New York ISO
Independent System Operator

2023-2042 System & Resource Outlook

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Manager, Long Term Assessments

Public Information Session

Thursday, August 8, 2024

Agenda

- NYISO System & Resource Planning Department
- NYISO Economic Planning Process
- 2023-2042 System & Resource Outlook
  - Study Process
  - Transmission Congestion Analysis
  - Report & Technical Appendices
  - Key Findings
- Questions, Comments, Feedback

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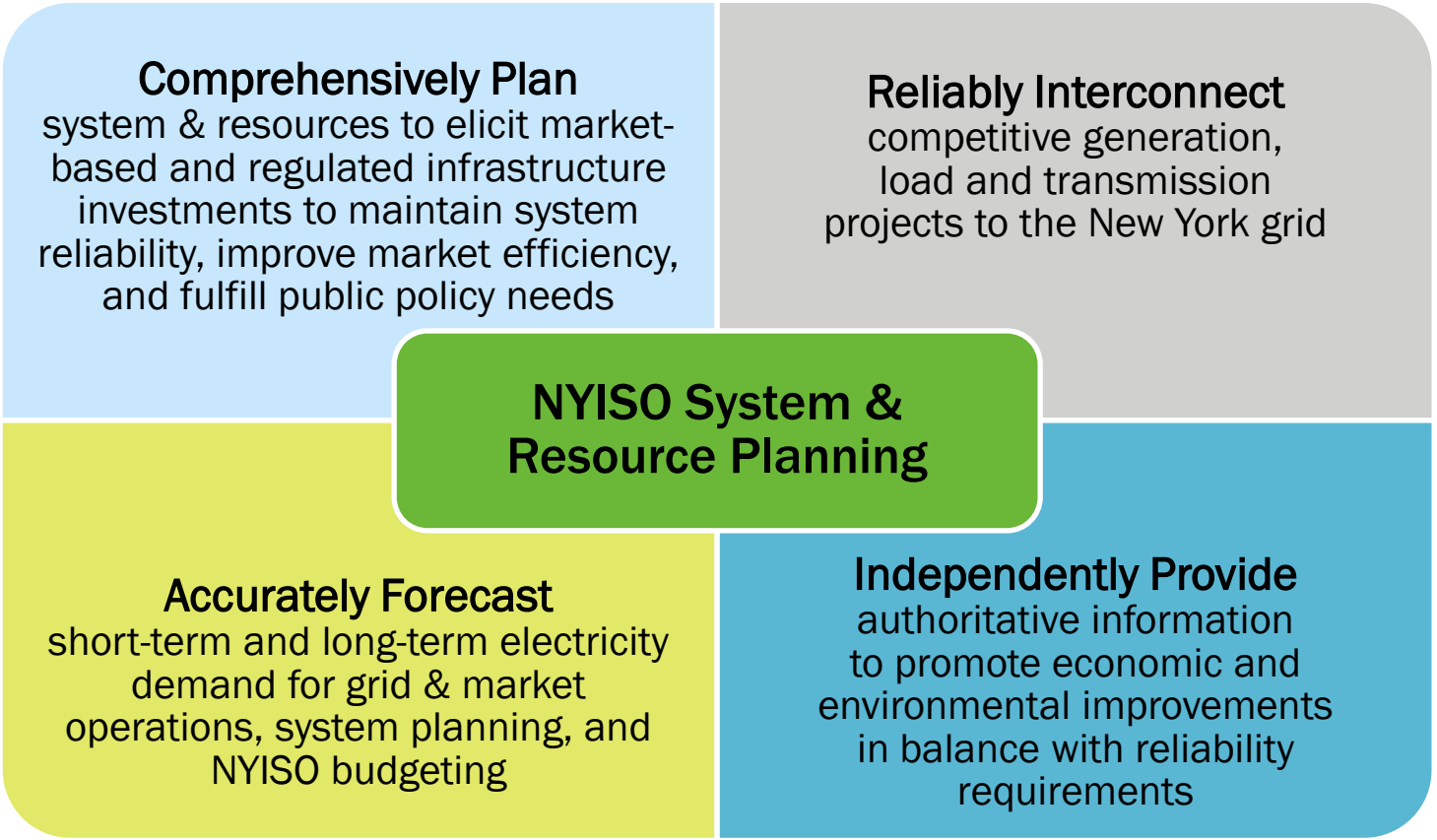
NYISO System & Resource Planning Department



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Comprehensive System Planning Process

- **NYISO's Comprehensive System Planning Process (CSPP) is a 2-year cycle that encompasses extensive planning analyses**
- **The CSPP under OATT Attachment Y covers:**
  - Reliability planning
  - Economic planning
  - Planning for Public Policy Requirements
  - Interregional planning with PJM and ISO-NE

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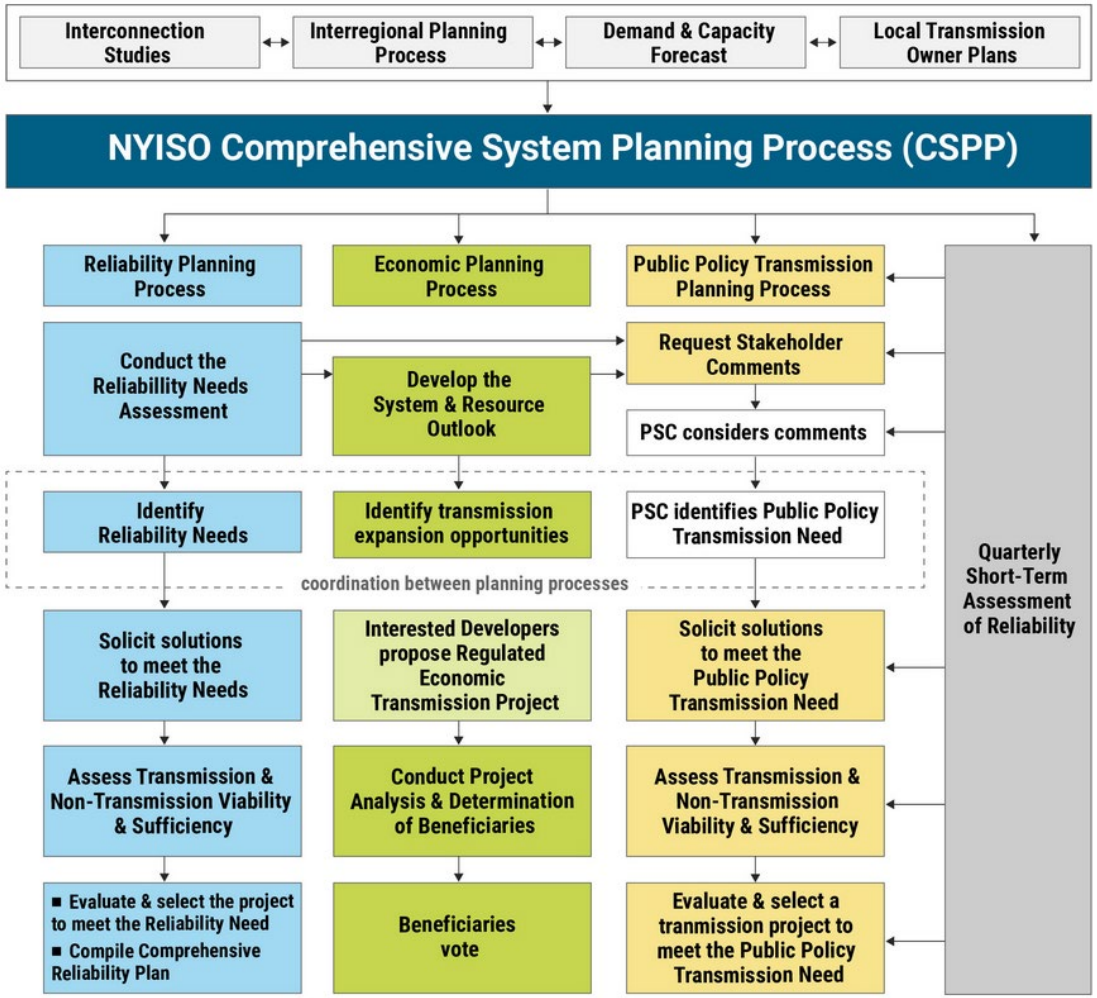

