De-Carbonization / DER Report for NYSRC Executive Committee Meeting 3/11/2022

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The March 2022 edition of the De-Carbonization / Distributed Energy Resources (DER) Report includes the following items:

- NERC ERATF Workshop Follow-up
- 60 Minutes Program Feature: How Secure is America's Electric Grid
- Results of New York Bight Offshore Energy Lease Sale
- EPRI Climate Activities and New Initiatives
- NYISO Blog: Buyer Side Mitigation, Challenges and Opportunities with Clean Energy, Forecasting
- Snapshot of the NYISO Interconnection Queue: Storage / Solar / Wind / Co-located Storage

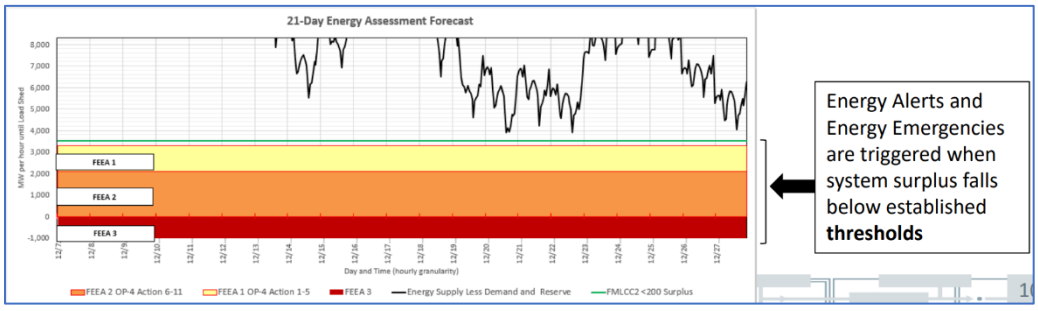
NERC ERATF Workshop Follow-up

On February 16th, NERC hosted an industry workshop to discuss the key findings and recommendations from a technical paper written by the Energy Reliability Assessment Task Force (ERATF). Here are links for the Workshop's Agenda, Presentations, and Speaker Bios. A series of presentations covered the impacts of variable Energy Resources on planning and resource adequacy studies, and included speakers from ISO-NE, AESO, CAISO, Southern, Bonneville, ERCOT, DOE, ESIG, NREL and EPRI.

Key Take-aways from the ISO-NE presentation include:

- This is not just a cold weather problem affecting certain regions. The emerging resource base is becoming increasingly energy-constrained by fuel availability, weather, and limitations of the energy supply chain
- This is not just a problem affecting a few "at risk" units
    - Large amounts of resources can be impacted at the same time
    - Regions may not be able to cover their neighbor's energy shortfalls if are all facing similar challenges simultaneously
    - Transmission solutions would need to extend to areas beyond those affected by a widespread extreme-weather event
- Energy assessments can help us identify these problems, and each region can formulate risk mitigation solutions

ISO-NE built a 21-day energy forecast to enhance situational awareness and is exploring ways to value resource capacity contributions toward resource adequacy in a more effective way.



The Energy Reliability Assessment Task Force serves the Reliability and Security Technical Committee (RSTC) in providing a formal process to analyze and collaborate with stakeholders to address the issues identified in the whitepaper entitled *Ensuring Energy Adequacy with Energy-Constrained Resources* (published in December 2020). This whitepaper identified energy availability concerns related to operations, operations planning, and mid- to long-term planning horizons. Background information can be found in the NERC ERATF Work Plan 2020-2022 (published February 19, 2021)

60 Minutes Program Feature: How Secure is America's Electric Grid?

This 13-minute Feature, hosted by Bill Whitaker, included interviews with Jon Wellinghoff, who was the chairman of NERC from 2009 through 2013, as well as other key players. Key points included:

- A coordinated attack on a relatively small number of critical substations (less than 20, maybe as low as 9) could plunge the U.S. into darkness.
- A review of the attack on the Metcalf Substation near San Jose, California on 4/16/2013.
- The previous Russian cyberattack on the Ukraine Power Grid, which knocked out about 60 substations, and 230,000 customers.

The program identified three publications from the National Academy of Sciences, now downloaded to the S&TO EPRI Website, shown below with publication dates, links and main chapter headings:

Terrorism and The Electric Power Delivery System (2012)

- The Electric Transmission and Distribution System as a Terrorist Target
- The Electric Power System Today
- Physical Security Considerations for Electric Power Systems
- Vulnerabilities of Systems for Sensing, Communication and Control
- Vulnerabilities Related to the People Who Run the Electric Power System
- Mitigating the Impact of Attacks on the Power System
- Restoration of the electric Power system After an Attack
- Strategies to secure crucial services and Critical Infrastructure in the event of an extended power outage
- Research and Development Needs for the Electric Power Delivery System
- Recommendations

Enhancing the Resilience of the Nation's Electricity System (2017)

