New York ISO
Independent System Operator

Planning for a Grid in Transition

Zach Smith

Vice President, System & Resource Planning

Environmental Advisory Council

November 7, 2023

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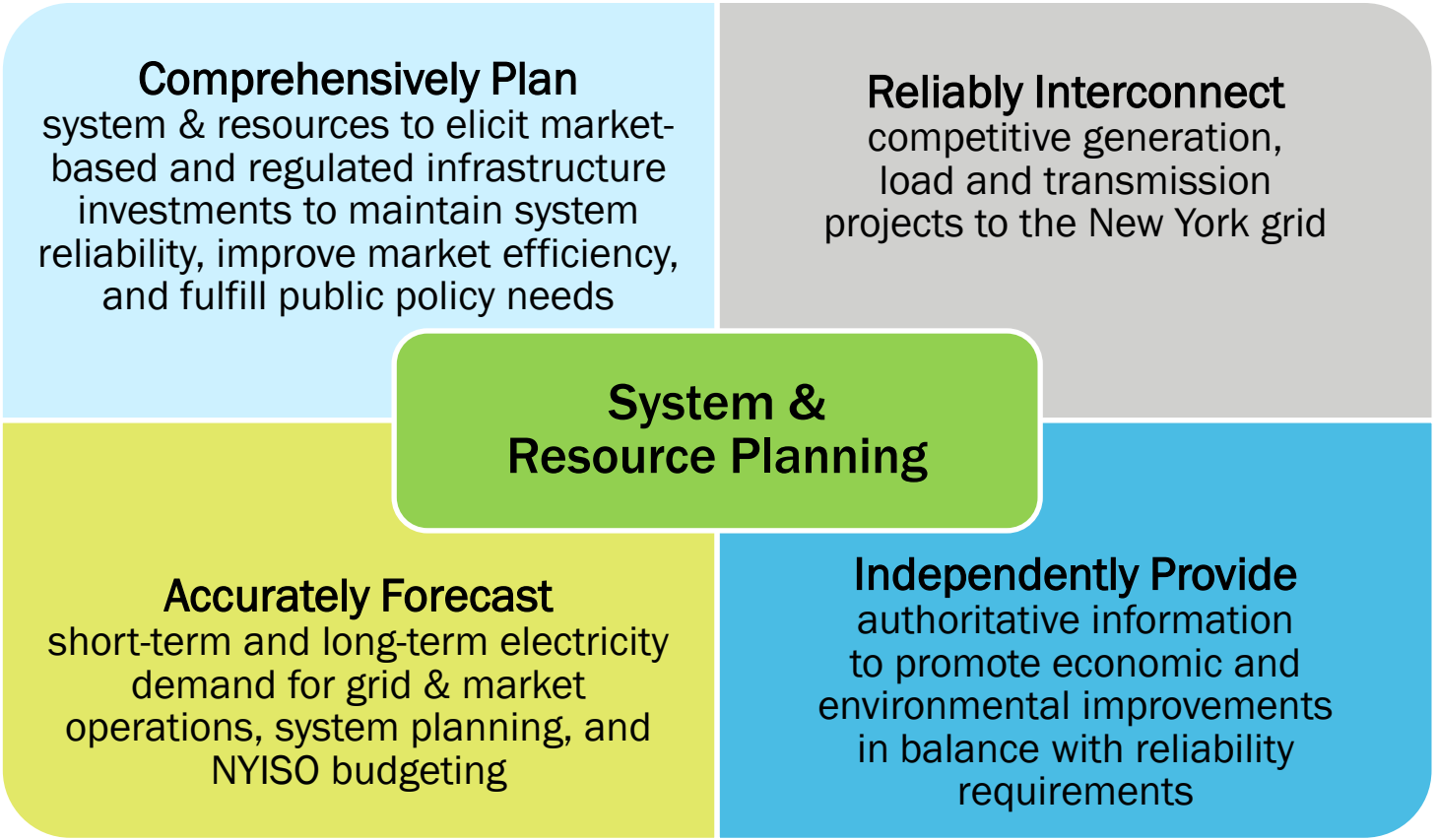

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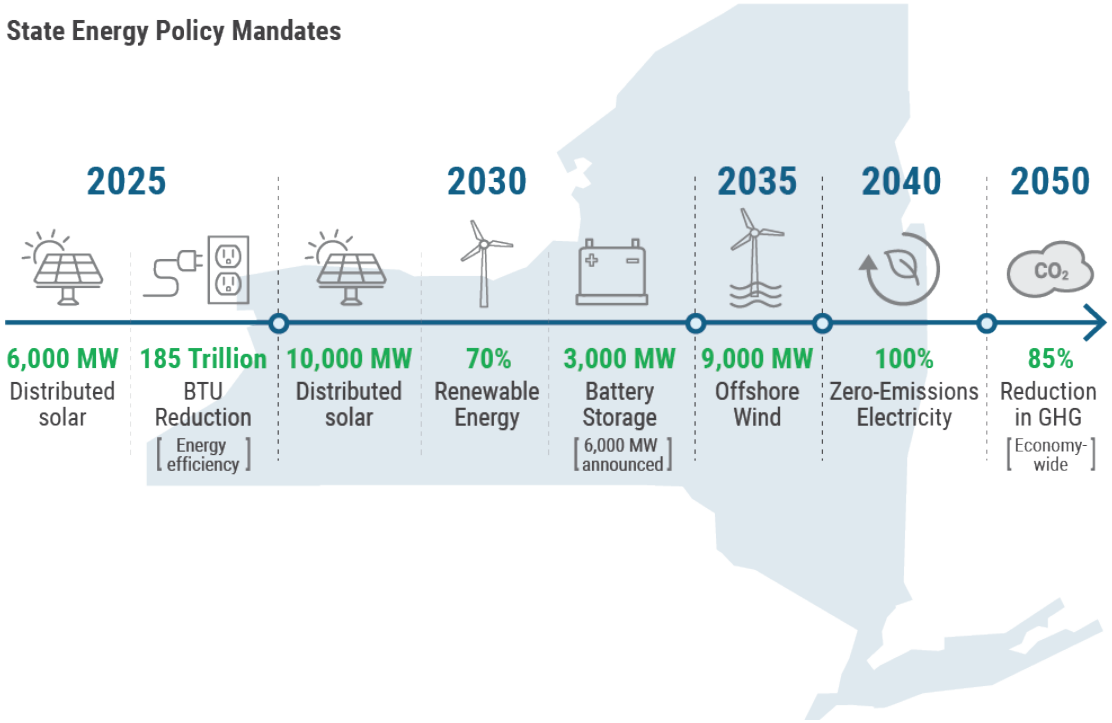
Public Policy Influence on Resource Mix

- Public policies are shaping investment on the grid, particularly the CLCPA
- Competitive markets will channel investment to achieve these goals while maintaining reliability at the lowest possible cost



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Demand Forecasting

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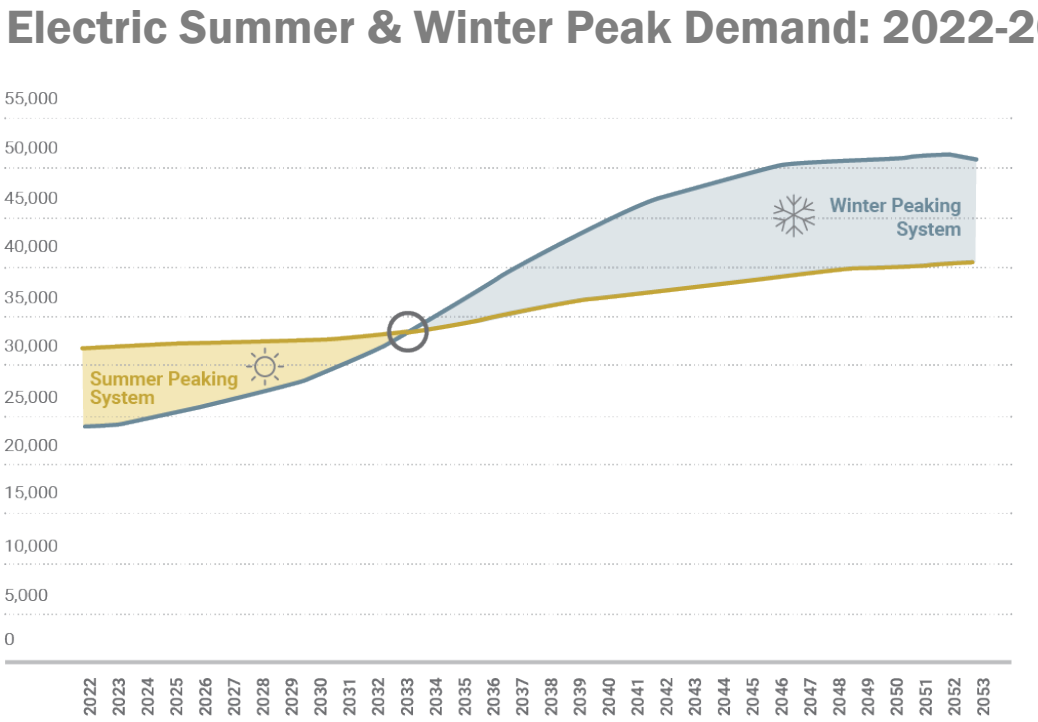
Demand Trends: Peak Demand Forecast

- The NYISO winter and summer peak load forecasts suggest that electrification will drive a shift in NY from a summer-peaking system to a winter-peaking system.
- The timing and degree of this shift will be influenced by EV and heat pump technology adoption.