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NYISO Economic Planning Process

Economic Planning Process Studies

- **System & Resource Outlook ("the Outlook")**
  - 20-year study of the system & transmission congestion
  - Identification of challenges related to achieving New York policy mandates
- **Economic Transmission Project Evaluation (ETPE)**
  - Study of actual transmission project proposals
  - Project with benefit/cost ratio eligible for vote for cost recovery
- **Requested Economic Planning Study (REPS)**
  - Stakeholder or other interested party requested study using economic planning models

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System & Resource Outlook: Objectives

1. Create a biennial report that summarizes the current assessments, evaluations, and plans in the biennial Comprehensive System Planning Process
2. Produce a twenty-year projection of system conditions for demand, generation, and transmission across the New York transmission system
3. Identify, rank, and group congested elements
4. Assess the potential benefits of addressing congestion
5. Develop informative scenario cases
6. Perform technical analyses to inform stakeholders and interested parties

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Uses for System & Resource Outlook

- Identify potential challenges to meeting the New York State CLCPA mandates
- Inform stakeholders and policymakers where future public policy needs may exist
- Define renewable generation pockets
- Prepare system models to perform Economic Transmission Project Evaluation and/or Requested Economic Planning Studies, if requested

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Stakeholder Engagement

- **The Outlook is developed through an open and transparent process and includes significant stakeholder engagement opportunities**
- **The 2023-2042 System & Resource Outlook:**
  - Began in June 2023 and concluded in July 2024
  - Included 17 stakeholder presentations at ESPWG & TPAS
  - Was unanimously approved at BIC, MC, and by the NYISO Board of Directors

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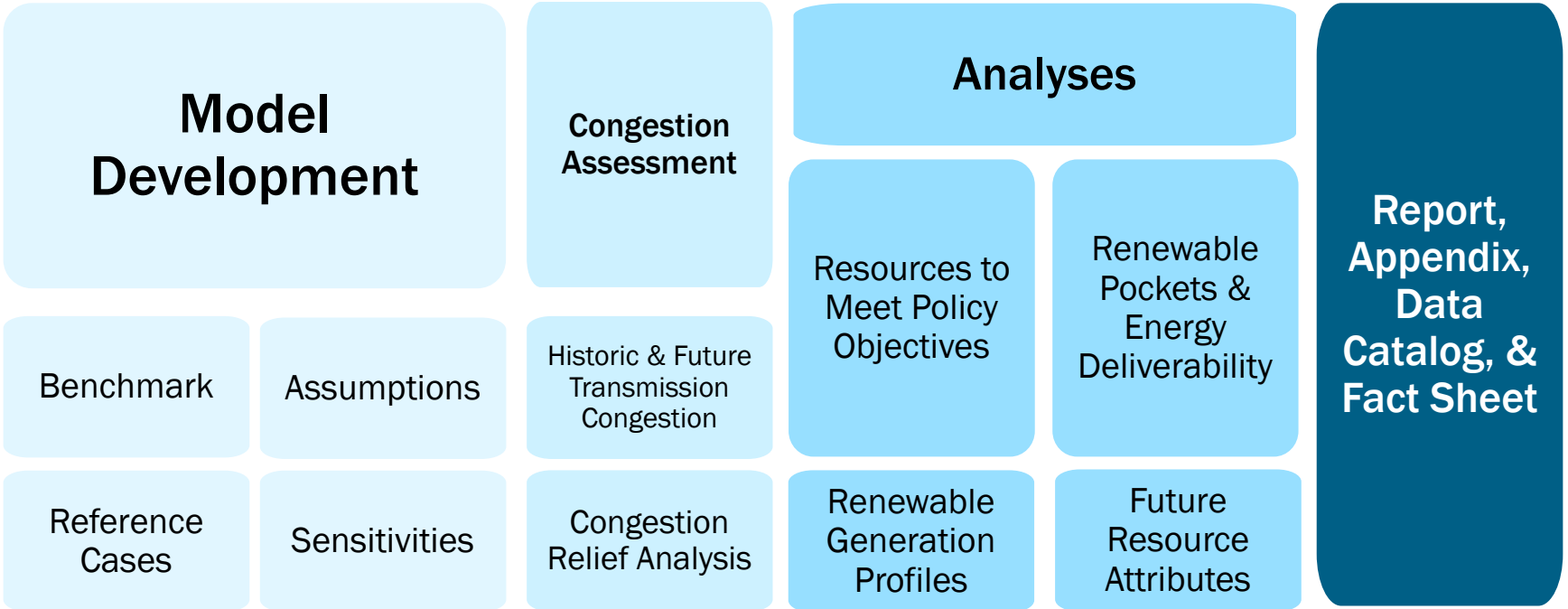
2023-2042 System & Resource Outlook

Study Process

System & Resource Outlook Scope



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Benchmarking Process: Overview

- **Goal**
  - To validate, test, and tune production cost model performance based on key metrics for the model including Generation, Net Imports, Load and Generation Payments, LBMPs, and Demand Congestion.
  - To initialize database for 2023-2042 System & Resource Outlook modeling
- **Process**
  - Perform production cost simulation with actual historical data as input (e.g., 2021)
  - Compare simulation output with actual system performance for that year to test model accuracy
  - Adjust model parameters, as needed, to align simulated output with actual historical data
  - Iterate steps 1 through 3, as necessary