- Many Causes of Grid Failure
- Strategies to Prepare for and Mitigate Large Area, Long Duration Blackouts
- Strategies for Reducing the Harmful Consequences From loss of Grid Power
- Restoring Grid Function After a Major Disruption
- Insights and Recommendations

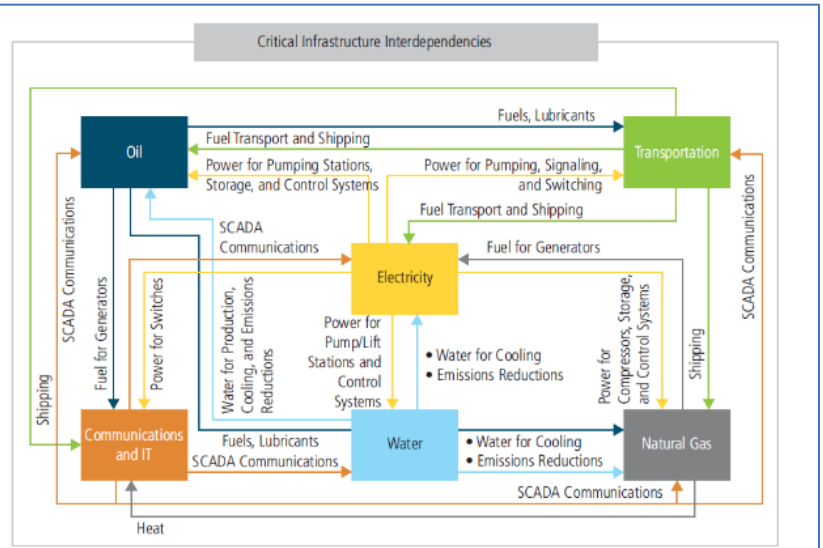


FIGURE 4.5 Disruption of any material or service that the electricity system relies on can result in loss of electric service and make restoration more challenging.
NOTE: SCADA, supervisory control and data acquisition.
SOURCE: DOE (2017).

[The Future of Electric Power in the United States (2021)]

- Drivers of change
- Legal and Regulatory Issues that Shape the Electric System
- The Persistent Underinvestment in Electric Power Innovation
- Technologies and Tools to Enable a Range of Future Power Systems
- Creating a More Secure and Resilient Power System
- High Level Needs and Specific Recommendations

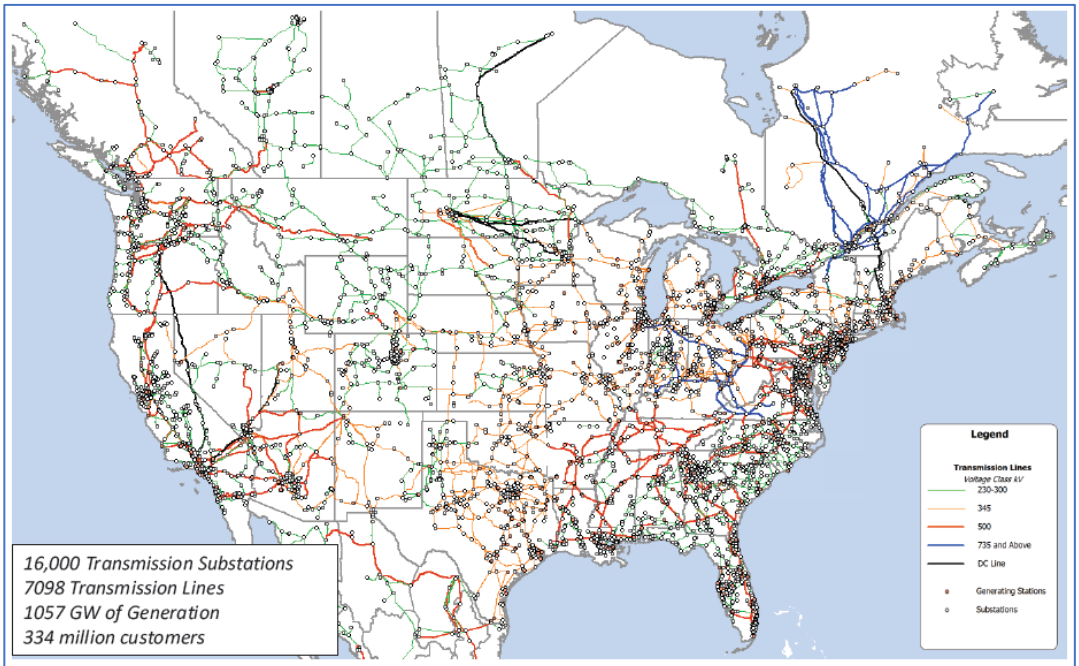


FIGURE 1.3 Diagram of the U.S. high-voltage transmission system. SOURCE: North American Electric Reliability Corporation, 2016, "Critical Infrastructure Protection Committee (CIPC)," presentation March 8–9, https://www.nerc.com/comm/CIPC.

