New York ISO
Independent System Operator

Economic Planning Process

2021-2040 System & Resource Outlook

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Public Information Session

October 25th, 2022

Agenda

- NYISO System & Resource Planning Overview
- NYISO Economic Planning Process Overview
- 2021-2040 System & Resource Outlook
  - Study Process
  - Transmission Congestion Analysis
  - Key Findings
- Questions, Comments, & Feedback

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NYISO System & Resource Planning

The Roles of the NYISO

- **Reliable Operations**
  Maintaining bulk power system reliability is the cornerstone of the NYISO's mission and focus, shaping how we operate, design markets, and conduct system planning.

- **Efficient Markets**
  Competitive wholesale electric markets provide reliable power at the lowest possible cost to meet consumer needs. We conduct and monitor competitive auctions of wholesale electricity including needed ancillary services every five minutes, every day of the year.

- **Comprehensive Planning**
  An important step in supporting New York's ambitious clean energy goals is to study the future grid to promote a better understanding of what will be needed, including emerging technologies, to meet reliability.

- **Authoritative Source**
  A pillar of our focus is to serve as an independent source of fact-based information on the evolving electric system.

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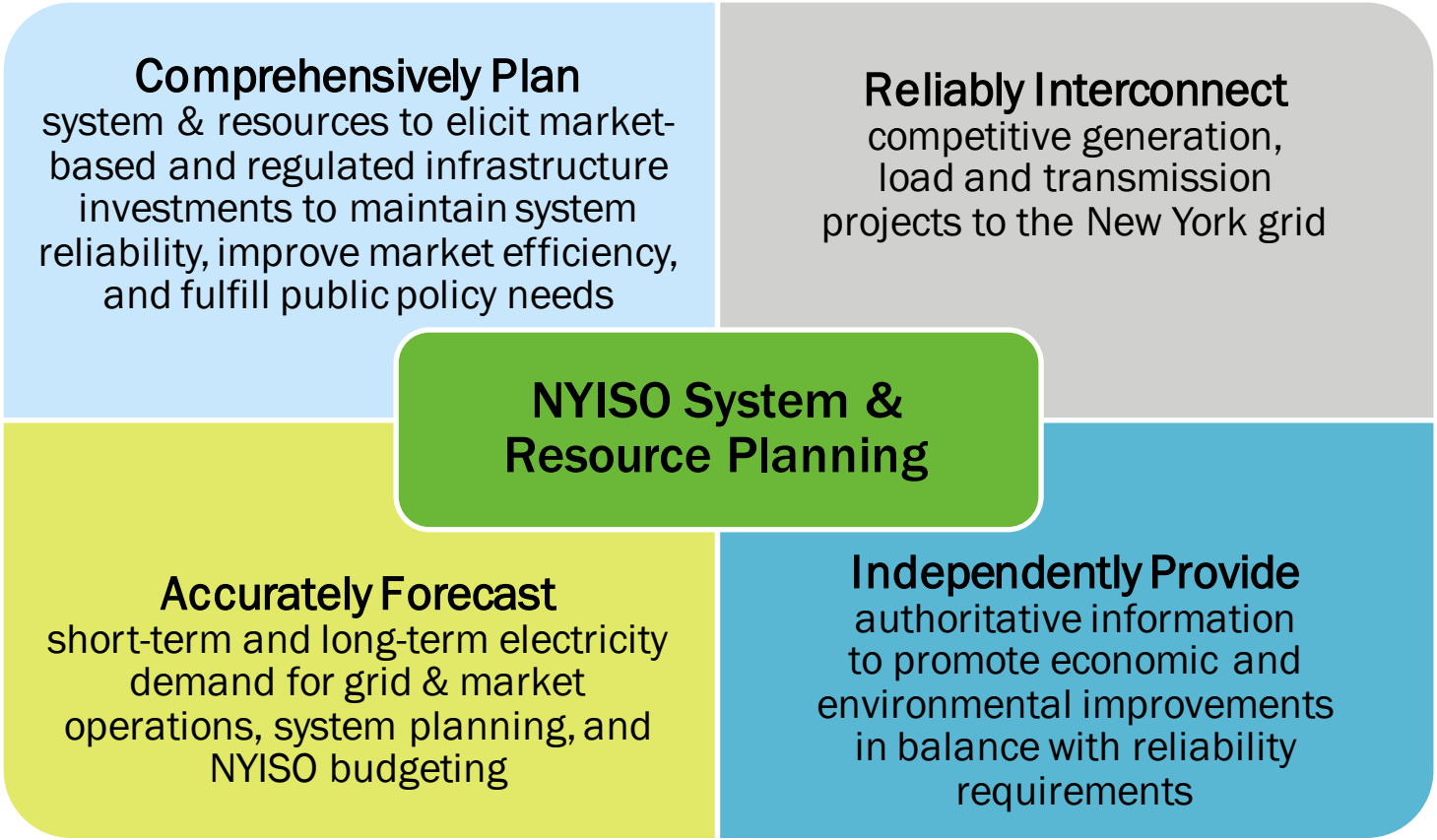