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High-Level Study Assumptions

- Assumptions developed pursuant to Economic Planning Process procedures and in collaboration with stakeholders at meetings of the ESPWG
  - Policy Case “State Scenario” assumptions developed by DPS and NYSERDA
- 20-year study period (2023-2042)
- 2023 Gold Book
  - Energy demand and peak forecasts
  - Generation capacity
- 2022 RNA, 2023 Q3 STAR
  - Generator additions and retirements
  - Transmission topology
- New generation and transmission projects modeled pursuant to inclusion rules for each reference case
- Assumptions lockdown dates in October/November 2023

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Outlook Reference Cases

- **Base Case**
  - Consistent with inclusion rules for NYISO's Reliability Planning Process
- **Contract Case**
  - Base Case + resource additions consistent with awarded resources from NYSERDA LSR database
  - Inclusion of approved Phase 1 and 2 transmission projects, including the Brooklyn Clean Energy Hub
- **Policy Case (3 scenarios)**
  - Contract Case + resource additions and retirements simulated for achievement of New York CLCPA mandates
    - Leverages a capacity expansion model to assess various potential future resource mixes

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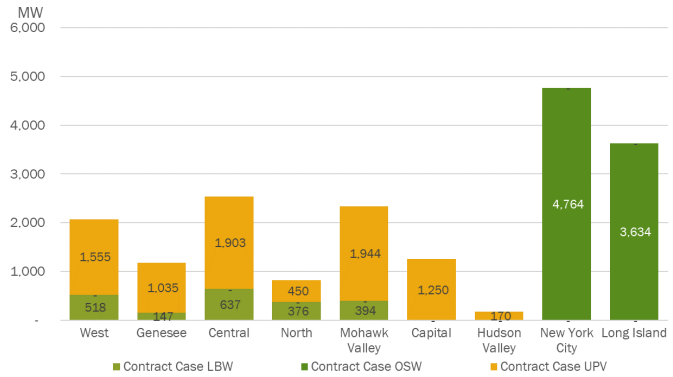
Base & Contract Cases

- **Focus on transmission congestion under:**
  - Base Case – system "as-is" with minimal changes to generation capacity mix and uses the 2023 Gold Book baseline load forecast
  - Contract Case – same as the Base Case but also includes the addition of renewable projects that have been awarded contracts with NYSERDA, as of the lockdown date

Figure 18: Renewable Generation Capacity Modeled as Firm Additions



~18 GW awarded renewable projects added by 2030

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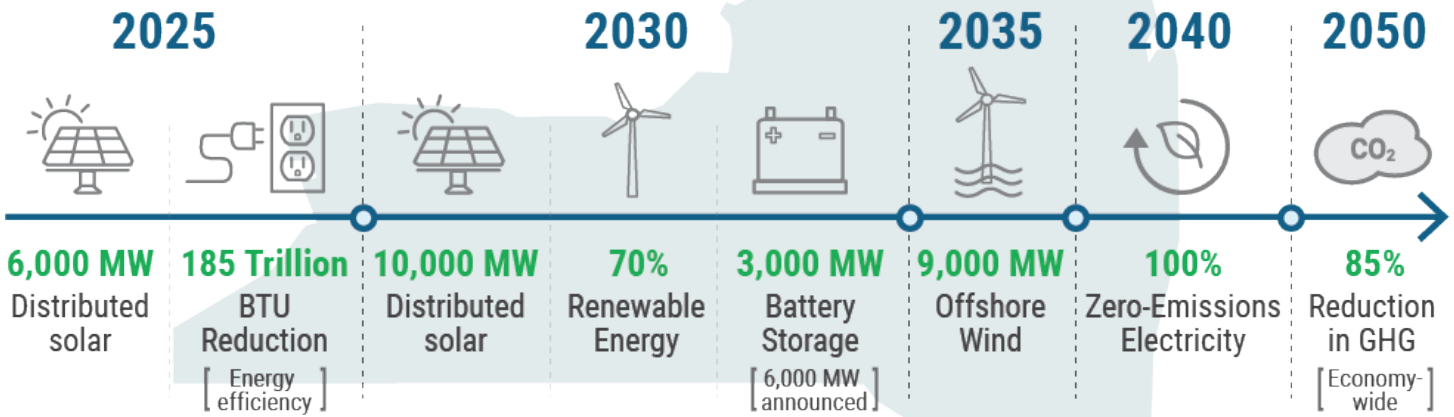
Energy Policy Mandates



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Policy Case

- **Three distinct scenarios modeled (Lower Demand, Higher Demand, and State Scenario)**
- **Major updates beyond the Base & Contract Cases include:**
  - Simulated achievement of CLCPA mandates
  - Increased energy demand forecasts due to electrification
  - Capacity margin targets (e.g., IRM and LCRs) to set minimum bounds on capacity
  - Dispatchable emission-free resources (DEFRs) proxy technology

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Policy Case (cont.)

- **In addition to many assumptions that have been updated since the 2021-2040 Outlook, several enhancements were incorporated into the capacity expansion model for each of the three Policy Case scenarios for the 2023-2042 Outlook**
  - Improved methodology for time representation
  - Addition of external pools
  - Addition of generation supply curves for renewable technologies
  - Addition of 8-hour battery storage as candidate for expansion
  - Marginal ELCC curves specific to each scenario
- **Additionally, the following constructs were incorporated into the State Scenario:**
  - Hydrogen repowered units as candidates for expansion, including electrolysis load
  - Sub-zonal constraints modeled to reflect estimated transmission headroom of local transmission & distribution system and conceptual marginal upgrade costs

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Power System Tools in the Outlook

- **Production cost simulations**
  - GE MAPS
- **Capacity expansion simulations**
  - Energy Exemplar PLEXOS
- **Powerflow and transfer analysis**
  - PowerGEM TARA & Siemens PSSE