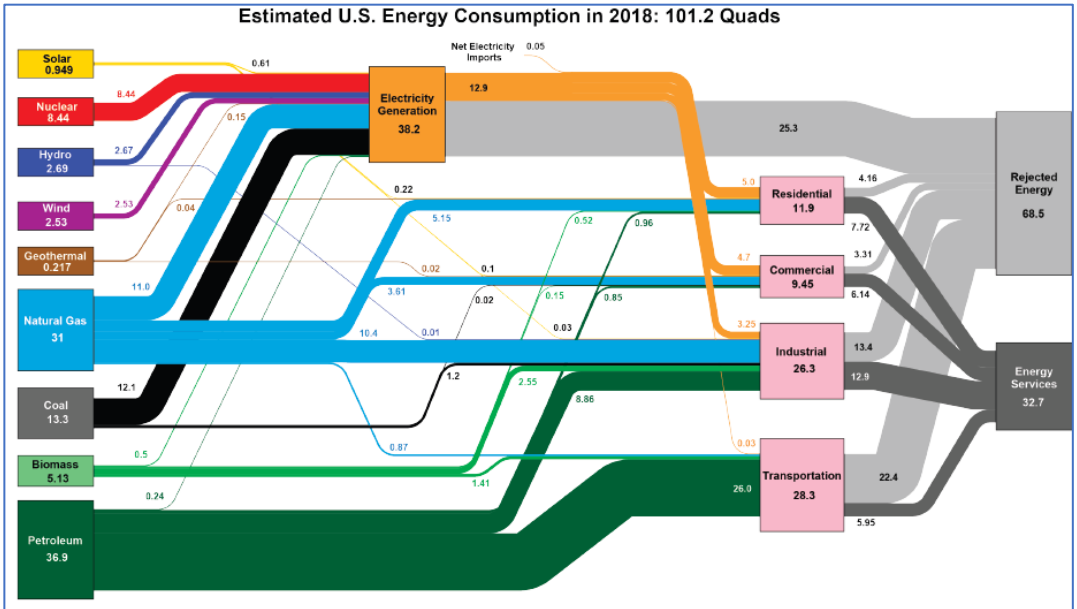
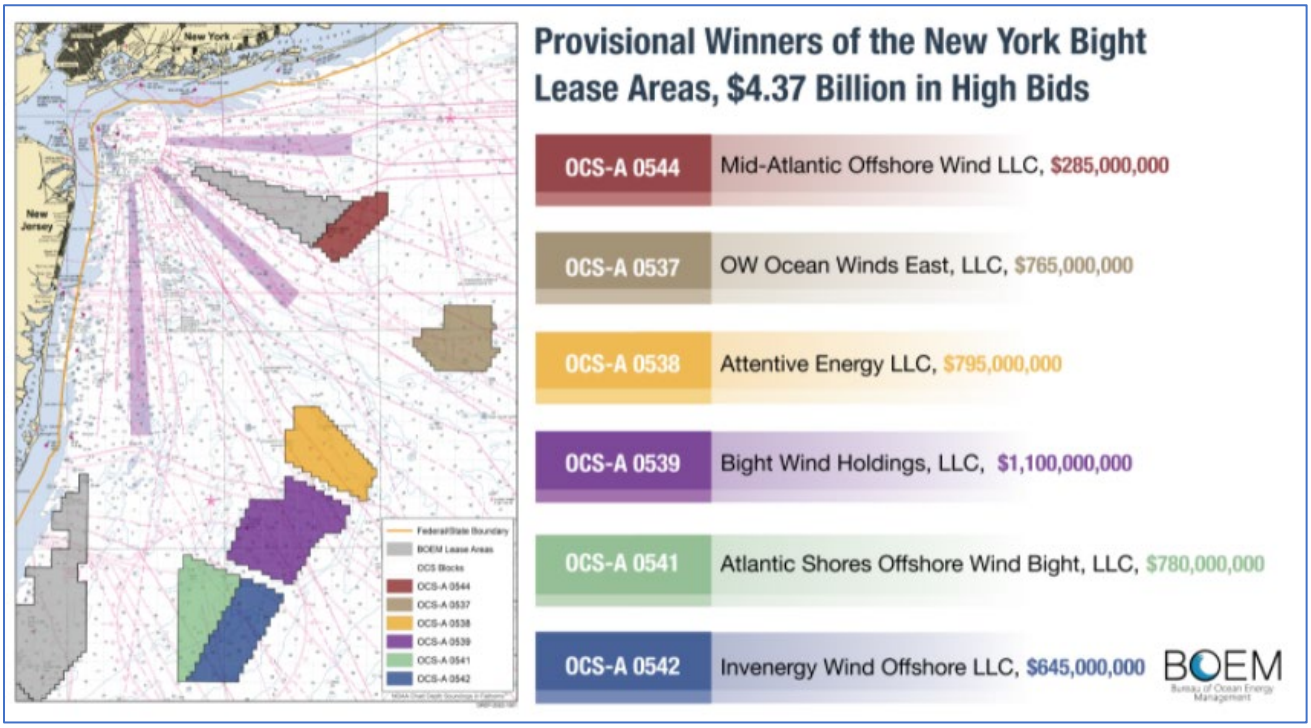


FIGURE 2.1 Energy flows in 2019, U.S. data. In 2019, less than 0.1 percent of energy going into the transportation sector was in the form of electricity, with 91 percent coming from petroleum. In comparison, commercial and residential sectors were getting 49 percent and 41 percent respectively from electricity. Industrial use of electricity was less, at only 12 percent of industrial energy use. SOURCE: Lawrence Livermore National Laboratory, 2018, "Energy US 2018," https://flowcharts.llnl.gov/content/assets/images/energy/us/Energy_US_2018.png.