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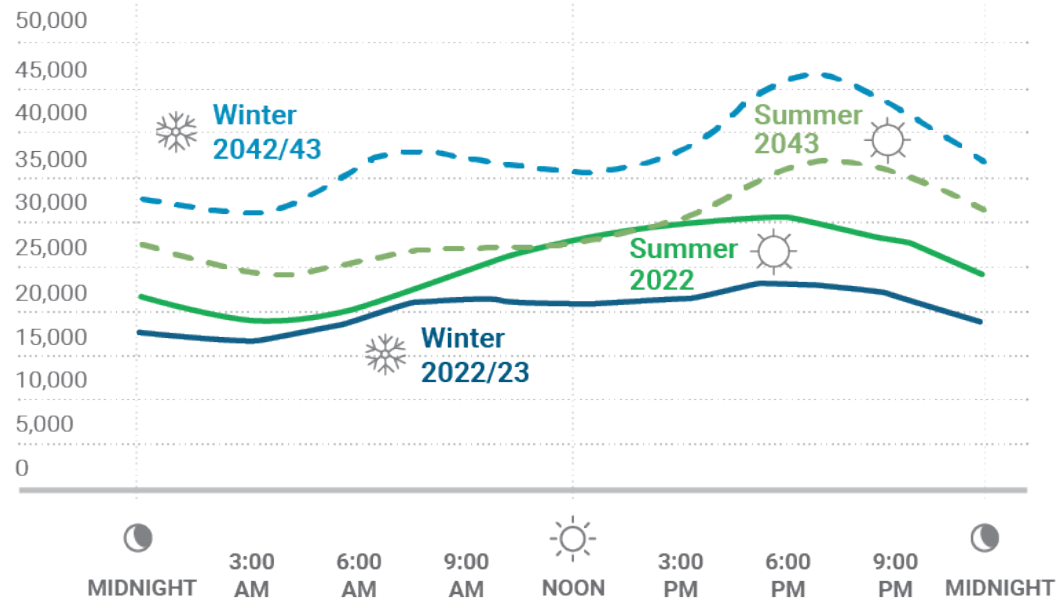
High-Demand Patterns: Current & Forecast

Load shapes for high-demand days are expected to shift in the future.

- Electrification will lead to increased overall demand
- BTM solar resources will likely push peak demand to later in the day

Actual & Projected Hourly Demand: Winter-Summer



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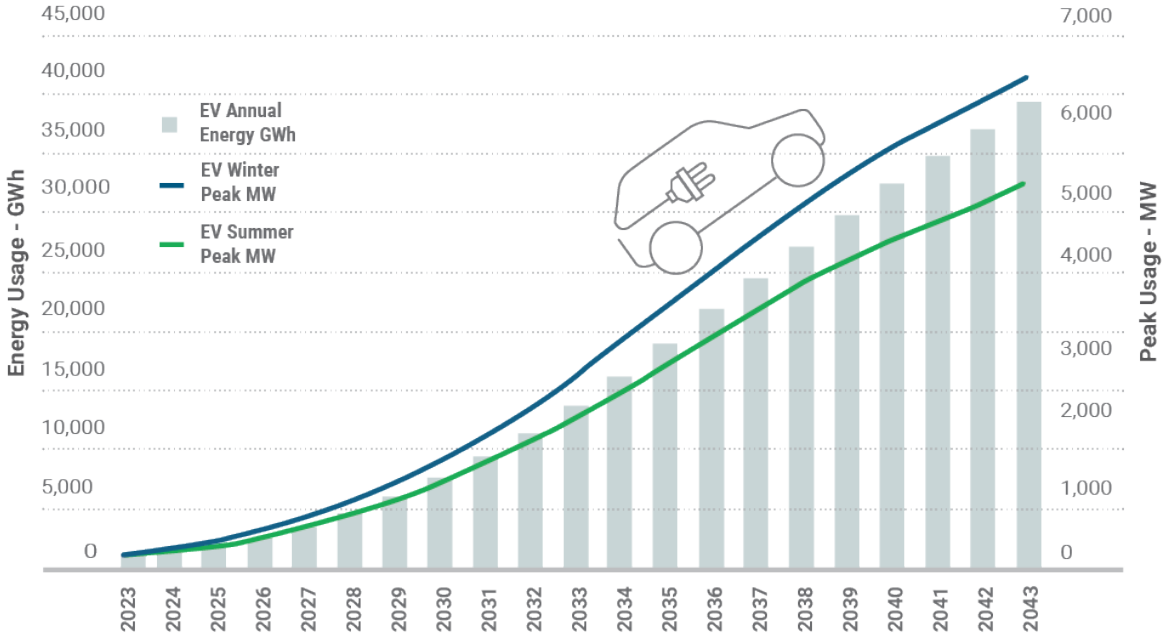
Electric Vehicle Energy & Peak Impacts Forecast

2023-2043

- Forecast of EV impacts on summer and winter peak demand and energy usage.
- Assumes over 7.3 million EVs on the road in NYS by 2043 compared to less than 200,000 today.
- The impacts on peak demand periods may be mitigated through policies that encourage off-peak charging.



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System & Resource Outlook

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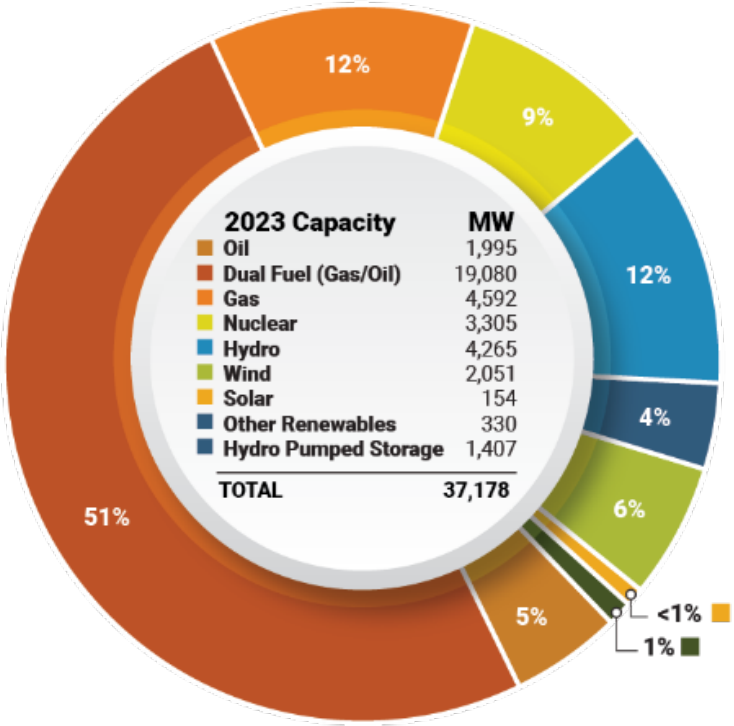
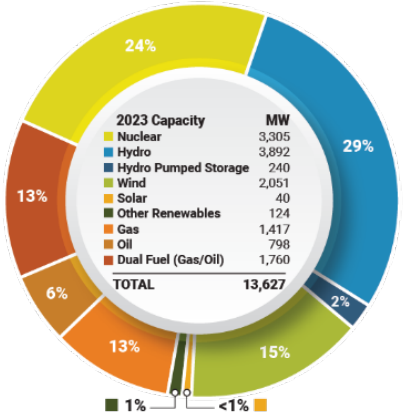
Generating Capacity by Fuel Source: 2023

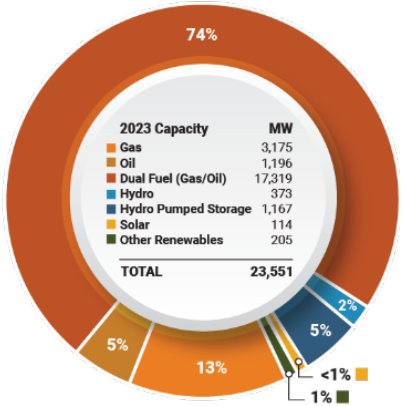
NYCA Generating Capacity by Fuel Source: 2023