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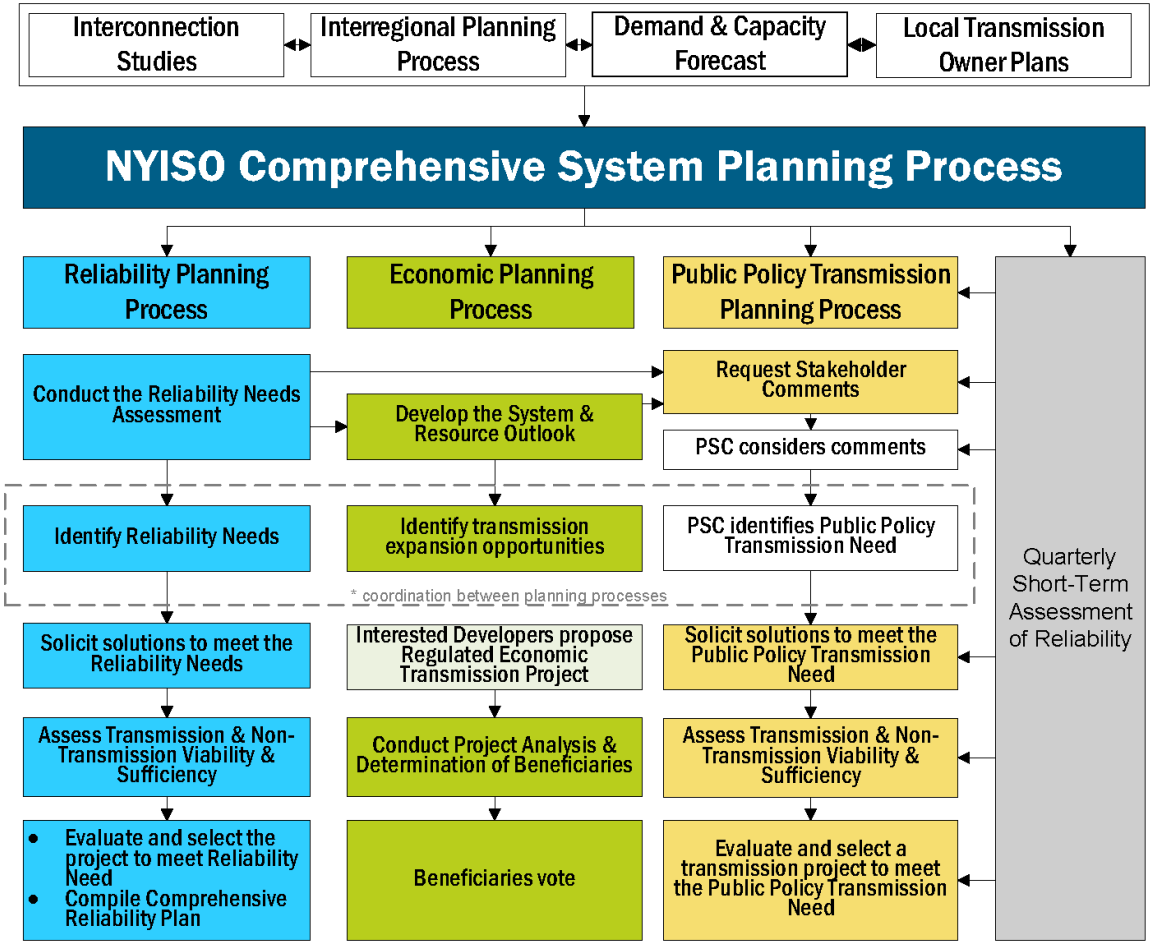