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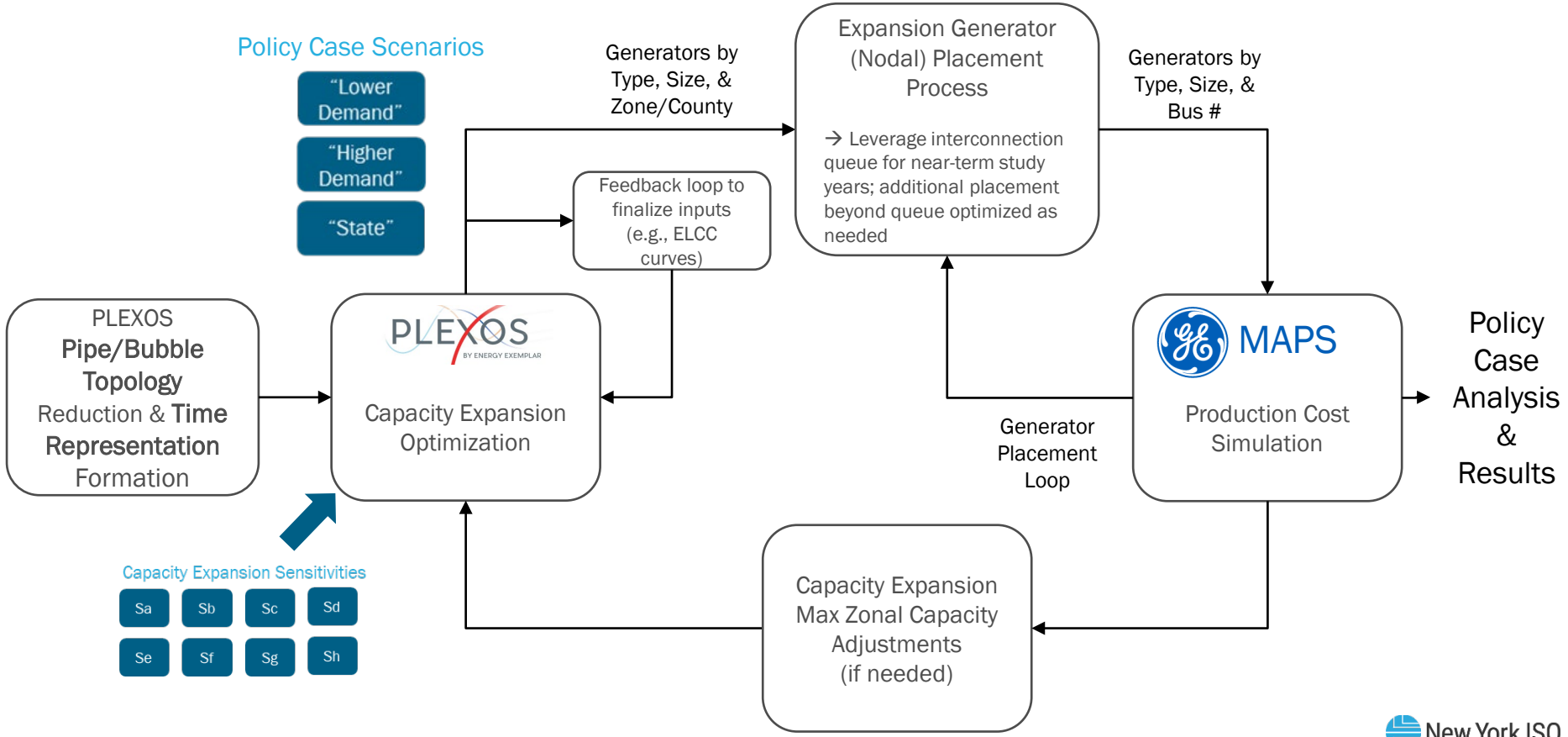
Policy Case Simulation Framework



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Transmission Congestion Analysis

Transmission Congestion Analysis

- **The Outlook quantifies historic congestion and evaluates future transmission congestion under a variety of scenarios**
- **Primary analyses focused on transmission congestion include:**
  - Quantification of projected future transmission congestion
  - Relaxation analysis (e.g., differences in flow patterns when specific lines are removed from simulation)
  - Energy deliverability of renewable resources and renewable generation pocket analysis
  - Spillage analysis

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Renewable Generation Pockets

- Renewable generation pockets have been evaluated in NYISO's Economic Planning process since 2019
- Each pocket depicts a geographic grouping of renewable generators and transmission constraints in a local area
  - These pockets provide an effective mechanism to quantify and describe the electrical interaction between generation resources in a specific geographic area to the surrounding transmission network

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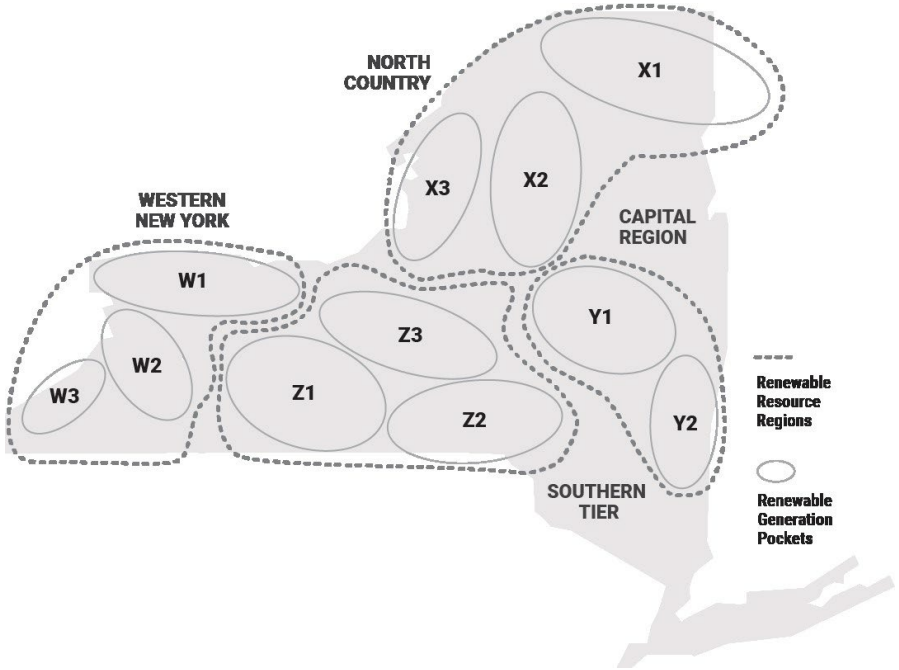
Renewable Generation Pockets



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Report & Technical Appendices

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System & Resource Outlook Appendices

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- Appendix F: Dispatchable Emission-Free Resources
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Key Findings

Key Finding 1: Demand

- ✓ Electric energy consumption is projected to increase significantly in response to the economic development and decarbonization energy policies. The resources and transmission system necessary to meet the changing energy demand needs to evolve accordingly.