Generating Capacity is the maximum electric output a generator can produce



Upstate (Zones A-E) Generating Capacity by Fuel Source: 2023



Downstate (Zones F-K) Generating Capacity by Fuel Source: 2023

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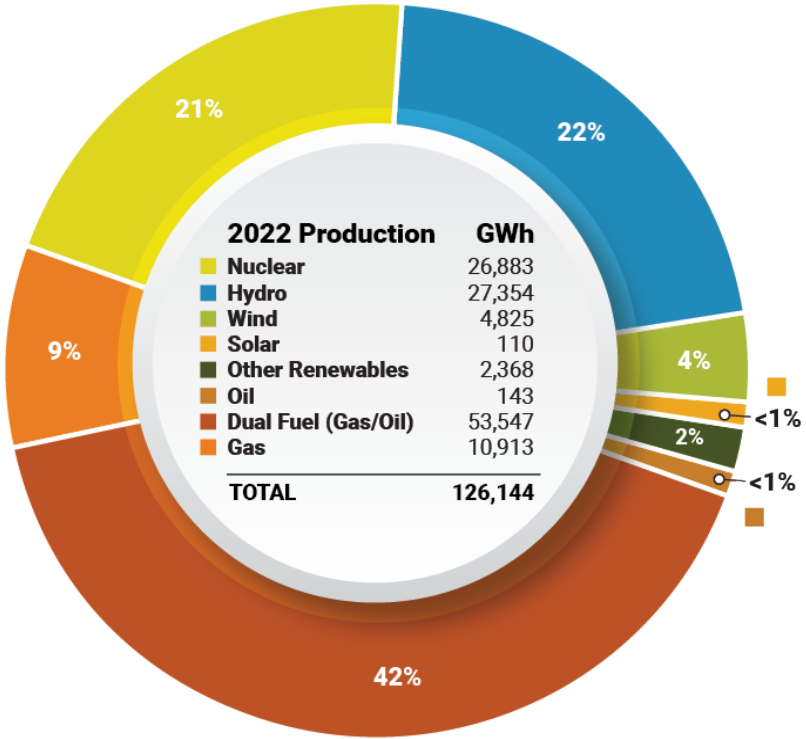
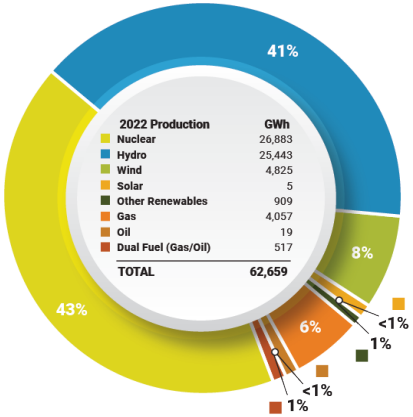
Energy Production by Fuel Source: 2022

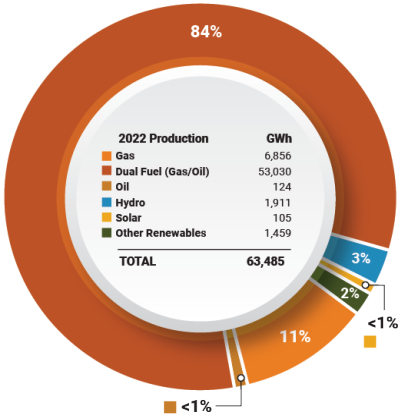
NYCA Energy Production by Fuel Source: 2022



Energy is the amount of electricity a generator produces over time



Upstate (Zones A-E) Energy Production by Fuel Source: 2022



Downstate (Zones F-K) Energy Production by Fuel Source: 2022

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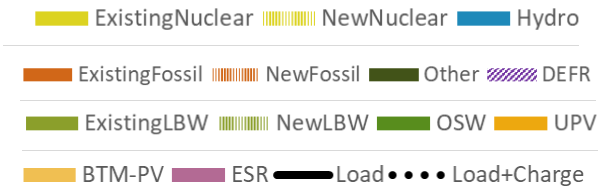
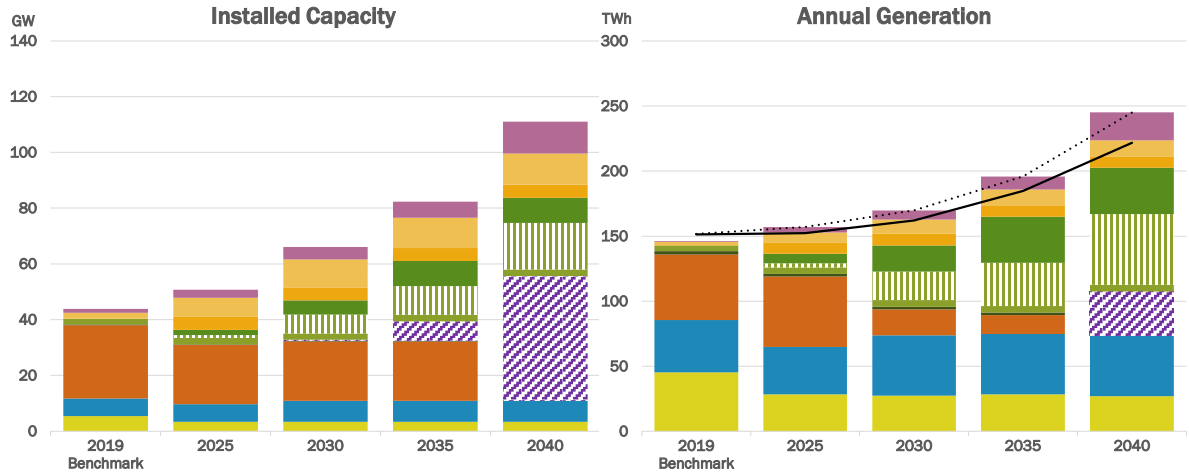
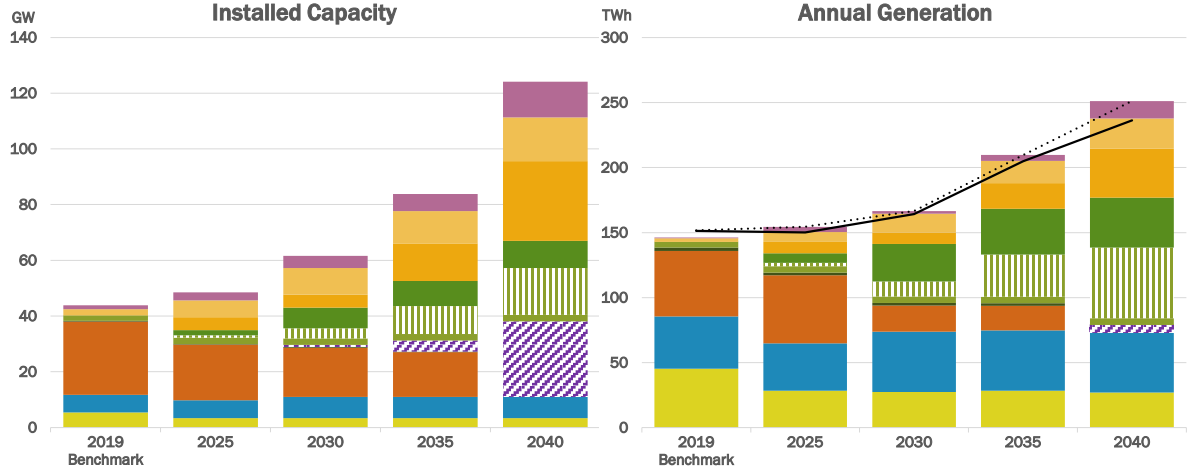
2021-2040 Outlook: Capacity Expansion Scenarios



Scenario 1 (S1)



Scenario 2 (S2)



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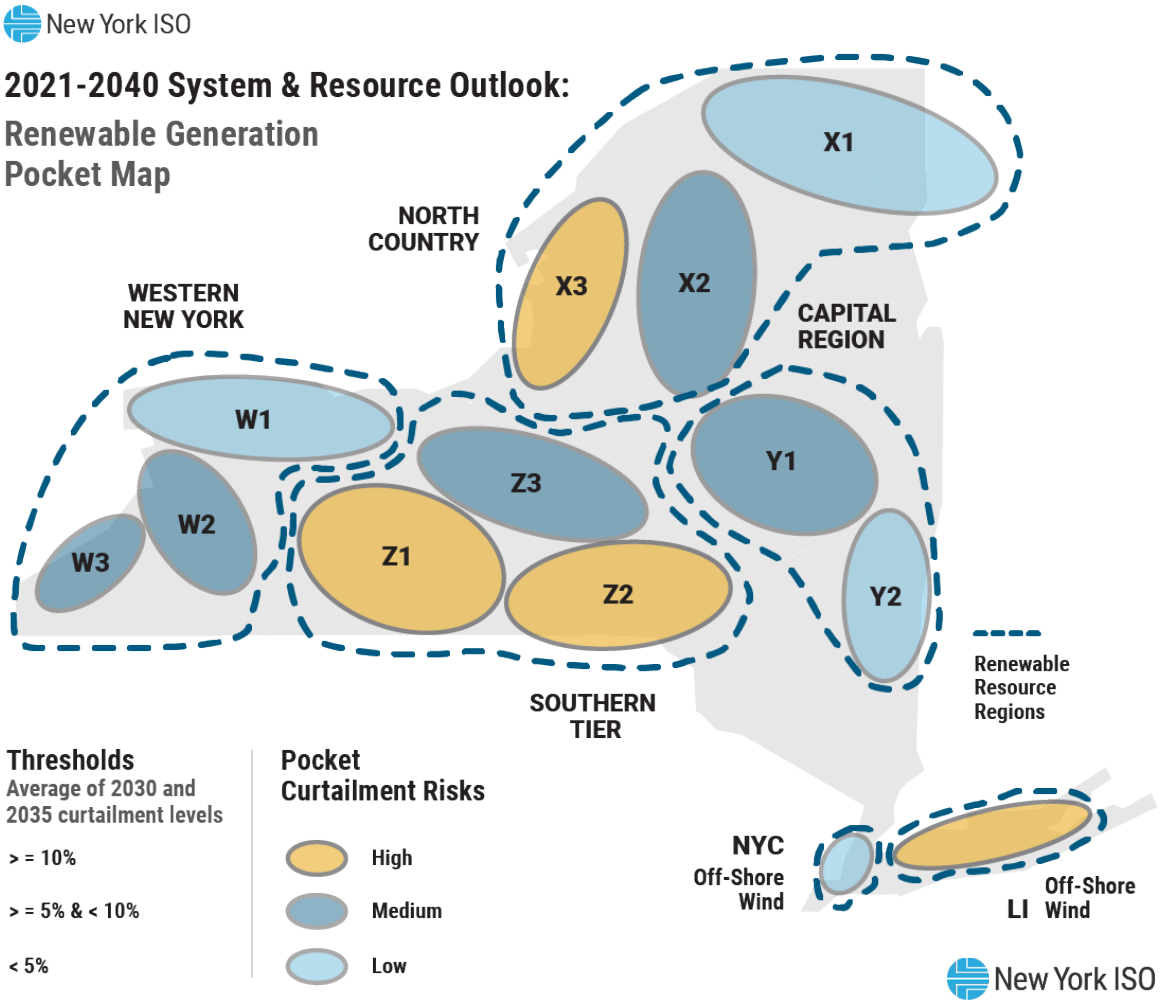
Renewable Generation Pockets