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NYISO's Economic Planning Process

Economic Planning Origins

- In 2007, the Federal Energy Regulatory Commission (FERC) issued Order 890 that identified **nine** "Transmission Planning Principles" that established the basis for transmission planning at ISO/RTOs
- The **eighth** principle required that all ISO/RTO's complete an economic planning study to identify "significant and recurring" congestion

h. Economic Planning Studies

529. In the NOPR, the Commission proposed to require transmission providers to prepare studies identifying "significant and recurring" congestion and post such studies on their OASIS. The Commission explained that the studies should analyze and report

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Economic Planning Origins (2)

- In response to Order 890, the NYISO developed OATT Attachment Y Section 31.3 & 31.5, which established the Congestion Assessment & Resource Integration Study (CARIS) to fulfill Order 890 requirements
- In 2021, the NYISO made major modifications to the tariff, eliminating the CARIS and creating the System & Resource Outlook, which is now the primary product of the Economic Planning Process

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Economic Planning Process Studies

1. **System & Resource Outlook, "The Outlook"**
   - 20-year study of system & congestion
   - Identification of challenges related to achieving New York policy objectives
2. **Economic Transmission Project Evaluation (ETPE)**
   - Study of actual transmission project proposals
   - Project w/ benefit/cost ratio eligible for vote for cost recovery
3. **Requested Economic Planning Study (REPS)**
   - Stakeholder or other interested party requested study

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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 internal and external stakeholders

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System & Resource Outlook Study Process

System & Resource Outlook Scope

Model Development

- Reference cases
- Sensitives and Scenarios

Congestion Assessment

- Historic & Future Transmission Congestion
- Congestion Relief Analysis

- Renewable Pocket Formation
- Energy Deliverability Assessment

- Projected Operations & Market Impact Analysis

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High Level Study Assumptions

- All assumptions developed pursuant to Economic Planning procedures and in collaboration with stakeholders at ESPWG
- 20-Year Study Period (2021-2040)
- 2021-2030 Comprehensive Reliability Plan (CRP)
- 2021 Gold Book Load and Capacity Forecasts
- Resource changes pursuant to base case inclusion screening rules
- Assumption lockdown dates in Fall 2021

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Outlook Reference Case Models

- **Base Case**
  - Assumptions aligned with Reliability Planning Process
- **Contract Case**
  - Base Case + renewable projects with existing REC contracts
- **Policy Case (2 Scenarios)**
  - Contract Case + New York CLCPA carbon-free targets and goals
  - This is the only case that leverages a capacity expansion model