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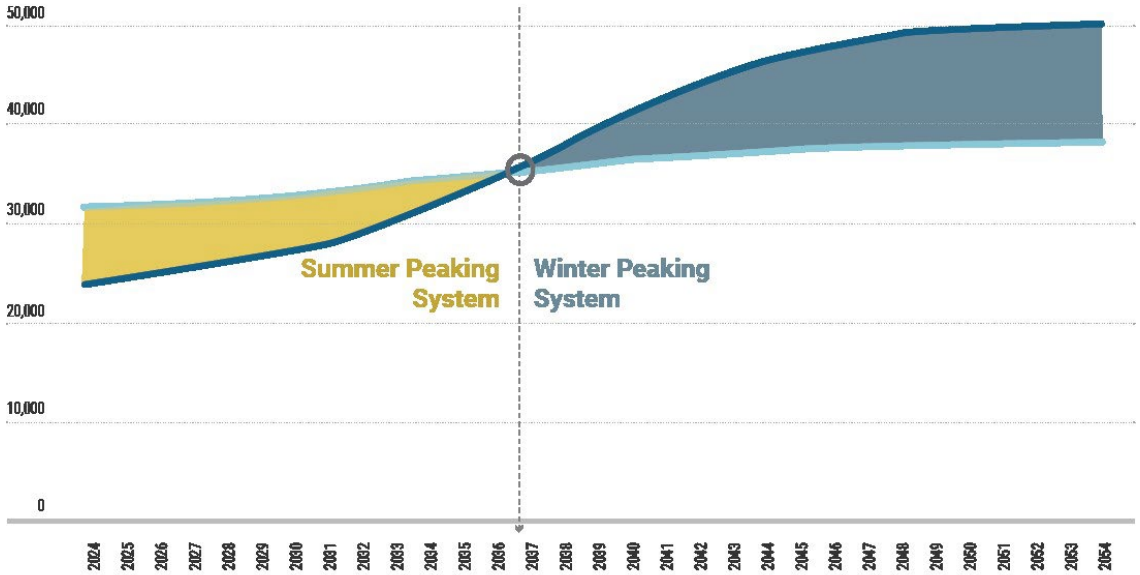
Peak Load Forecast for Summer & Winter (MW)



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Key Finding 2: Demand

- ✓ Siting large loads in electrical proximity to renewable resources, or siting resources near large loads, may benefit both the loads and the resources, particularly if located upstream of known constraints.

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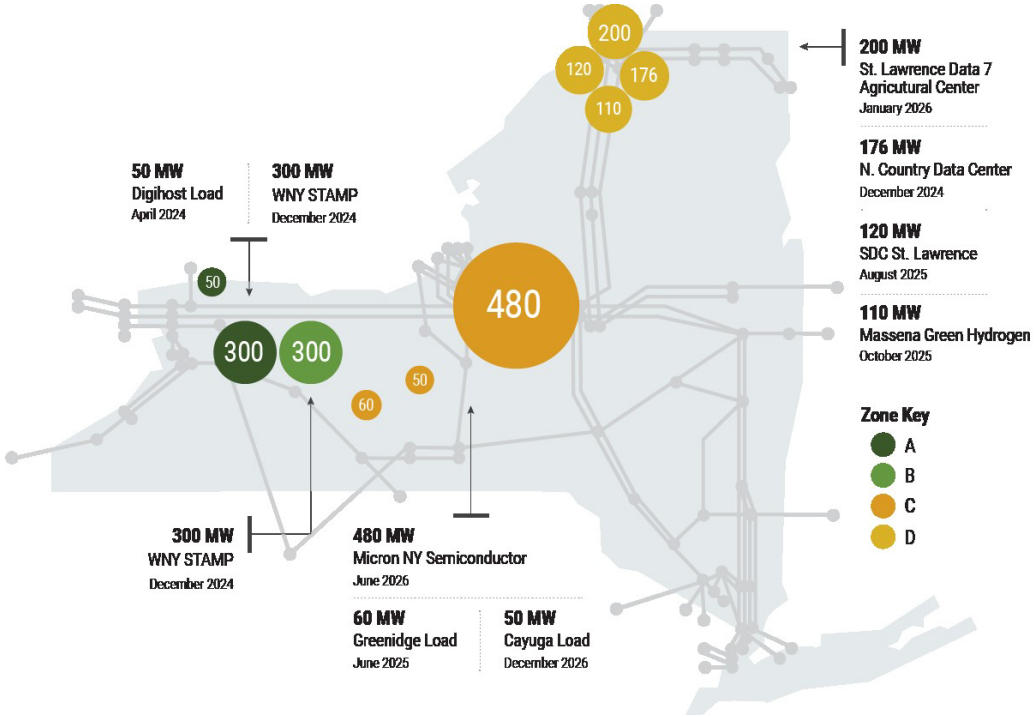
New York New Large Load Projects



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Key Finding 3: Supply Resources

- ✓ Dispatchable emission-free resources must be developed to provide the capacity, energy, and other essential grid services required to achieve the policy mandate for a zero-emissions grid by 2040.

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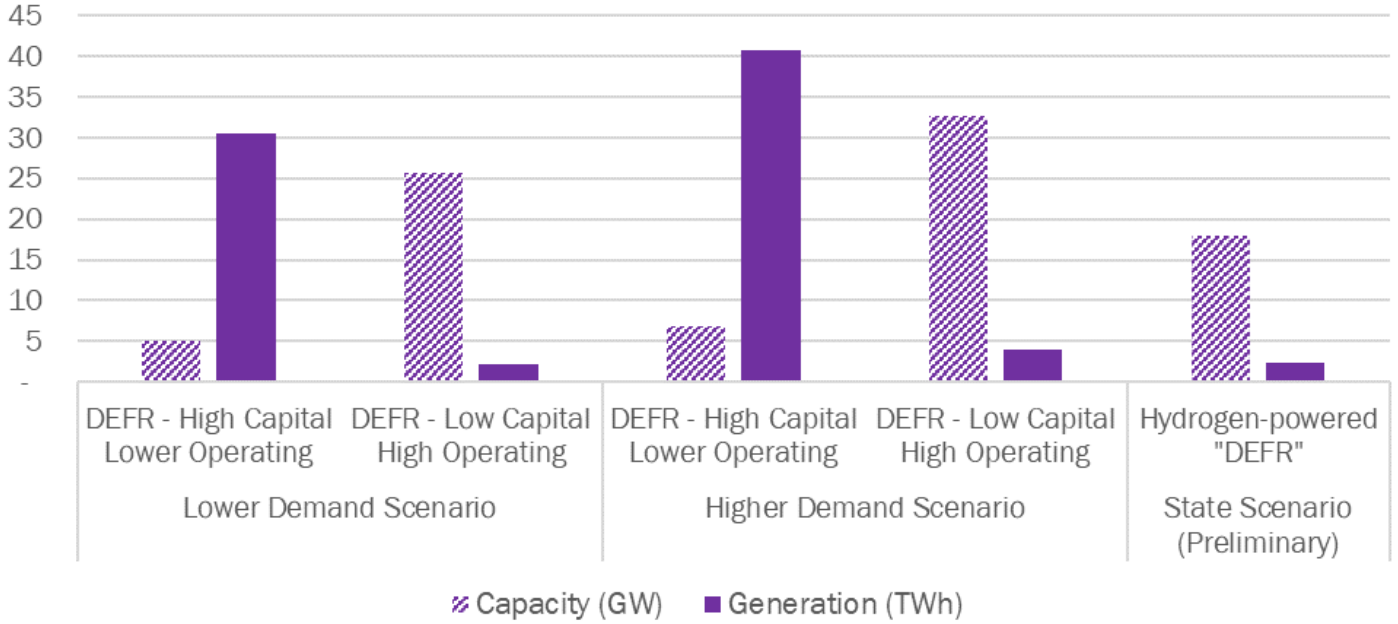
Dispatchable Emission-Free Resource Capacity and Generation in 2040



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Key Finding 4: Supply Resources

- ✓ New York will require three times the capacity of the current New York generation fleet to meet projected future electricity demands.