- NYISO has identified transmission constraints that may prevent the delivery of renewable energy to achieve the state policy targets.
- In each of the major pockets observed, renewable generation would be curtailed due to the lack of sufficient bulk and local transmission capability to deliver the power.
- The results support the conclusion that additional transmission expansion, at both bulk and local levels, will be necessary to efficiently deliver renewable power to New York consumers.



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Reliability Planning

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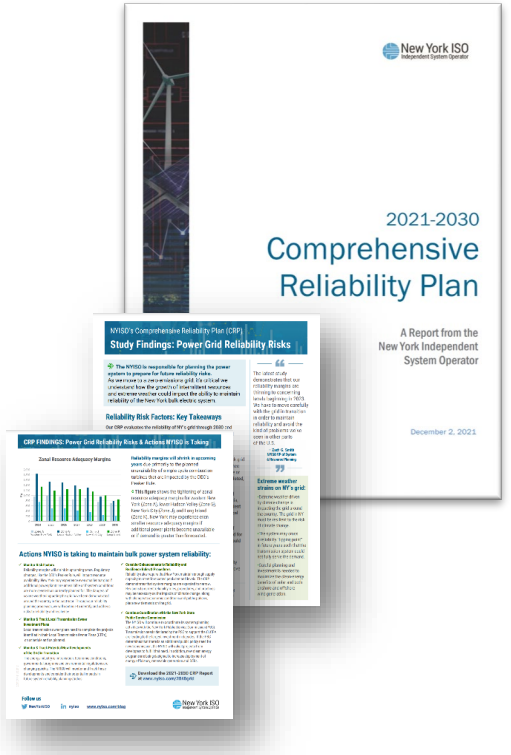
NYISO's Reliability Planning Process

Role and Purpose

- Every year, the NYISO is required to conduct an independent analysis of risks to meet reliability standards.
- Over a ten-year timeframe.
- Forecasts the balance between generation, load, and transmission.
- Grid reliability is determined by transmission security and resource adequacy.
- Serves to identify the impacts of a changing grid.



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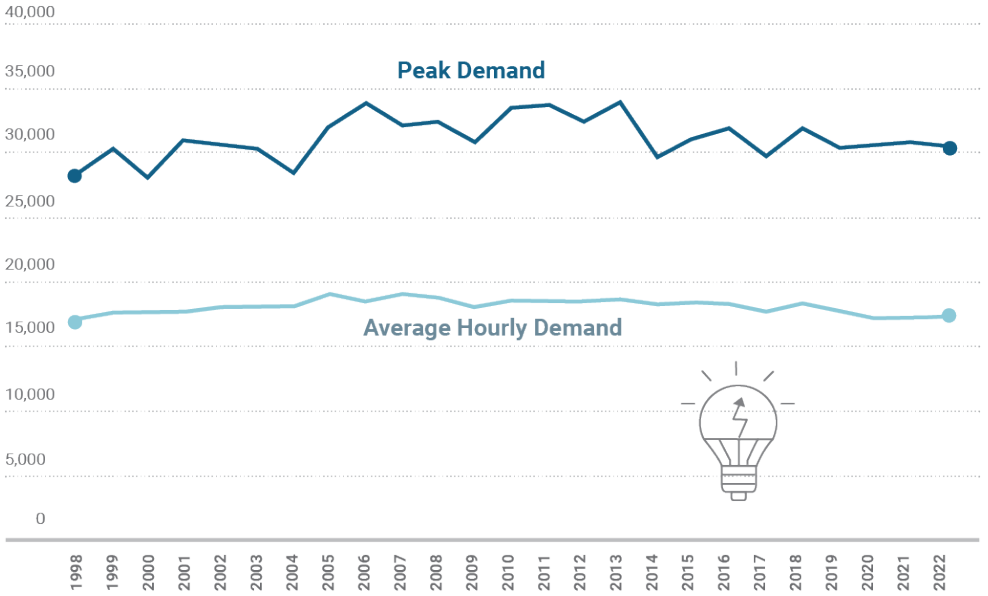
Resource Adequacy: Peak Demand vs. Average Load

Historical Peak vs. Average Demand

- New York's power grid must be flexible enough to supply peak demand periods that may be two times higher than average system demand
- Resources must be retained on the grid to meet demand in these peak periods even if those resources are not needed to supply the grid for much of the year



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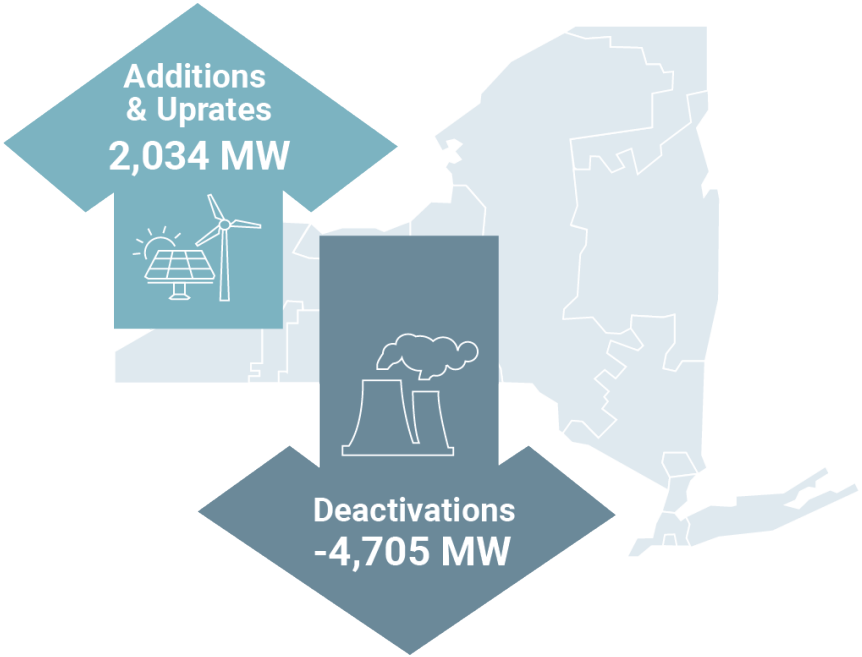
Additions, Uprates & Retirements

- Growing imbalance between generator deactivations and additions is contributing to shrinking reliability margins
  - Deactivating resources tend to be dispatchable and located downstate
  - Generator additions are largely renewable resources located upstate
  - New resources do not provide the same reliability services as exiting resources
- Since the CLCPA was approved in 2019, interconnection requests have quadrupled
- NYISO and stakeholders working to enhance process efficiency while maintaining reliability benefits