Results of New York Bight Offshore Energy Lease Sale

On February 25th, the US Department of the Interior announced the results of the nation's highest-grossing competitive offshore energy lease sale in history, including oil and gas lease sales, with the New York Bight offshore wind sale. The sale offered six lease areas totaling over 488,000 acres in the New York Bight for potential wind energy development and drew competitive winning bids from six companies totaling approximately $4.37 billion. The provisional winners of today's lease sale are shown below along with the parcels and winning bids:



The New York Bight offshore wind leases include innovative stipulations designed to promote the development of a robust domestic U.S. supply chain for offshore wind energy and enhance engagement with Tribes, the commercial fishing industry, other ocean users and underserved communities. The stipulations will also advance flexibility in transmission planning. Stipulations include incentives to source major components domestically – such as blades, turbines and foundations – and to enter into project labor agreements to ensure projects are union-built.

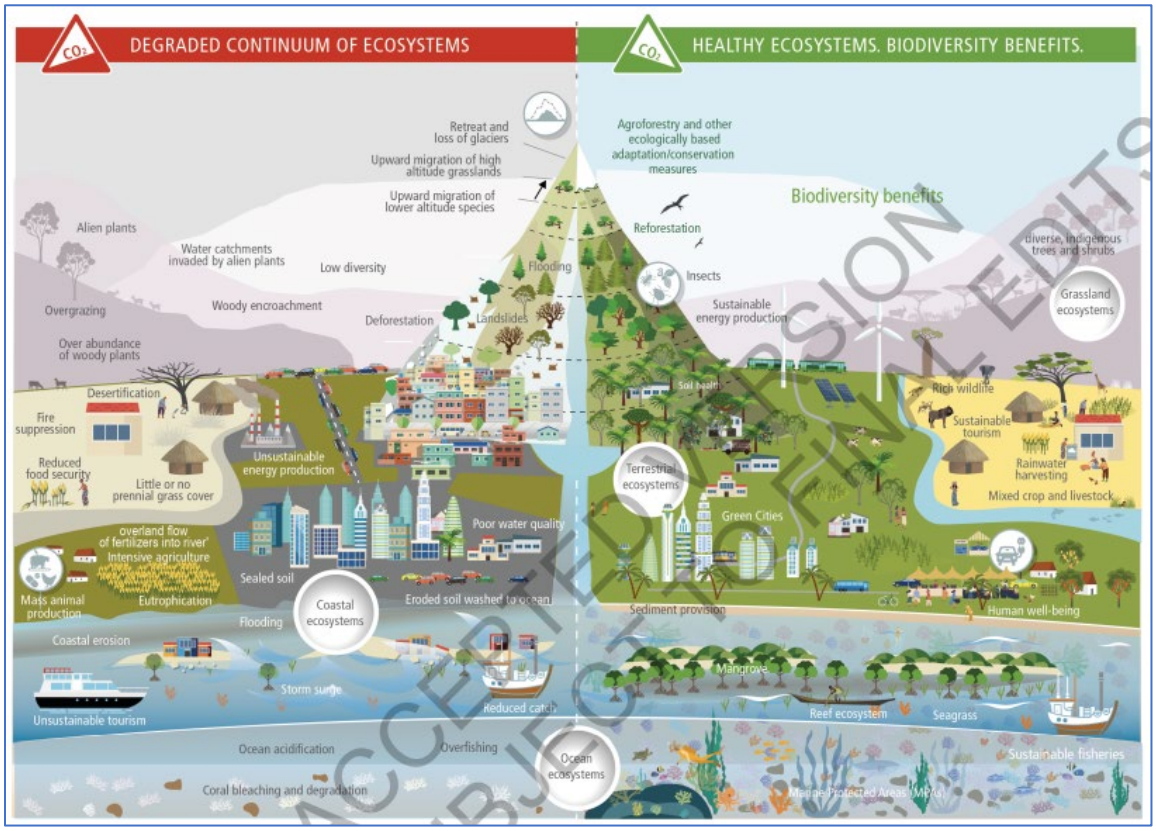
Parcels range in size from 43,000 acres to 126,000 acres. The Bureau of Ocean Energy Management (BOEM) expects to review at least 16 plans to construct and operate commercial offshore wind energy facilities by 2025, which would represent more than 22 GW of clean energy for the nation. More information about the auction can be found on BOEM's website.

