Power Authority (NYPA) ownership. While this approach has attracted offers for renewable development, New York has fallen behind in its procurement targets due to supply chain interruptions and other challenges. This shortfall could potentially be mitigated by allowing utilities to develop and own renewable assets.

The authors used illustrative new solar PV and onshore wind generation projects to compare future costs for customers under two ownership models:

- Utility ownership and cost recovery under regulated cost-of-service rates and
- Private ownership with a fixed-price long-term Renewable Energy Credit (REC) - based power purchase agreement.

Results from the report found that the customer costs are broadly comparable between the utility ownership option and the private ownership option. However, in the scenarios we analyzed, customer costs for new solar generation tend to be slightly lower under private ownership, while utility ownership tends to result in lower costs for new onshore wind generation. Customer cost differences between the utility and private ownership models are driven by the following key drivers:

- Since the utility will include the capital cost of the renewable asset in its rate base, its rate of return is tied to its cost of capital approved in its general rate case. By comparison, publicly reported developer rates of returns are generally at least as high, if not higher, than utility-allowed returns. All else equal, this increases costs under the private ownership model.

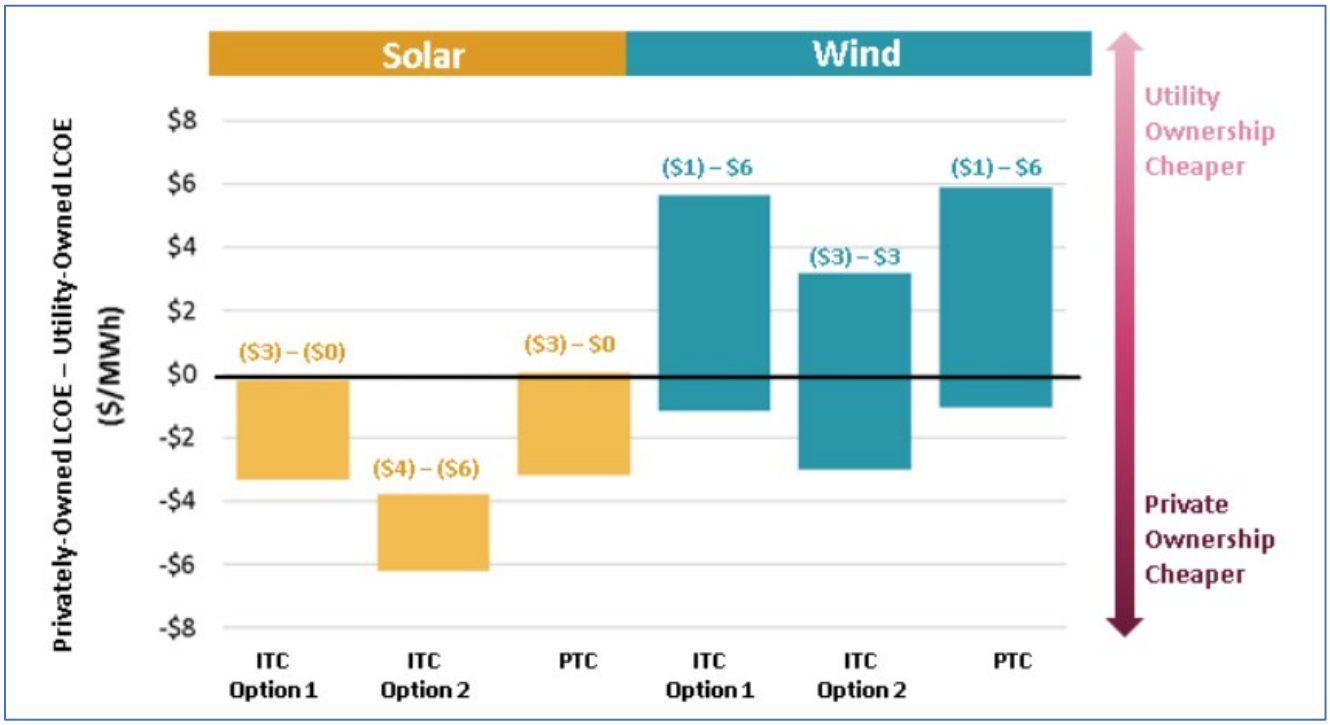
- Private developers can monetize federal tax credits through tax-equity financing relationships, which can reduce costs for customers. Unlike a developer, utilities must utilize Investment Tax Credits (ITCs) in one of two ways:
    - As an *Option 1 taxpayer*, the utility will reflect ITC benefits through a reduction in the rate base.
    - As an *Option 2 taxpayer*, the utility will reflect benefits from the ITC through reductions in revenue requirements outside the rate base.