Nameplate Capacity: 2019-2022



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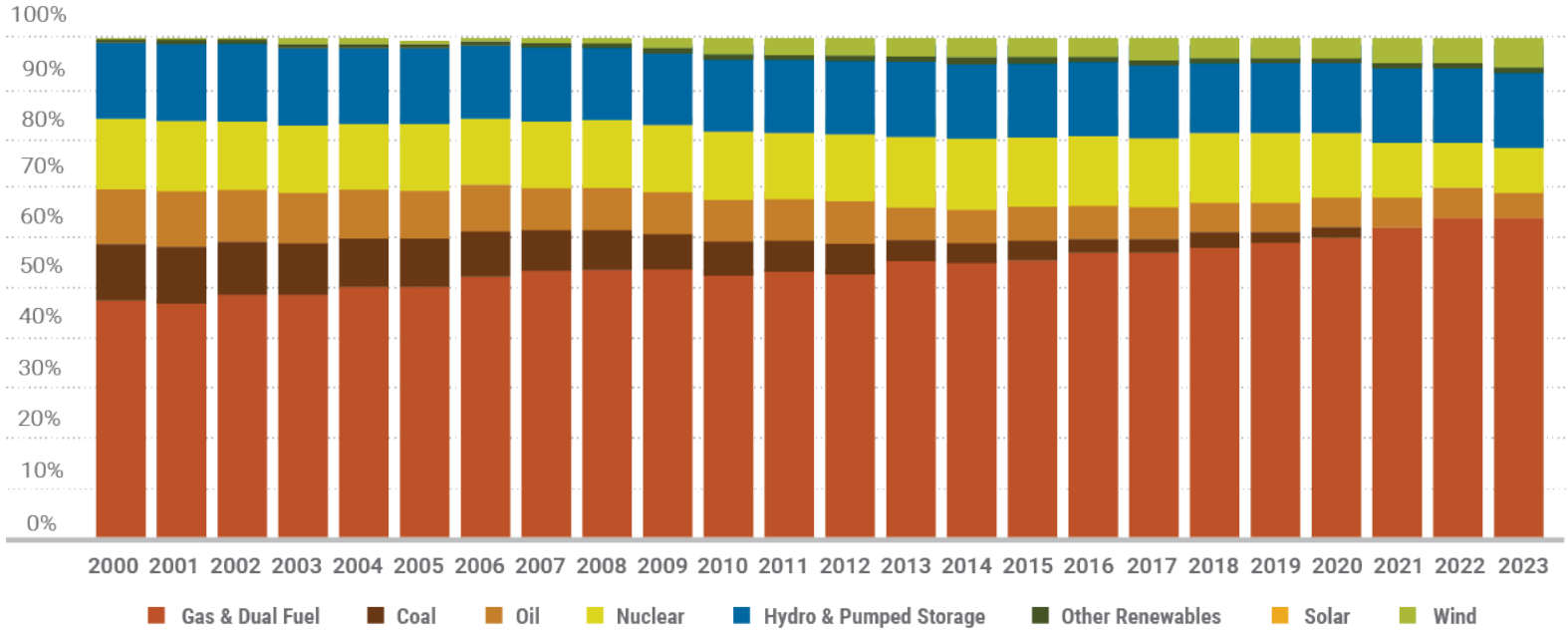
Historical Generating Capacity Fuel Mix: 2000-2023



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2025 Reliability Need

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Overview: DEC's Peaker Rule

- New York State Department of Environmental Conservation (DEC) adopted a regulation to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines ("Peaking Units") (referred to as the "Peaker Rule")
- The Peaker Rule required all impacted plant owners to file compliance plans by March 2, 2020. NYISO considered generators' compliance plans in the development of reliability plans starting with the 2020 Reliability Needs Assessment.
- As of May 1, 2023, 1,027 MW of affected peakers have deactivated or limited operations.
- An additional 590 MW of peakers are expected to be impacted beginning May 1, 2025, all of which are in New York City.
- The DEC's Peaker Rule anticipated this scenario when it authorized the NYISO to designate certain units to remain in operation beyond 2025 on an as needed basis for reliability.
- The rule allows the NYISO to designate a two-year extension (through 2027) and a potential additional two-year extension (through 2029) if needed for reliability.

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2023 Q2 STAR Reliability Findings

- Beginning in summer 2025, the transmission security margin within New York City is deficient.
  - The New York City zone (Zone J) is deficient by as much as 446 MW for a duration of nine hours on the peak day during expected weather conditions when accounting for forecasted economic growth and policy-driven increases in demand
- Beyond 2025, the reliability margins within New York City may not be sufficient if:
  - The CHPE project experiences a delay from Spring 2026;
  - There are additional generator deactivations beyond what is already planned; or
  - Demand significantly exceeds current forecasts.
- The statewide system margin may be deficient by nearly 150 MW in 2025 when accounting for large economic development projects.

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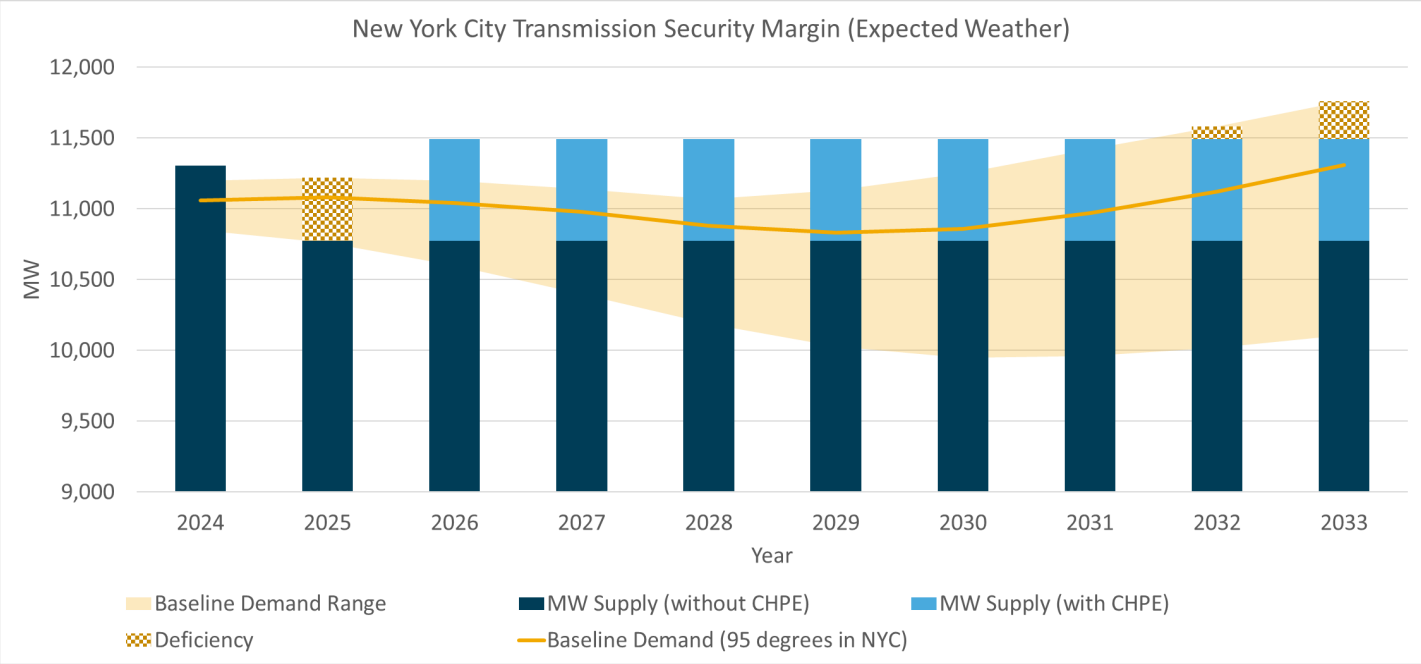
NYC Supply vs. Demand



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The NYISO Identifies a Reliability Need

Next Steps Timeline

1

July 14, 2023

NYISO RELEASES Q2 "STAR" REPORT; DECLARES A RELIABILITY NEED

The NYISO's report identifies a reliability need for New York City beginning in summer 2025 driven by forecasted increases in peak demand and the expected retirement of generation units in response to NYS DEC's "Peaker Rule."

2

August 4 - October 3, 2023

NYISO CALLS FOR BACKSTOP SOLUTION FROM CON EDISON

In response to the NYISO's declaration, the local utility (Con Edison) will be called upon to propose a backstop solution. The NYISO will work closely with the local utility to evaluate proposals.

3

August 4 – October 3, 2023

NYISO SOLICITS MARKET-BASED SOLUTIONS

Solutions proposed by developers may include generation and demand response offerings. Parties will have 60 days to submit proposals in response to the solicitation.

4

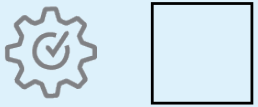
October – November 2023

NYISO REVIEWS PROPOSED SOLUTIONS

The NYISO reviews Con Edison's backstop solution and proposed market-based solutions to determine if any are viable and sufficient to meet the need within the required timeframe.

5

November 2023



NYISO DETERMINES SOLUTIONS

The NYISO selects viable and sufficient solution(s). If solutions are not sufficient to address the need within the necessary timeframe, the NYISO would submit a letter to the NYS DEC designating which "peaker" generators may be needed to maintain reliability until permanent solutions are in place.

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Reliability Risks Over the Next 10 Years

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2023-2032 Comprehensive Reliability Plan

- At this time there are no actionable, long-term Reliability Needs (2026-2032).
- There is a Short-Term Reliability Process Need, which was identified in the 2023 Quarter 2 STAR. The need occurs in New York City in the summer of 2025 and is driven primarily by forecasted increases in peak demand and generation unavailability due to the Peaker Rule. Solutions are being determined through the Short-Term Reliability Process.
- While no long-term Reliability Needs were identified in this CRP, the margin to maintain reliability over the next ten years will narrow or could be eliminated based upon a variety of potential changes in forecasted system conditions.