EPRI Climate Activities and New Initiatives:

On February 28th, EPRI issued a press release regarding the activities of the Intergovernmental Panel on Climate Change (IPCC), which is an agency formed within the United Nations (and supported by EPRI) to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options. The IPCC has released its second (of four) installments of their Sixth assessment report, which evaluates the impacts of climate change - looking at ecosystems, biodiversity, and human communities at global and regional levels. The report also reviews vulnerabilities and the capacities and limits of the natural world and human societies to adapt to climate change. Here are links for the Executive Summary (37 pages), Technical Summary (96 pages), and Full Report (3,676 pages).

The reports highlighted the following broad themes:

- Climate change will affect all natural and human systems.
- More climate change is expected, and climate risks will increase, but there are opportunities to manage those risks.
- Adaptation and resilience planning will be needed, how much will depend on the world's emissions pathway and changes in adaptation effectiveness.
- Managing climate risks will require consideration of societal factors, integration of adaptation and mitigation planning, and balancing of multiple societal priorities.
- Economic impacts increase with global warming level, but the specific implications are not well understood and highly uncertain.



The conclusions drawn from this report are sobering: "The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a livable and sustainable future for all."

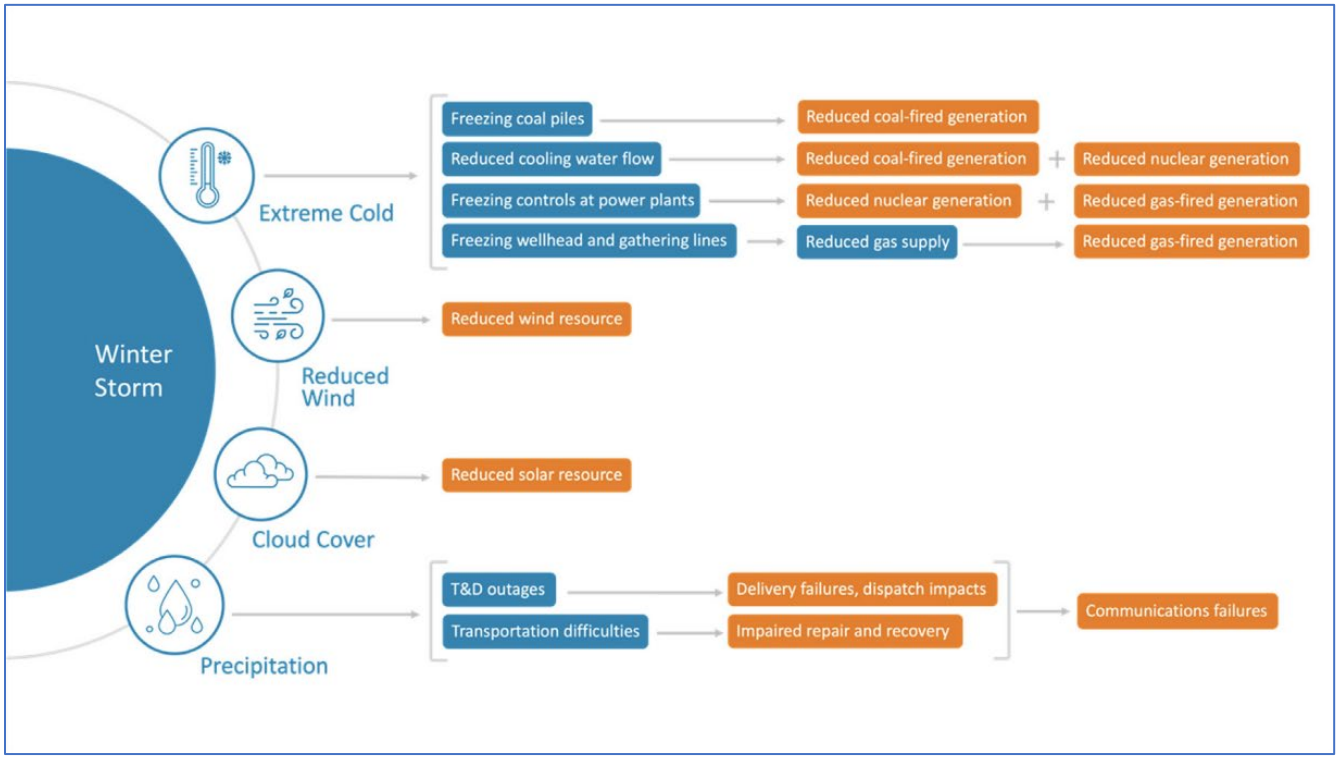
EPRI Climate Activities and New Initiatives (Continued):

EPRI has published Quick Insights: Extreme Weather Considerations for Resource Adequacy, which shows how these extreme weather events can have significant impacts on the ability of the electric sector to meet customer demand.