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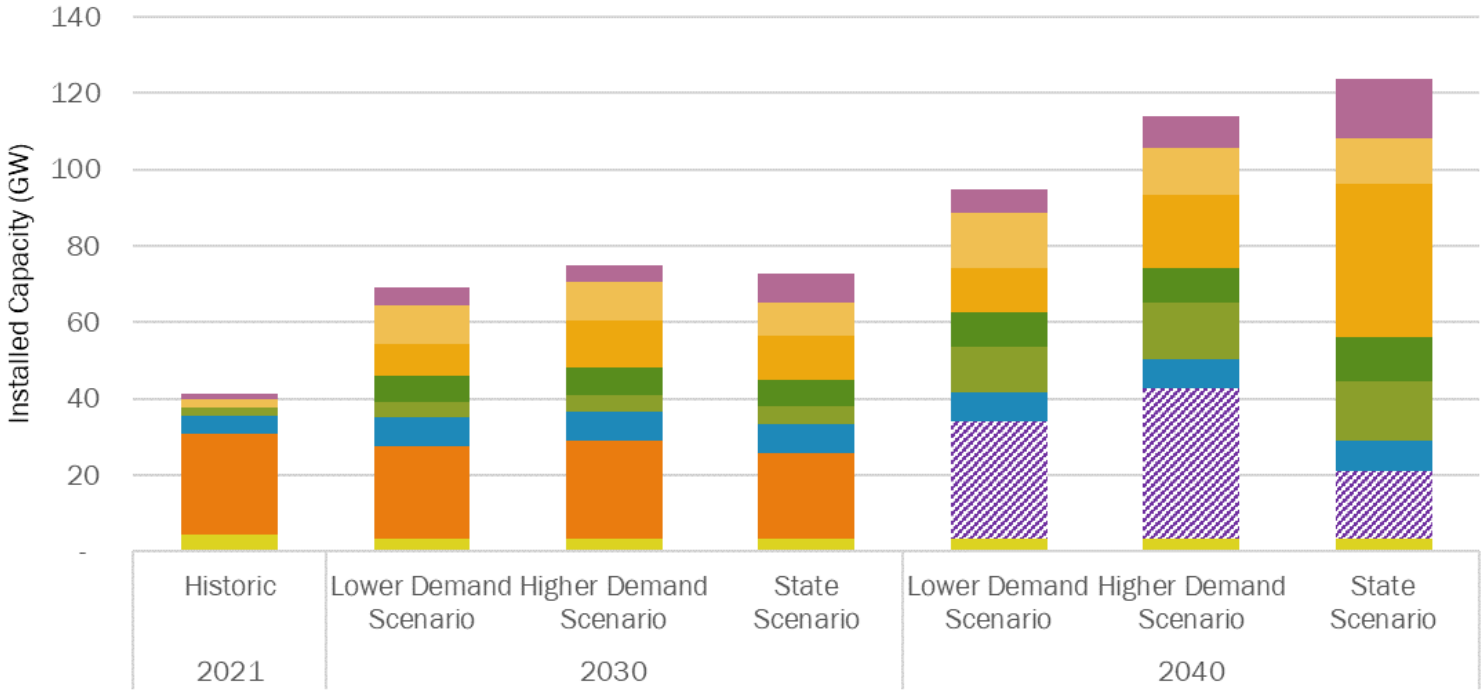
NYCA Installed Capacity for Policy Case Scenarios



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Key Finding 5: Supply Resources

- ✓ The coordination of new generator additions and existing generator retirements is essential to maintain the reliability of the New York power system while simultaneously pursuing achievement of CLCPA.

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Key Finding 6: Supply Resources

- ✓ Uncertainty in siting new renewable generation could lead to delays in or inefficient expansion of the transmission and distribution systems.

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Key Finding 7: Transmission

- ✓ Historic levels of investment in the transmission system are happening but more will be needed.

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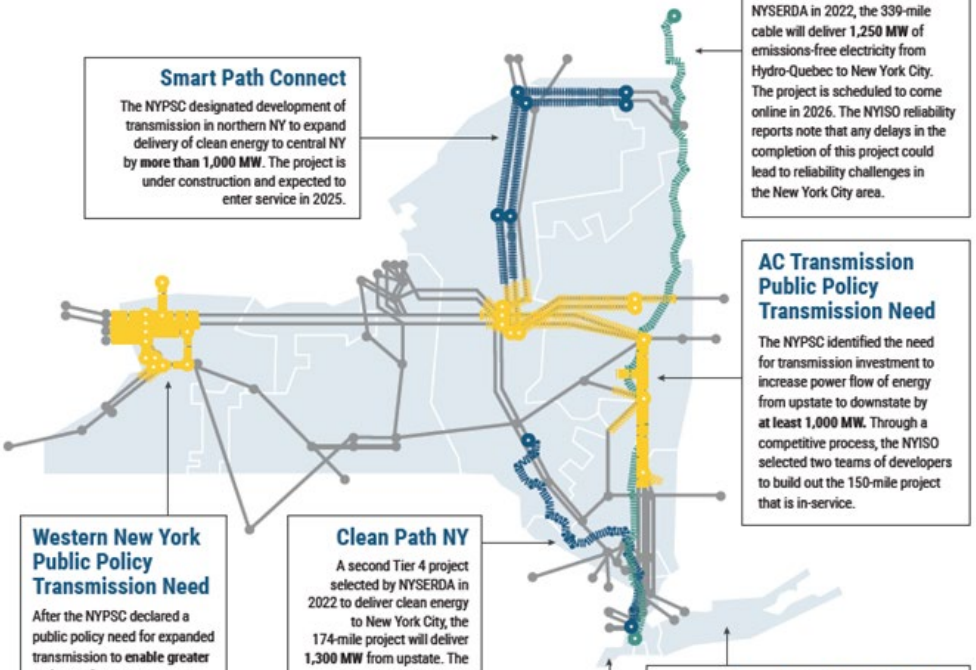
NEW TRANSMISSION PROJECTS IN NEW YORK STATE



Champlain Hudson Power Express (CHPE)

Awarded a Tier 4 REC contract by NYSERDA in 2022, the 339-mile cable will deliver **1,250 MW** of emissions-free electricity from Hydro-Quebec to New York City. The project is scheduled to come online in 2026. The NYISO reliability reports note that any delays in the completion of this project could lead to reliability challenges in the New York City area.