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Key Risk Factors to CRP

- The pace of generation retirements has exceeded the pace of resource additions to date. Should this trend continue, reliability needs will be identified both locationally and statewide.
- The reliability of the grid is heavily reliant on the timely completion of planned transmission projects, chiefly the CHPE project. Without the CHPE project in service or other offsetting changes or solutions, the reliability margins would be deficient for the ten-year planning horizon.
- There is a clear upward trend forecasted in peak demand over the next ten years, with significant uncertainty driven by electrification of heating and transportation coupled with the development of multiple high-electric demand facilities (e.g., microchip fabrication and data centers). As the demand on the grid grows at a rate greater than the build out of generation and transmission, deficiencies could arise within the ten-year planning horizon.

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Key Risk Factors to CRP

- New York's current reliance on neighboring systems is expected to continue through the next ten years. Without emergency assistance from neighboring regions, New York would not have adequate resources throughout the next ten years.
- Extreme events, such as heatwaves or storms, pose a threat to grid reliability throughout the planning horizon and could result in deficiencies to serve demand statewide, especially in New York City. This outlook could improve as more resources and transmission are added to New York City.
- The New York statewide grid is projected to become a winter-peaking system in the mid-2030s, primarily driven by electrification of space heating and transportation. The New York statewide grid is reliable for normal weather in the winter for the next ten years, but deficiencies would arise as early as winter 2027-2028 for an extreme 1-in-100-year winter cold snap coupled with a shortage of gas fuel supply. This deficiency would grow to a 6,000 MW shortfall by winter 2032-2033.

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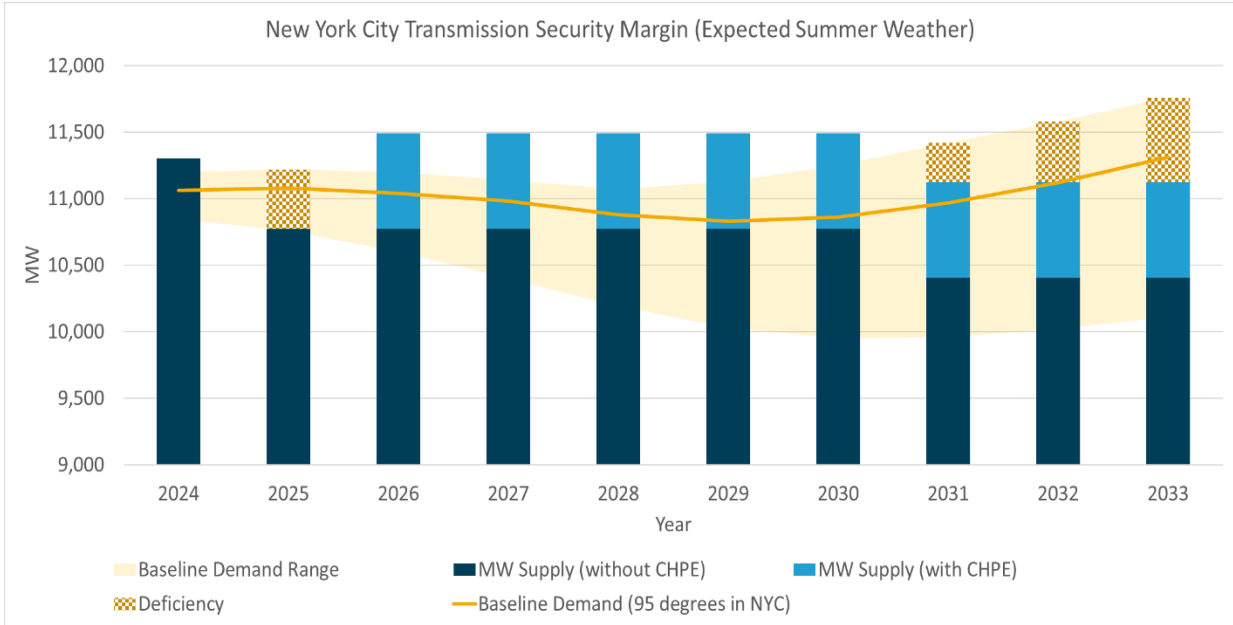
Impact of NYPA Small Plant Phase-Out

- New York City will have a transmission security deficiency starting in 2031 should NYPA's small gas plants (517 MW) retire in December 2030 without replacement resources.
- The deficiency worsens to over 600 MW by 2033 when considering the higher range of the forecast, and would be far worse without the CHPE project in service.



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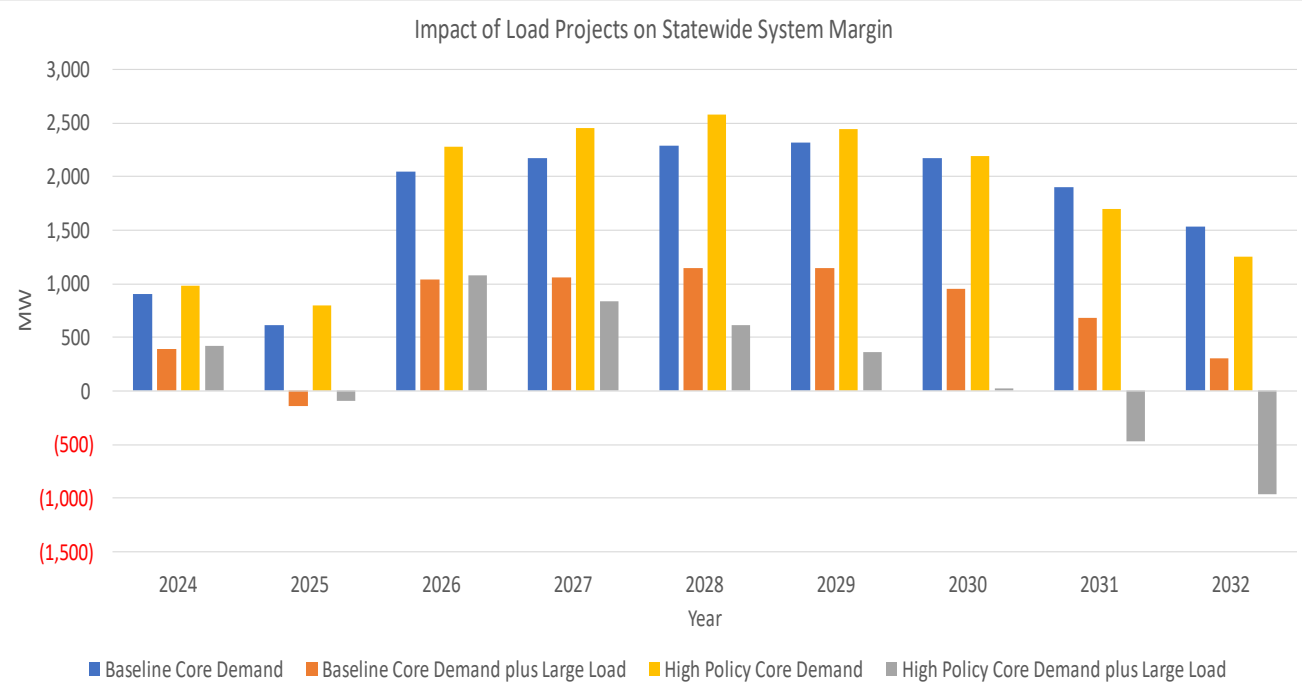
Impact of Large Loads

- High forecast of core load for expected weather plus future large loads may result in a statewide deficiency in 2031



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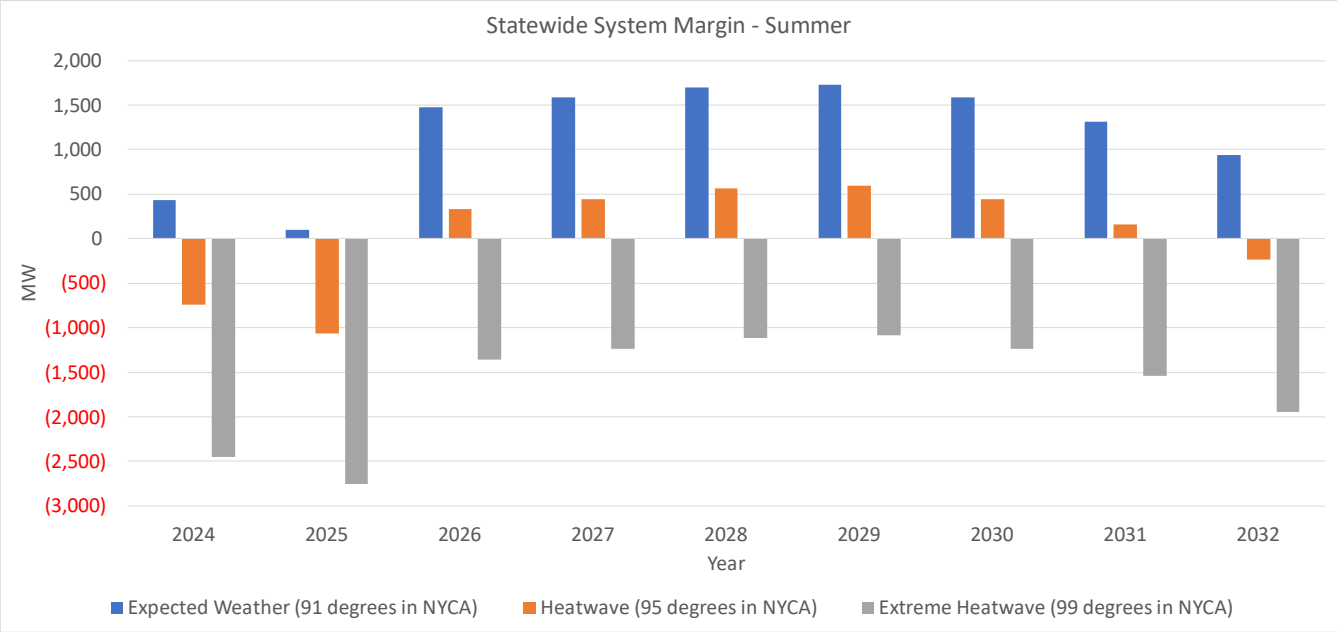
Impact of Extreme Weather