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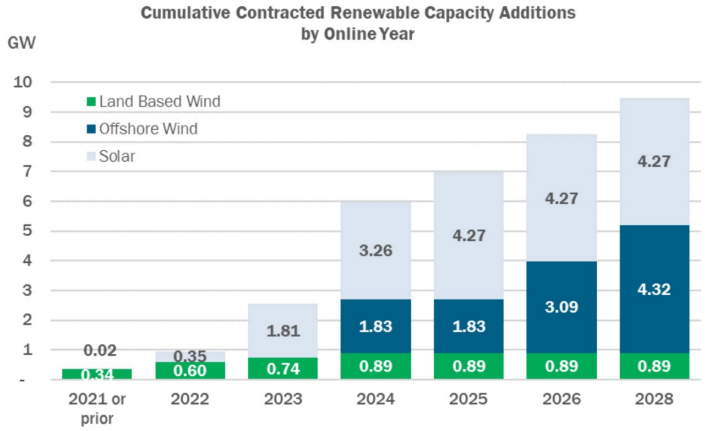
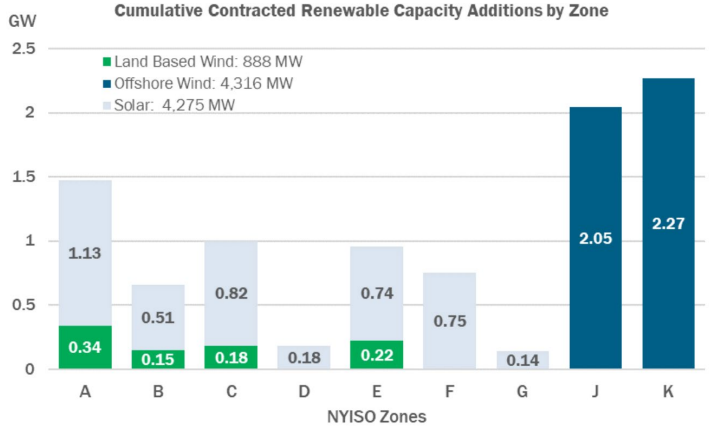
Base & Contract Cases

- **Focus on transmission congestion under**
  - Base – system "as-is" with minimal changes to capacity and uses the Goldbook Base load forecast
  - Contract – same as the Base case but also include the addition of current NYSERDA awarded renewable projects (~9 GW)





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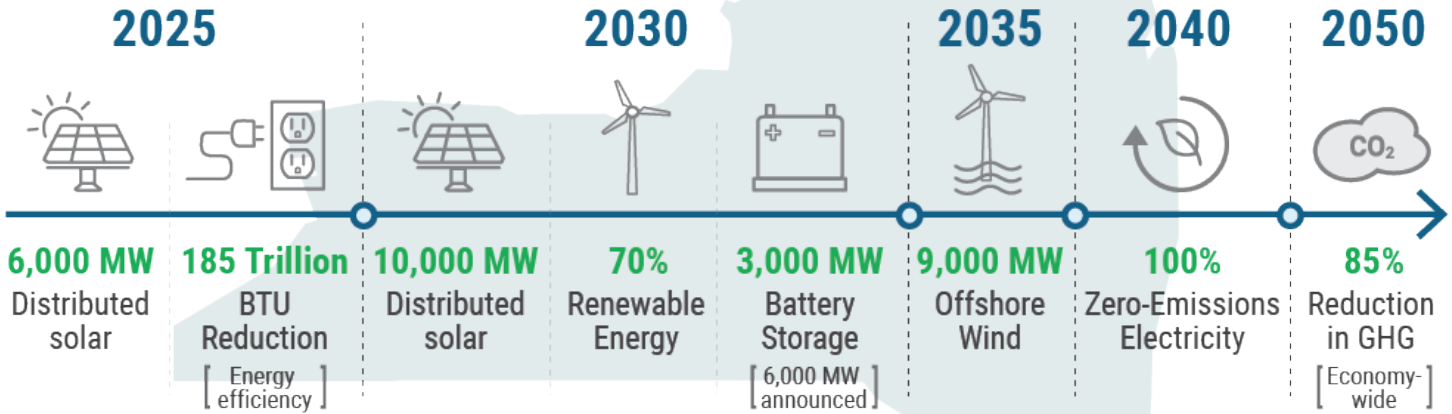
State energy policy goals



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Policy Case(s)

- **Two distinct Scenarios modeled (S1 & S2)**
- **Major updates beyond Base & Contract cases include:**
  - CLCPA policies all modeled to achievement
  - Increased demand forecasts due to electrification
  - Two "Tier 4" HVDC projects (Clean Path NY and Champlain Hudson Power Express) and NYPA Northern NY Priority Transmission Projects modelled
  - Most recent IRM/LCR used to maintain reliability
  - Dispatchable Emissions Free Resources (DEFR) proxy technology, which operates like a fully flexible combined cycle with 24x7 availability and CO2 free production

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Power System Tools in The Outlook