Smart Path Connect

The NYPSC designated development of transmission in northern NY to expand delivery of clean energy to central NY by **more than 1,000 MW**. The project is under construction and expected to enter service in 2025.

AC Transmission Public Policy Transmission Need

The NYPSC identified the need for transmission investment to increase power flow of energy from upstate to downstate by **at least 1,000 MW.** Through a competitive process, the NYISO selected two teams of developers to build out the 150-mile project that is in-service.

Western New York Public Policy Transmission Need

After the NYPSC declared a public policy need for expanded transmission to **enable greater delivery of hydro resources** from Niagara, the NYISO selected a 20-mile, $181 million project through an extensive, competitive process. The project is in-service.

Clean Path NY

A second Tier 4 project selected by NYSERDA in 2022 to deliver clean energy to New York City, the 174-mile project will deliver **1,300 MW** from upstate. The project is expected to be in-service in 2027.

Long Island Public Policy Transmission Need

In 2021, the NYPSC identified a need to expand the transmission capability between Long Island, NYC, and the rest of the state by **at least 3,000 MW** to support the CLCPA's offshore wind requirements. Expanded transmission is needed to move offshore wind energy from Long Island to the rest of NY. The NYISO Board of Directors selected a solution in June 2023.

NYC Public Policy Transmission Need

In June 2023, the NYPSC identified a need to expand the state's transmission system to **deliver energy from offshore wind resources to New York City.**

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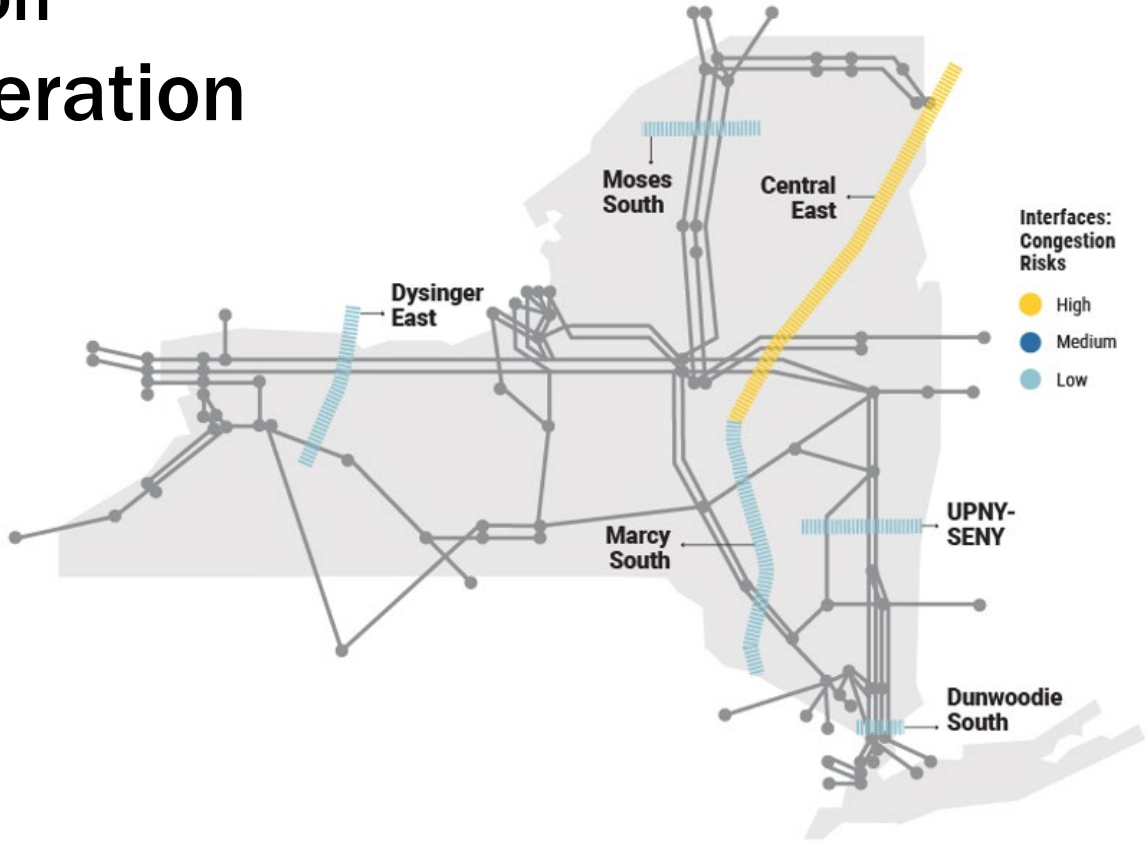
Key Finding 8: Transmission

- ✓ Actionable expansion opportunities: Additional dynamic reactive power support must be added to the grid in upstate New York to alleviate congestion and fully utilize the transmission capability of the Central East interface.

Bulk Transmission Renewable Generation Resource Map



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Key Finding 9: Transmission

- ✓ Opportunities for further transmission investment in Western and Northern New York should be monitored as resources are developed in those regions.