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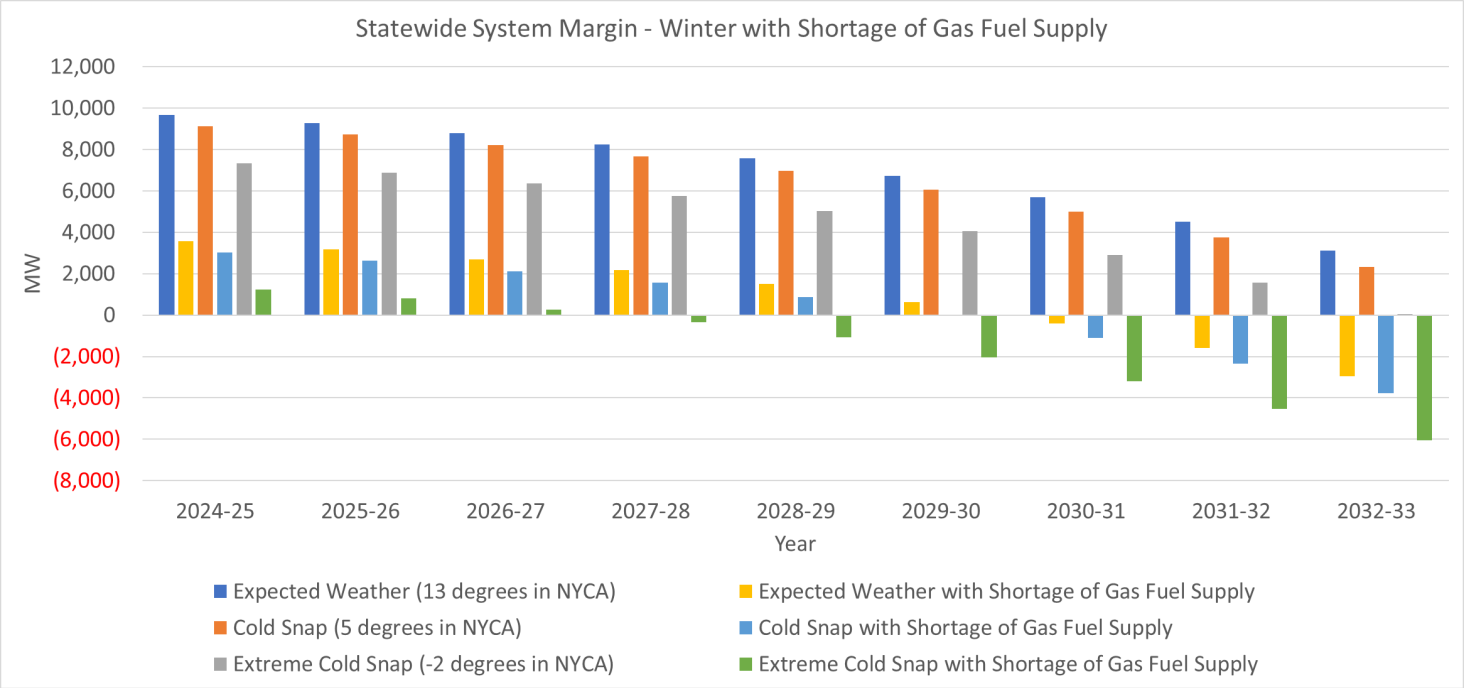
Impact of Winter Cold Snaps and a Potential Gas Fuel Shortage



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Reliance on Emergency Assistance

		NYCA LOLE (days/year) by Margin State									
Step	**EOP**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
1	Removing Operating Reserve	6.32	4.37	4.99	1.91	2.98	2.32	2.89	2.94	5.02	6.74
2	Require SCRs (Load and Generator)	3.30	2.72	3.16	0.94	1.46	1.38	1.54	1.72	2.73	4.12
3	5% Manual Voltage Reduction	3.12	2.59	3.01	0.88	1.34	1.32	1.47	1.64	2.60	3.94
4	30-Minute Reserve (*i.e.*, 655 MW) to Zero	2.01	1.42	1.89	0.41	0.79	0.55	0.65	0.76	1.20	2.05
5	5% Remote Controlled Voltage Reduction	1.36	1.00	1.32	0.27	0.52	0.37	0.44	0.51	0.81	1.47
6	Voluntary Load Curtailment	1.18	0.84	1.11	0.23	0.47	0.30	0.37	0.42	0.69	1.32
7	Public Appeals	1.13	0.78	1.06	0.21	0.44	0.27	0.33	0.38	0.63	1.23
8	Emergency Assistance	0.11	0.10	0.11	0.05	0.05	0.04	0.04	0.05	0.07	0.09
9	Part of 10-Minute Reserve (*i.e.* , 960 of 1310 MW) to Zero	**0.02**	**0.02**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.02**

Note:
• The results in bold font (Step 9) represent the NYCA LOLE that is compared against the 0.1 event-days/year criterion.

- **New York's current reliance on neighboring systems is expected to continue through the next ten years. Without emergency assistance from neighboring regions, New York would not have adequate resources to serve forecasted demand.**

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Road to 2040

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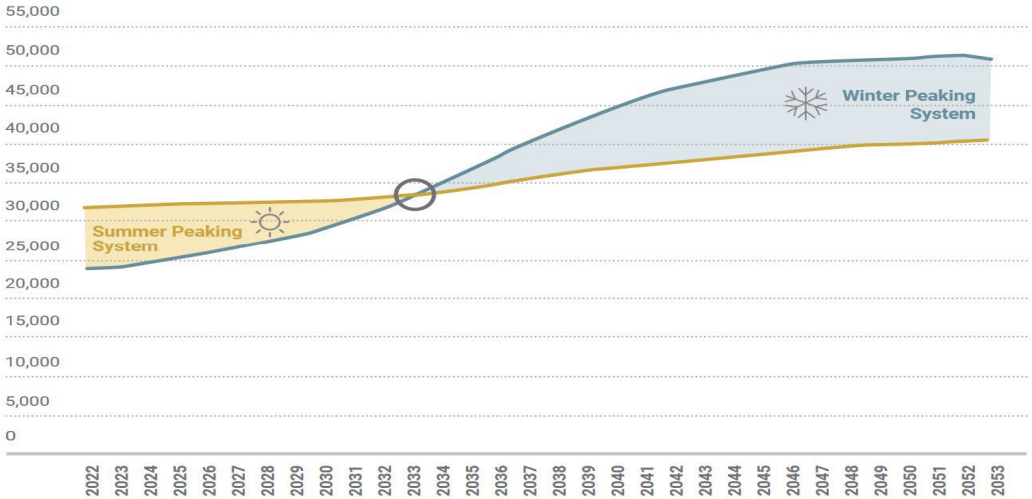
Road to 2040: Demand



Key Takeaways

- Electrification of transportation and building heating and cooking will cause the NYCA to go from summer peaking to winter peaking in the mid-2030s
- The NYISO develops 90/10 and 99/1 forecasts and is engaged in several efforts at the state, regional, and national level to model and plan for extreme weather
- Potential load growth from low carbon fuel production (e.g., hydrogen production via electrolysis) could be significant and is captured in the high policy demand forecast

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Road to 2040: Generation

- **Key takeaways**
  - High penetration of inverter-based resources presents reliability risks due to weak-grid interconnection, common mode failures, and modeling accuracy.
  - NYCA will need significant amounts of dispatchable emission-free resources (DEFRs) that can run for multiple day periods.
  - DEFRs will be required to provide both energy and capacity over long durations, as well as the reliability attributes of retiring synchronous generation. The attributes do not need to be encapsulated in a singular technology, but in aggregate the system needs a sufficient collection of these services to be reliable.