The study cited several examples, including a heatwave in California in August 2020, which drove a high system demand for air conditioning. A shortfall between supply and demand resulted in rolling outages of between 500 megawatt (MW) and 1000 MW on August 14th and 15th. Key factors that influenced the outages included:

- The heatwave was a one in 30-year event and resulted in a peak demand 2.2 gigawatt (GW) higher than forecast on August 14th
- Solar and wind generation supplied less than the day ahead forecast. The high "net demand peak" occurred as behind-the-meter solar decreased in the evening as air conditioning (AC) demand from the bulk system ramped up.
- Demand response resources underperformed. Of a potential 1,472 MW, 910 MW of actual load drop was achieved. However, demand response performed well in the days after the event, preventing further load shed.
- The widespread nature of the heatwave limited imports from neighboring regions. Import bids were 40–50% higher than imports under resource adequacy obligations. This indicates an overdependence on non-contractual obligations which impacted supply.
- Faulty market design issues, and under-scheduling of demand, obscured the tight supply challenges in the day-ahead market.

The figure below shows the relationships between extreme weather events and power system failures. These events may have multiple dimensions that can begin causal chains resulting in common-mode outages.



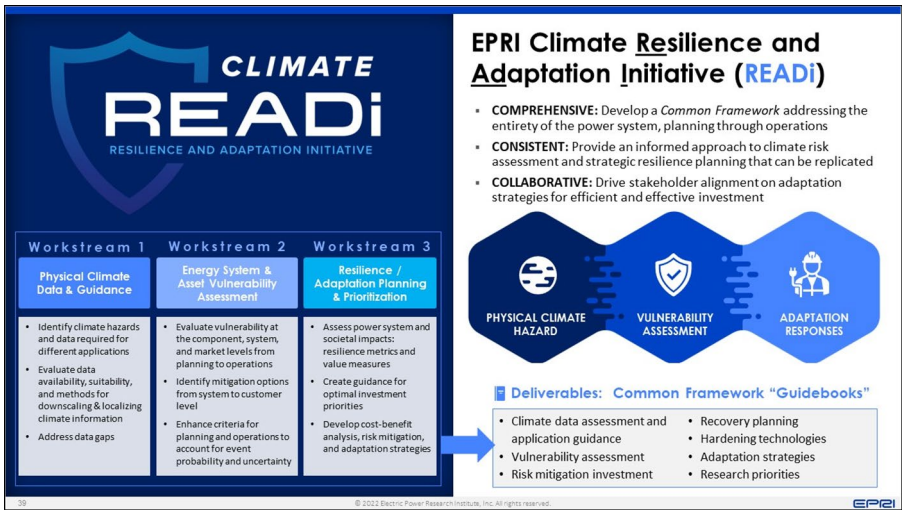
EPRI Climate Activities and New Initiatives (Continued):

The report suggests that traditional methods of assessing resource adequacy do not cover the full extent of causes behind recent power outages. While there is confidence in the trends for extreme heat and cold events, their impact on long-term changes in wind and solar are not considered. A new modeling approach would be needed to incorporate changes in extreme event frequency and duration, along with increasing variability of weather patterns. As extreme weather events may be major influences on the amount of capacity required, analysts should consider studying these extremes to determine whether adding capacity is the best way to prepare for them.

Future research topics for resource adequacy planning, including extreme weather, include the following:

- Demand response and demand-side participation may become more valuable as more variable renewable resources continue to be added onto the grid. Model accuracy will be important to address a realistic value while also recognizing limitations.
- Inter-region reserve and capacity sharing may become important with increased renewables on the grid. A larger footprint means increased load and renewable generation diversity. More thorough modeling of neighboring grids and transmission capability may be needed to support reserve-sharing.
- Exploring the need for low or zero carbon 'clean firm' resources to provide capacity and energy during relatively low wind/solar output periods, and how to ensure these are modeled in studies.
- How markets may ensure that attributes related to adequacy and resilience are properly incentivized.
- Explicitly evaluating flexibility in resource adequacy analyses as opposed to solely evaluating capacity adequacy.
- Further understanding how dual events can affect resources. For example, extreme heat events during drought conditions could impact the ability of hydropower resources to serve a stressed grid.
- Improved integration of both historical weather and climate model projection data into the development of resource adequacy planning scenarios.

EPRI also announced a series of joint workshops with the ENEL Foundation (EF) under a new Climate Resilience and Adaptation Initiative (READi). The workshops will address physical climate risk assessments, potential vulnerabilities, adaptation strategies and technologies across system assets and resources, and implications for grid operations and planning. Upon completion of the joint technical workshops, EPRI and EF will issue a white paper summarizing key findings and identifying future research priorities.



EPRI has an entire program devoted to Energy Systems and Climate Analysis (ESCA). Their latest Newsletter provides notifications of upcoming events, workshops and webcasts, highlights of recent activities, and links to various reports ad contacts for further information.