  All things being equal, customers of an Option 2 utility will incur higher costs relative to customers of an Option 1 utility, as well as the private ownership structure. Alternatively, the utility can elect to receive Production Tax Credits (PTCs) rather than ITCs, in which case the benefits of the tax credits are accrued to customers in a manner similar to the private ownership model.

- Private developers can earn revenues by selling energy, capacity, and environmental attributes into the market after the contract period. The present value of any difference between those market revenues and operating costs during the post-contract period would offset the developer's costs to recover during the contract period (hence would affect the contract price). Lower post-contract prices provide a smaller offset to contract-period revenue requirements, but this is offset by lower customer costs for procuring and replacing energy, capacity, and environmental attributes in the market after the contract expires.

- However, in certain circumstances, the customer costs under utility ownership may be nearly equivalent to or lower than under private ownership. For example, higher discount rates for private owners reduce the cost differential between the utility ownership and private ownership models due to the higher return on capital requirements for the private developer during the contract period. Alternatively, the expectation of higher market prices during the post-contract period provides a larger offset to the contract-period revenue requirement, but the post-contract replacement costs would also be higher.

The figure below shows estimates for the range of differences in levelized costs between the private ownership model in comparison to the utility ownership model for solar and wind assets and tax credit assumptions. The range within each bar represents the impact of different inputs and assumptions based on the set of sensitivities evaluated (i.e., power prices, cost of capital, contract period, etc.). As shown in the figure, the utility ownership option could provide up to 14% customer cost savings relative to the private ownership option (positive bars), particularly in scenarios with high wholesale power prices and high cost of capital for private owners. However, the private ownership model results in up to 11% customer cost savings (negative bars) in other scenarios, including when the utility acts as an Option 2 taxpayer or there are low wholesale power costs.



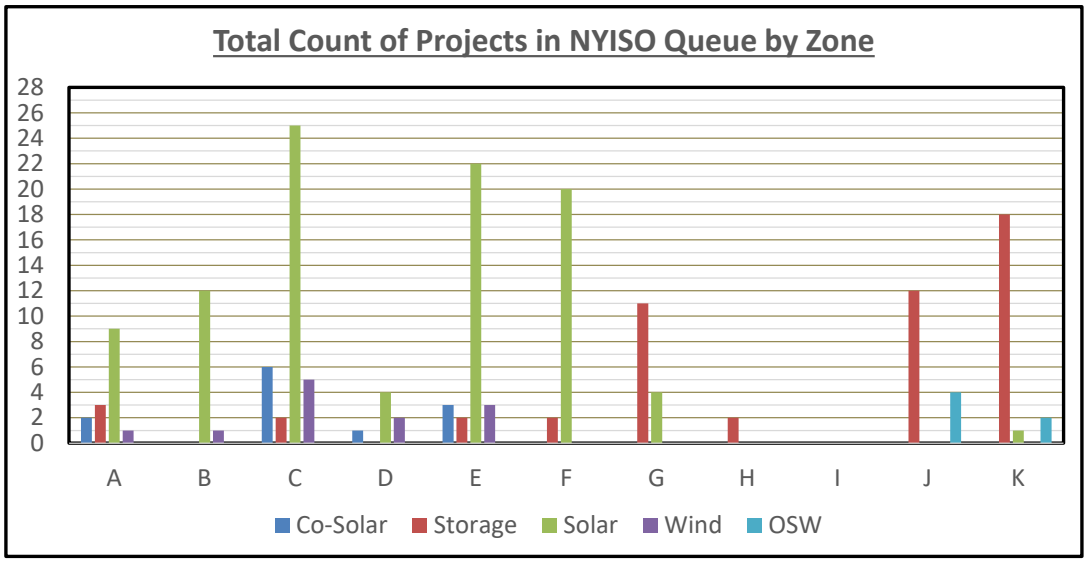
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