- **Production Cost**
  - GE MAPS
- **Capacity Expansion**
  - Energy Exemplar PLEXOS
- **Powerflow and Transfer Analysis**
  - PowerGEM TARA & Siemens PSSE

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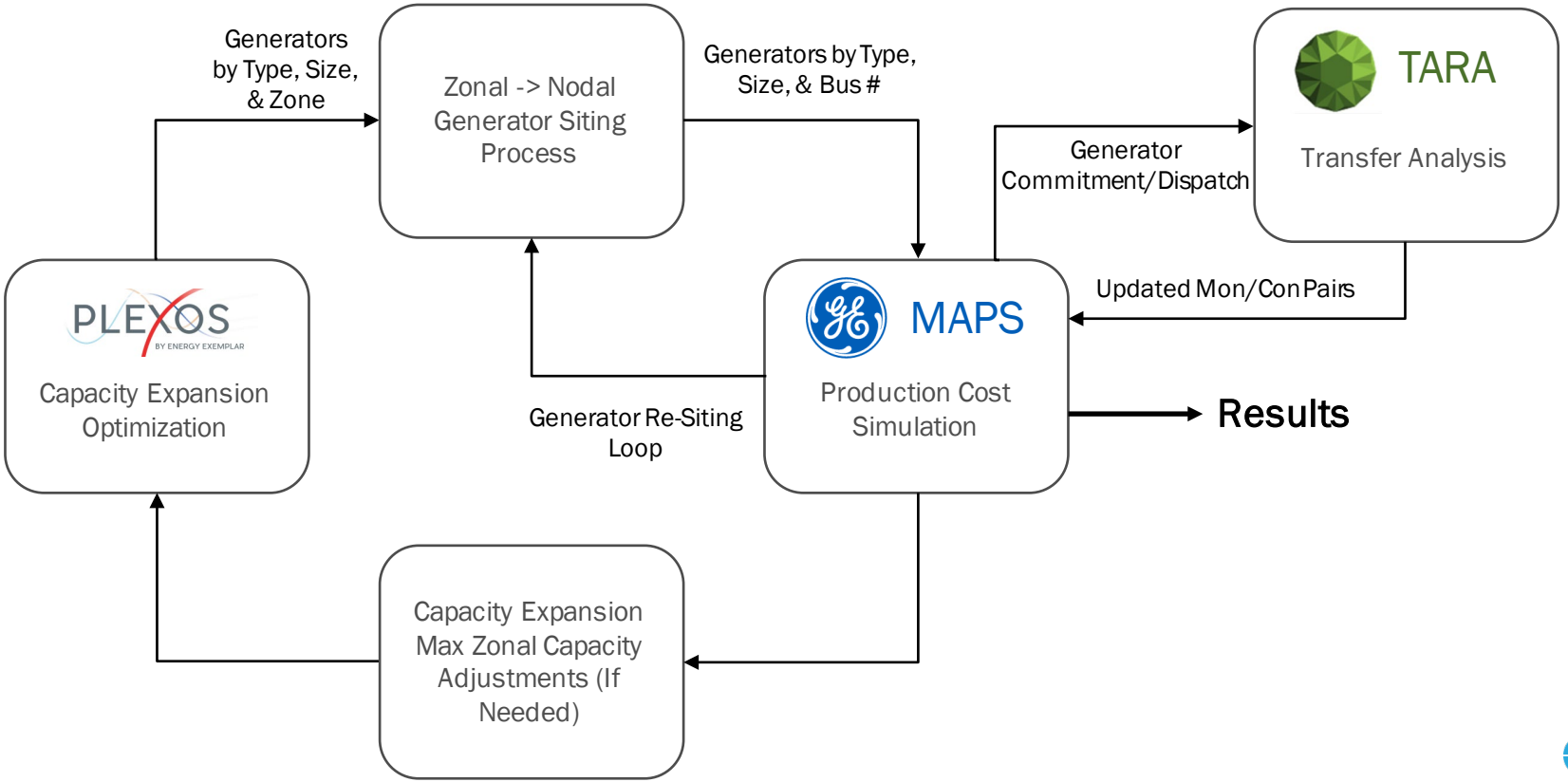
Policy Case Simulation Framework