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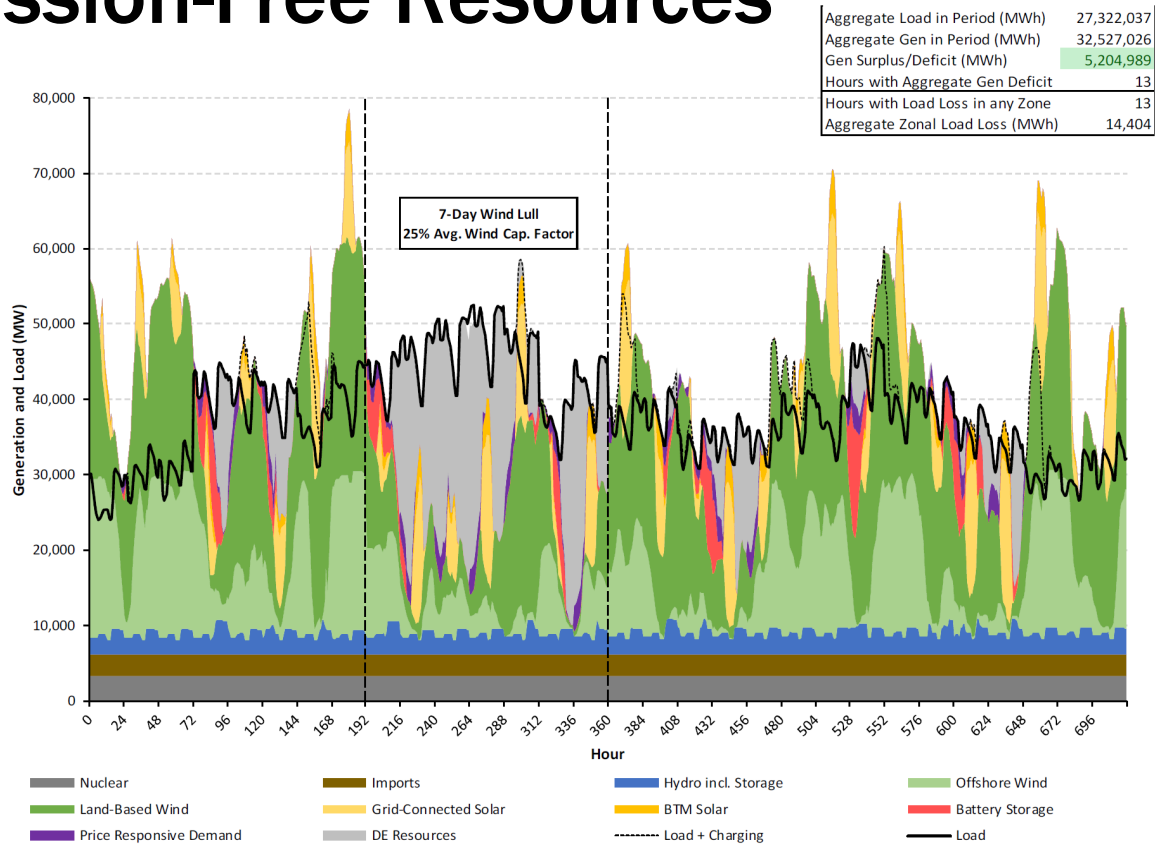
Dispatchable Emission-Free Resources

- Large quantity of installed dispatchable energy resources needed in a small number of hours
- Dispatchable resources must be able to start up quickly, and be flexible enough to meet rapid, steep ramping needs



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Attributes of Sample Generation Technologies (DEFR Options)

		2023 NYCA Summer Capacity (MW)	Energy Attributes						Other Reliability Attributes			
			Carbon Free*	Dependable Fuel Source	Energy Limited	Dispatchable	Quick start	Flexible	Multi start	Inertial Response	Dynamic Reactive control	High Short Circuit current
Sample Technology	Fossil	25,667	No	Yes*	No	Yes	Yes*	Yes	Yes	Yes	Yes	Yes
	Hydro	4,265	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Pumped Hydro	1,407	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Hydrogen Fuel Cell	0	Yes	Yes*	No	Yes	Yes	Yes	Yes	No	Yes	No
	Hydrogen Combustion	0	Yes	Yes*	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Nuclear	3,305	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
	Modular Nuclear	0	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes
	Battery	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
	Solar	154	Yes	No	Yes	No*	Yes	Yes	Yes	No	Yes	No
	Wind	2,051	Yes	No	Yes	No*	Yes	Yes	Yes	No	Yes	No
	Demand Response*	1,234	Yes*	Yes	Yes	No	No	Yes	No	No	No	No
	Synchronous Condenser*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	Yes	Yes

* See Figure 39 of the 2023-2032 Comprehensive Reliability Plan for more detail.

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Road to 2040: Transmission

- **Key takeaways**
  - Transmission expansion is critical to facilitating efficient CLCPA energy target achievement. The current New York transmission system, at both local and bulk levels, is inadequate to achieve current policy objectives.
  - Major transmission development efforts are underway: NYC PPTN, three selected PPTN projects, Smart Path Connect, CHPE, Clean Path NY, and “Phase 2” local transmission projects.
  - Further transmission development will be necessary to address several renewable generation pockets across the state.

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Public Policy Transmission

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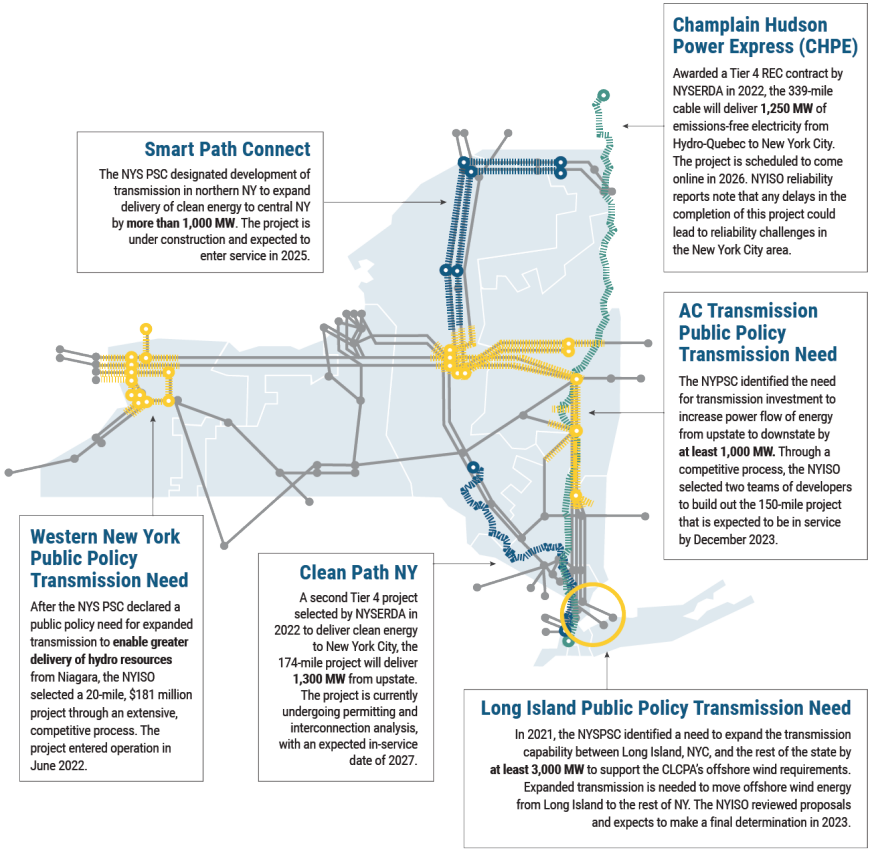
Ongoing Transmission Planning and Construction



Transmission investment needs driven by public policy requirements:

- Needs are identified by the NYS Public Service Commission (PSC)
- Solutions are solicited and evaluated by the NYISO
- NYPA designated for priority transmission projects by the PSC in some instances
- Tier 4 RECs support delivery into NYC

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Long Island Public Policy Transmission: T051 - Propel Alternate Solution 5

- The total calculated cost estimate is $3,262M with a 20/80 soft Cost Cap of $2,554M (SECO estimate for Included Capital Costs is $2,902M)
- The project adds three new AC tie lines and a 345 kV backbone across western/central Long Island, and partially addresses congestion from Empire Wind 2
- The project provides effective operability under a variety of outage conditions, with low cost per MW for transfer capability, expandability, and operability range
- The project has relatively low procurement, permitting, and construction risks compared to other projects, reducing the potential for increases to project cost and schedule
- The Required Project In-Service Date is May 2030

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NYC Public Policy Transmission Need

- On June 22, 2023, the PSC issued an order identifying a new public policy transmission need.
- The Order declared that the Climate Leadership and Community Protection Act (CLCPA), constitutes a Public Policy Requirement driving the need for additional transmission facilities to deliver the output of offshore wind generating resources to New York City interconnection points.
- The Order calls for complete, end-to-end solutions that will accommodate the full output of at least 4,770 MW of incremental offshore wind generation injected into New York City (Zone J) and will have a high degree of constructability based on a timely and realistic construction schedule.
- Projects shall plan to complete all permitting and construction activities necessary to achieve an in- service date no later than January 1, 2033.

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Questions?

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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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