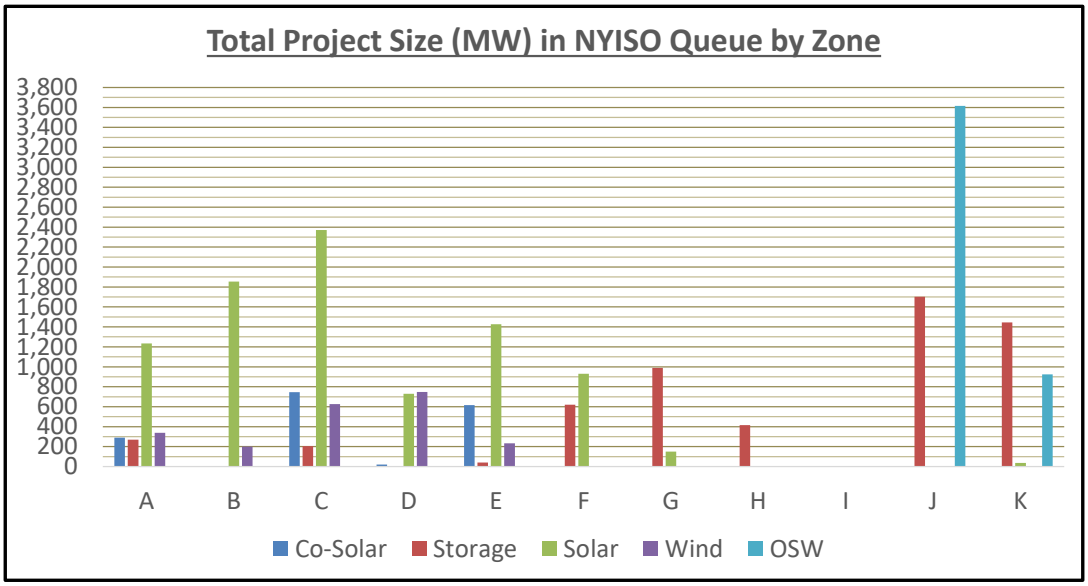
The intent is to track the growth of Co-Located Solar / Storage, Energy Storage, Solar, Wind, and Offshore Wind (OSW) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on September 20th, and representing the Interconnection Queue as of August 31st. Note that 120 projects were added, and 25 were withdrawn during the month of August.

Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	2	3	9	1	
B			12	1	
C	6	2	25	5	
D	1		4	2	
E	3	2	22	3	
F		2	20		
G		11	4		
H		2			
I					
J		12			4
K		18	1		2
State	12	52	97	12	6

Total Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Storage	Solar	Wind	OSW
A	290	270	1,235	339	
B			1,855	200	
C	745	205	2,371	626	
D	20		730	747	
E	615	40	1,426	232	
F		620	931		
G		989	150		
H		416			
I					
J		1,703			3,616
K		1,445	36		924
State	1,670	5,688	8,733	2,144	4,540

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	Solar	Storage	Solar	Wind	OSW
A	145	90	137	339	
B			155	200	
C	124	103	95	125	
D	20		183	374	
E	205	20	65	77	
F		310	47		
G		90	38		
H		208			
I					
J		142			904
K		80	36		462
State	139	109	90	179	757


Total Count of Projects in NYISO Queue by Zone
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
A
B
C
D
E
F
G
H
I
J
K
Co-Solar
Storage
Solar
Wind
OSW


Total Project Size (MW) in NYISO Queue by Zone
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
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800
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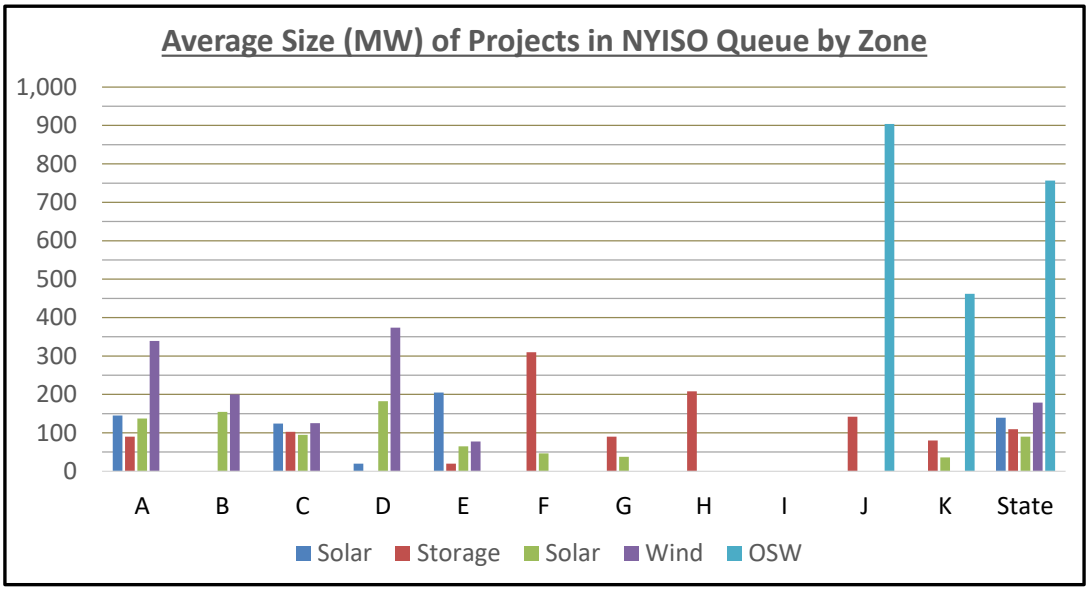
Co-Solar
Storage
Solar
Wind
OSW


Average Size (MW) of Projects in NYISO Queue by Zone
1,000
900
800
700
600
500
400
300
200
100
0
A
B
C
D
E
F
G
H
I
J
K
State
Solar
Storage
Solar
Wind
OSW