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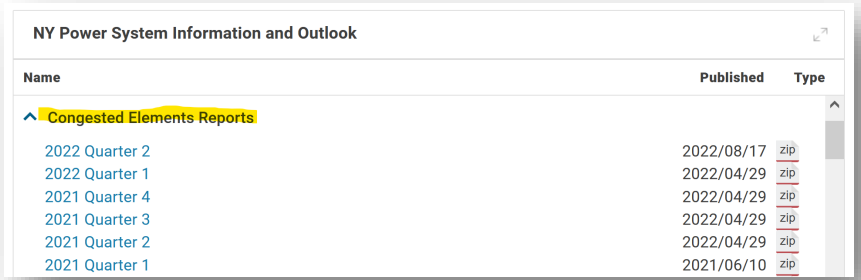
Transmission Congestion Analysis

Historic Transmission Congestion

- Per Order 890 requirements, the NYISO built routine transmission congestion data collection and reporting into the Economic Planning Process
- Historic congestion data is posted publicly to the NYISO website:



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Historic Congestion Metrics

- Congestion by Constraint ($)
- Demand Congestion by Constraint ($)
- Zonal Metrics by Day
  - Generation & Load (MWh)
  - Supply Energy, Congestion, & Loss Costs ($)
  - Demand Energy, Congestion, & Loss Costs ($)

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Recent Congestion Cost Data

Top 11 Constraints	Annual Congestion Cost (M$)					
	2018	2019	2020	2021	2022	5-Yr Total
23330 | CENTRALEAST-VC | BASECASE	171	157	123	320	412	1,183
23318 | SCH-NE-NY | BASECASE	32	14	9	23	23	102
25091 | DUNWODIE345SHORE_RD3451 | SCB:SPBK(RNS2):Y49&M29&Y49_ST	25	17	13	12	15	82
25164 | PACKARD230SAWYER2301 | BUS:PACKARDBK3&61&78	46	10	0	0	0	57
25186 | NIAGARA230PACKARD2301 | TWR:PACKARD62&BP76	10	18	16	14	2	59
25204 | SCRIBA345VOLNEY3451 | SCRIBA__-VOLNEY___345_21	5	34	4	3	1	47
25091 | DUNWODIE345SHORE_RD3451 | BASECASE	3	1	10	11	13	37
25455 | MARCY765MARCY3451 | TWR:MOSESMA1&MA2	19	2	0	0	0	22
26014 | GRISLD64115NIAGB1301151 | TWR:PACKARD77&78	0	19	0	0	0	19
23324 | SCH-HQ-NY | BASECASE	9	3	1	3	6	21
25105 | SPRNBRK345EGRDNCTR3451 | BASECASE	5	3	3	4	2	16

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Future Congestion Results

Figure 132: Projection of Future Demand$ Congestion 2021-2040 by Constrained Path for Baseline Case (nominal $M)[50]

Demand Congestion ($M)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CENTRAL EAST	$609	$286	$122	$25	$4	$1	$1	$4	$1	$2
DUNWOODIE TO LONG ISLAND	$56	$40	$29	$26	$27	$27	$29	$27	$30	$32
N.WAV-E.SAYR_115	$25	$29	$18	$12	$15	$17	$18	$18	$20	$20
ELWOOD-PULASKI_69	$24	$24	$14	$8	$5	$4	$1	$1	$6	$8
VOLNEY SCRIBA	$6	$6	$7	$6	$7	$8	$6	$8	$9	$9
UPNY-ConEd	$0	$0	$0	$2	$2	$2	$1	$3	$6	$5
CHESTR-SHOEMAKR_138	$31	$27	$26	$2	$1	$1	$1	$2	$3	$2
NEW SCOTLAND KNCKRBOC	$0	$0	$0	$20	$8	$3	$5	$13	$7	$8
SGRLF-RAMAPO_138	$0	$0	$0	$8	$5	$4	$5	$5	$5	$4
NORTHPORT PILGRIM	$7	$8	$5	$4	$2	$2	$1	$1	$3	$4
GREENBSH-STEPHTWN_115	$0	$0	$0	$5	$5	$5	$4	$5	$5	$5
INGHAMS CD-INGHAMS E_115	$0	$0	$0	$11	$2	$2	$2	$4	$2	$1
ALCOA-NM - ALCOA N_115	$0	$1	$1	$2	$2	$3	$3	$4	$4	$4
DUNWOODIE MOTTHAVEN	$3	$3	$0	$1	$1	$3	$3	$1	$2	$2
OWENSCRN-SABICO_115	$0	$0	$0	$3	$3	$3	$3	$2	$3	$3
FERND-W.WDB_115	$13	$6	$8	$2	$2	$1	$0	$0	$2	$1