NYISO: Announcements on the Blog Page of the NYISO Website:
Features from the Blog Page of the NYISO Website are as follows:

Podcast: How Comprehensive Mitigation Reform will remove barriers for new Clean-Energy Resources.
Director of Market Design Mike DeSocio, and Manager of Capacity Market Design Zach T. Smith discuss the proposed Buyer-side mitigation (BSM) rules, which look to ensure that no single resource could have an unfair competitive advantage over another, including out-of-market payments. Many new wind and solar resources entering the market receive government subsidies because of their clean-energy attributes. Without reform, current BSM rules could limit how these clean energy resources could compete in the wholesale markets. The concern was that existing rules could make electricity more expensive and limit new investment in clean energy.

The other important component of these reforms is known as Resource Capacity Accreditation, which looks to value the contribution that each resource has toward reliability. Battery storage, for instance, will have additional value because it can provide flexible power to offset clean energy when renewables are unavailable.

Video: The State of the Grid: The first of a multi-part series exploring the challenges and opportunities in pursuit of a reliable, clean energy. This episode includes interviews with NYISO President and CEO Rich Dewey, NYISO Executive Vice President Emilie Nelson, and former FERC Chair Norman Bay as they share thoughts on the rapid changes necessary to meet the mandates of the Climate Leadership and Community Protection Act.

VIDEO: Forecasting Power Usage from 5 Minutes to 20 Years; a Look Behind the Scenes.
This interview with Chuck Alonge (Manager of Demand Forecasting and Analysis at NYISO) describes how the load forecasting group supports the reliability of the grid by providing forecasts to support both the real-time operations of the system and the long-range reliability needs over the next decade. Factors include weather, economic factors and, most recently, changes in load patterns due to the global COVID-19 pandemic. Longer term forecasting (from 10 to 20 years into the future) requires more attention to trends. Examples include the expected adoption of electric vehicles and electric building heat that can increase demand, or new types of energy-efficient appliances that could reduce demand. The load forecasting team also evaluates demographic and economic shifts, such as the impact of electrification changing the peak load season from summer to winter.

FAQ: on Winter Pricing
In response to the increase in costs for electricity impacting consumers throughout the state, this NYISO publication looks to provide answers to common questions involving:

- The role of wholesale prices in retails electric bills
- How do NYISO markets respond to these price impacts
- The practical difference between the Real-Time and Day-Ahead Market and why they are not the same
- Who pays for the NYISO's operating expenses, and how costs get passed on to household consumers
- Understanding Supply and Delivery costs
- Strategies for reducing energy usage, including this link to the New York State DPS Home Energy Assistance Program (HEAP)

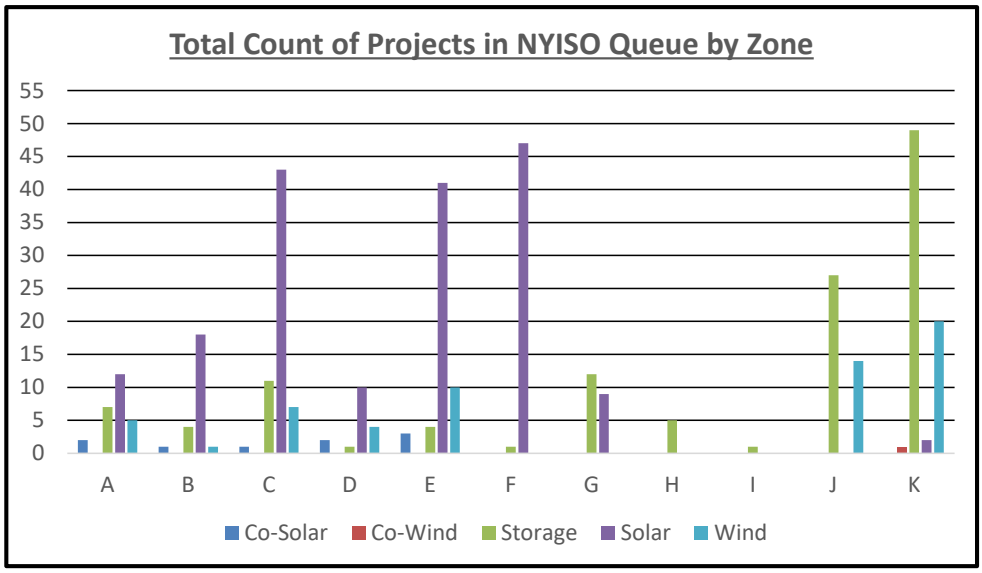
Interconnection Queue: Monthly Snapshot – Storage / Solar / Wind / CSRs (Co-located Storage)