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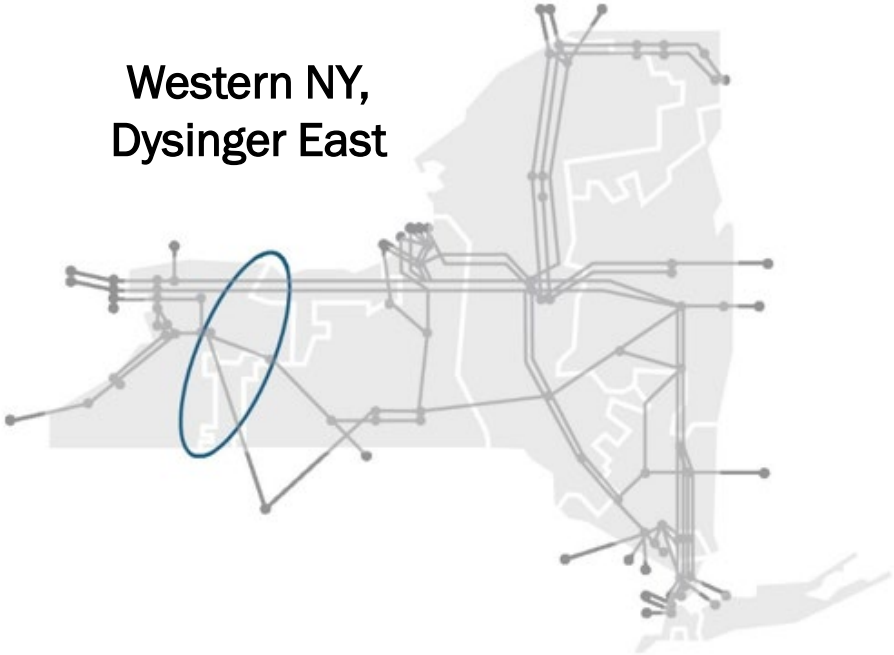
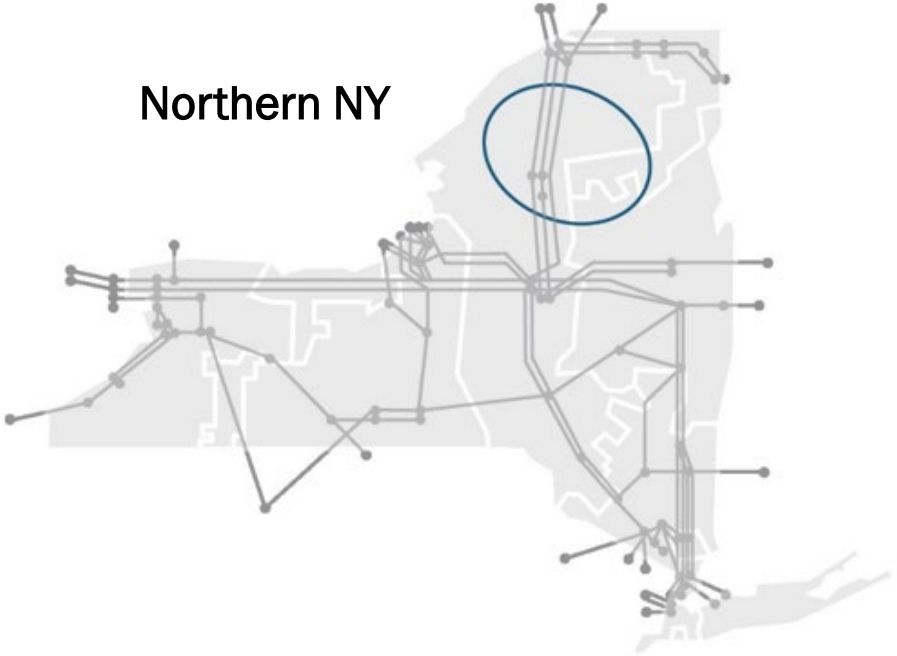
Western and Northern NY Bulk Transmission Areas





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Key Finding 10: Transmission

- ✓ Planning energy exchange with neighboring systems is becoming more complex and will be increasingly so in the future as each system transitions to more decarbonized systems.

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NYISO Interregional Connections

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Questions, Comments, & Feedback?

Email additional feedback to:
SCarkner@nyiso.com

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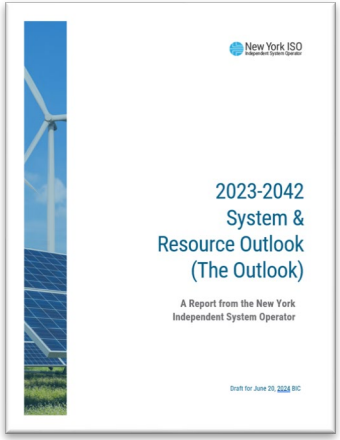
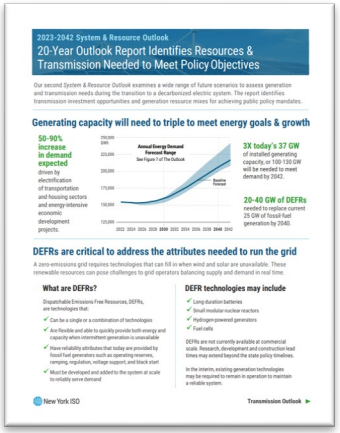
2023-2042 System & Resource Outlook Data Catalog

Report



Study Summary



Report Appendices

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Data Documents

- Production Cost Results
- Forecast Assumptions
- Policy Case Nodal Placement
- Policy Case Zonal Capacity Additions
- Policy Case LBMPs
- Zonal Renewable Shapes

Stakeholder Presentations

November 18, 2022
- 2021 Outlook Lessons Learned
- NYSERDA Outlook Suggestions

June 16, 2023
- 2023-2042 Outlook Kickoff

July 17, 2023
- 2023-2042 Outlook Benchmark
- 2023-2042 Outlook Update

August 22, 2023
- 2023-2042 Outlook Preliminary Reference Case Assumptions

September 21, 2023
- 2023-2042 Outlook Reference Case Assumptions Update

October 24, 2023
- 2023-2042 Outlook Reference Case Assumptions Update

November 2, 2023
- 2023-2042 Outlook Reference Case Assumptions Update & Preliminary Base Case Results

November 21, 2023
- 2023-2042 Outlook Reference Case Updates

December 19, 2023
- 2023-2042 Outlook Reference Case Updates & Preliminary Contract Case Results

January 23, 2024
- 2023-2042 Outlook Reference Case Updates

February 22, 2024
- 2023-2042 Outlook Reference Case Updates & Final Base & Contract Case Results

March 1, 2024
- 2023-2042 Outlook Preliminary Contract Case Renewable Pockets & Capacity Expansion Scenario Results

March 21, 2024
- 2023-2042 Outlook Policy Case Updates

April 4, 2024
- 2023-2042 Outlook Policy Case Updates

April 30, 2024
- 2023-2042 Outlook Policy Case Updates & Preliminary Policy Case Renewable Pockets

May 3, 2024
- 2023-2042 Outlook Status Updates

May 14, 2024
- 2023-2042 Outlook Status Updates and Preliminary Draft Report

June 7, 2024
- 2023-2042 Outlook Preliminary Key Findings and Draft Report

June 20, 2024 (BIC)
- 2023-2042 System and Resource Outlook Draft Report
- 2023-2042 System and Resource Outlook Presentation
- 2023-2042 System and Resource Outlook Appendices (Zip Folder)
- MMU Review of 2023-2042 System and Resource Outlook

June 27, 2024 (MC)
- 2023-2042 System and Resource Outlook Presentation
- 2023-2042 System and Resource Outlook Draft Report
- 2023-2042 System and Resource Outlook Appendices (zip folder)
- MMU 2023-2042 System and Resource Outlook Review

2021-2040 System & Resource Outlook Data Catalog

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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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