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System & Resource Outlook Key Findings

2021 – 2040 System & Resource Outlook

Key Findings

Critical Factors for New York's CLCPA Success	The NYISO Will
Add New Resources To meet policy objectives, over 95 GW of new zero-emission resources will be required by 2040, at least 20 GW needs to be added in the next 7 years	**Identify Needs & Opportunities** Continue to assess the evolving system and identify the challenges and opportunities associated with achieving state policies in an economic and reliable manner
Expand Transmission The current New York transmission system, at both local and bulk levels, is inadequate to achieve currently required policy objectives.	**Review Its Wholesale and Reliability Rules** to facilitate the orderly transition of replacement resources
Maintain Reliability Dispatchable emission-free resources must be developed and deployed throughout New York.	**Solicit Stakeholder Feedback** on Public Policy Transmission Needs

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Key Finding 1:

✓ **The pace of renewable project development is unprecedented and requires an increase in the pace of transmission development**

Every incremental advancement towards policy achievement matters on the path to a greener and reliable grid in the future, not just at the critical deadline years such as 2030 and 2040. In general, resource and transmission expansion take many years from development to deployment.

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Key Finding 2:

✓ **Coordination of project additions and retirements is essential to maintaining reliability and achieving policy.**

Coordination of renewable energy additions, commercialization and development of dispatchable technologies, fossil fuel plant operation, and staged fossil fuel plant deactivations over the next 18 years will be essential to facilitate an orderly transition of the grid.

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Key Finding 3:

✓ **Significant new resource development will be required to achieve CLCPA energy targets.**

The total installed generation capacity to meet policy objectives within New York is projected to range between 111 GW and 124 GW by 2040. At least 95 GW of this capacity will consist of new generation projects and/or modifications to existing plants. Even with these additions, New York still may not be sufficient to fully meet CLCPA compliance criteria and maintain the reliable electricity supply on which New York consumers rely. The sheer scale of resources needed to satisfy system reliability and policy requirements within the next 20 years is unprecedented.