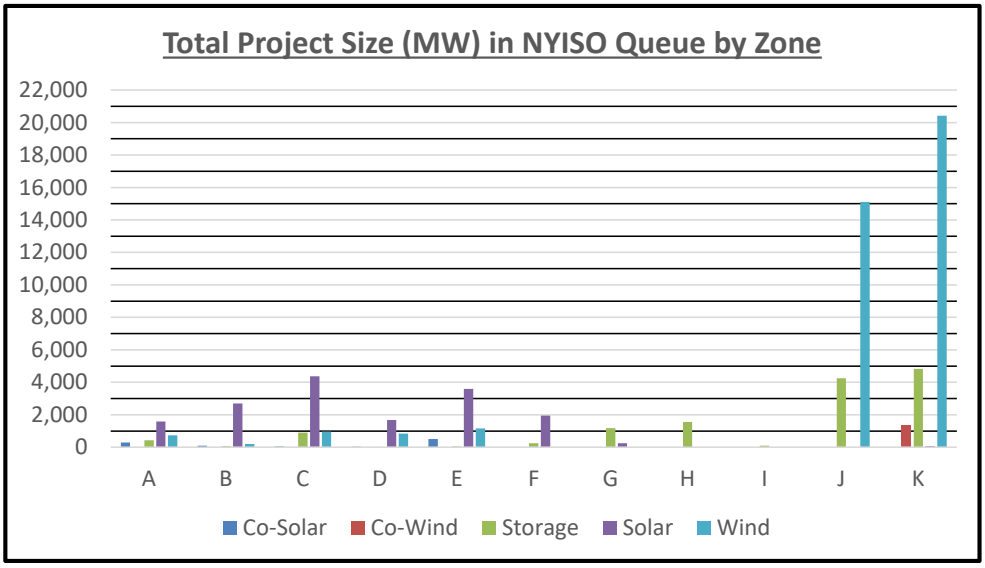
The intent is to track the growth of Energy Storage, Wind, Solar and Co-Located Storage (Solar and Wind now in separate categories) projects in the NYISO Interconnection Queue, looking to identify trends and patterns by zone and in total for the state. The information was obtained from the NYISO Interconnection Website, based on information published on February 21st, and representing the Queue as of January 31st. Note that 6 projects were added, and 7 were withdrawn during the month of January. Results are tabulated below and shown graphically on the next page.

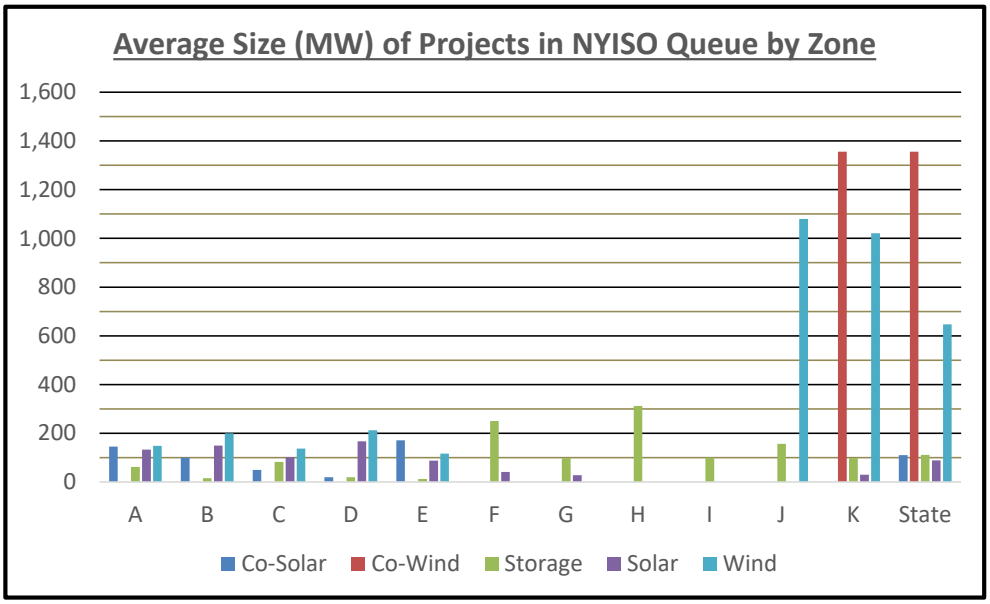
Total Count of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	2		7	12	5
B	1		4	18	1
C	1		11	43	7
D	2		1	10	4
E	3		4	41	10
F			1	47	
G			12	9	
H			5		
I			1		
J			27		14
K		1	49	2	20
Grand Total	9	1	122	182	61

Total Project Size (MW) in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	290		430	1,590	741
B	100		61	2,695	200
C	50		908	4,369	960
D	40		20	1,674	847
E	513		50	3,599	1,165
F			250	1,957	
G			1,173	250	
H			1,560		
I			100		
J			4,241		15,112
K		1,356	4,821	59	20,418
Grand Total	993	1,356	13,614	16,192	39,444

Average Size (MW) of Projects in NYISO Queue by Zone					
Zone	Co-Solar	Co-Wind	Storage	Solar	Wind
A	145		61	132	148
B	100		15	150	200
C	50		83	102	137
D	20		20	167	212
E	171		13	88	117
F			250	42	
G			98	28	
H			312		
I			100		
J			157		1,079
K		1,356	98	29	1,021
State	110	1,356	112	89	647


Total Count of Projects 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
1,600
1,400
1,200
1,000
800
600
400
200
0
A
B
C
D
E
F
G
H
I
J
K
State
Co-Solar
Co-Wind
Storage
Solar
Wind