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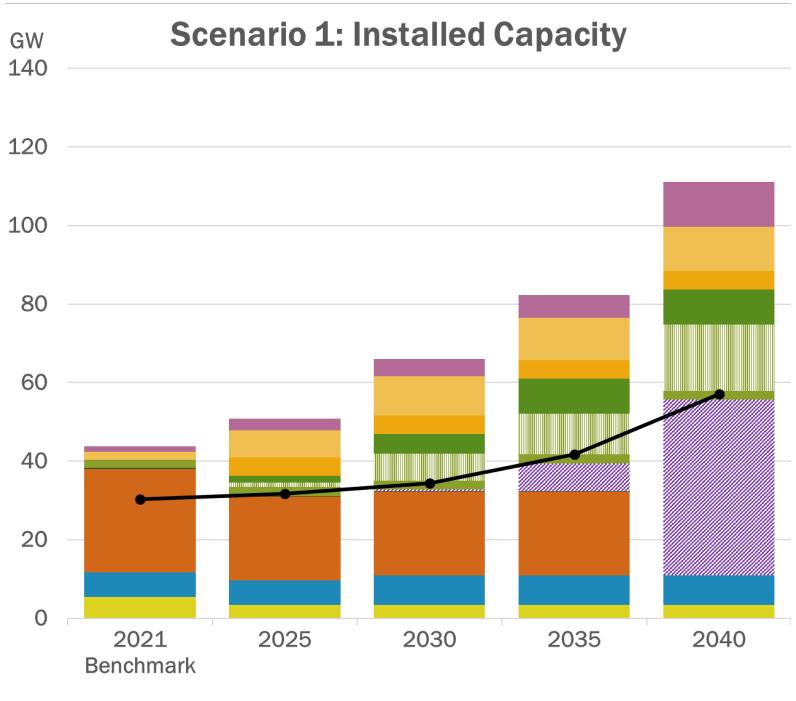
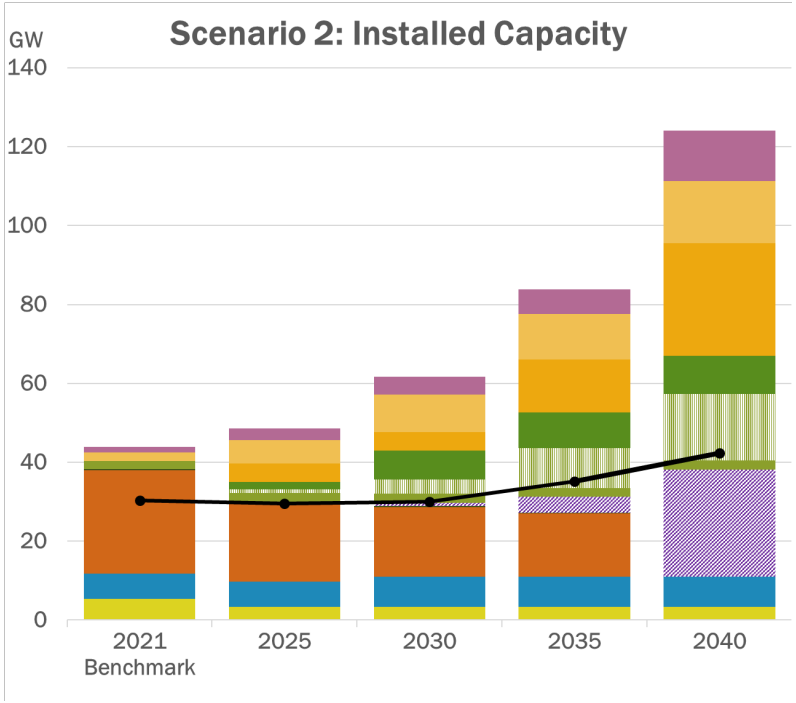
New York Generation Resource Mix Scenarios and Demand Forecast





ExistingNuclear NewNuclear Hydro ExistingFossil NewFossil Other DEFR
ExistingLBW NewLBW OSW UPV BTM-PV ESR Peak Load

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Key Finding 4:

✓ **To achieve an emission-free grid, dispatchable emission-free resources (DEFRs) must be developed and deployed throughout New York.**

DEFRs that provide sustained on-demand power and system stability will be essential to meeting policy objectives while maintaining a reliable electric grid. While essential to the grid of the future, such DEFR technologies are not commercially viable today. DEFRs will require committed public and private investment in research and development efforts to identify the most efficient and cost-effective technologies with a view towards the development and eventual adoption of commercially viable resources. The development and construction lead times necessary for these technologies may extend beyond policy target dates.

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Key Finding 5:

✓ **As the energy policies in neighboring regions evolve, New York's imports and exports of energy could vary significantly due to the resulting changes in neighboring grids.**

New York is fortunate to have strong interconnections with neighboring regions and has enjoyed reliability and economic benefits from such connections. The availability of energy for interchange is predicted to shift fundamentally as policy achievement progresses. Balancing the need to serve demand reliably while achieving New York's emission-free target will require continuous monitoring and collaboration with our neighboring states.

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Key Finding 6:

✓ **Transmission limitations prevent full delivery of renewable energy.**

A minimum of 5 TWh of renewable energy in 2030 and 10 TWh in 2035 is projected to be curtailed due to transmission limitations in renewable pockets. This equates to roughly 5% less renewable energy that can be counted toward the CLCPA targets.

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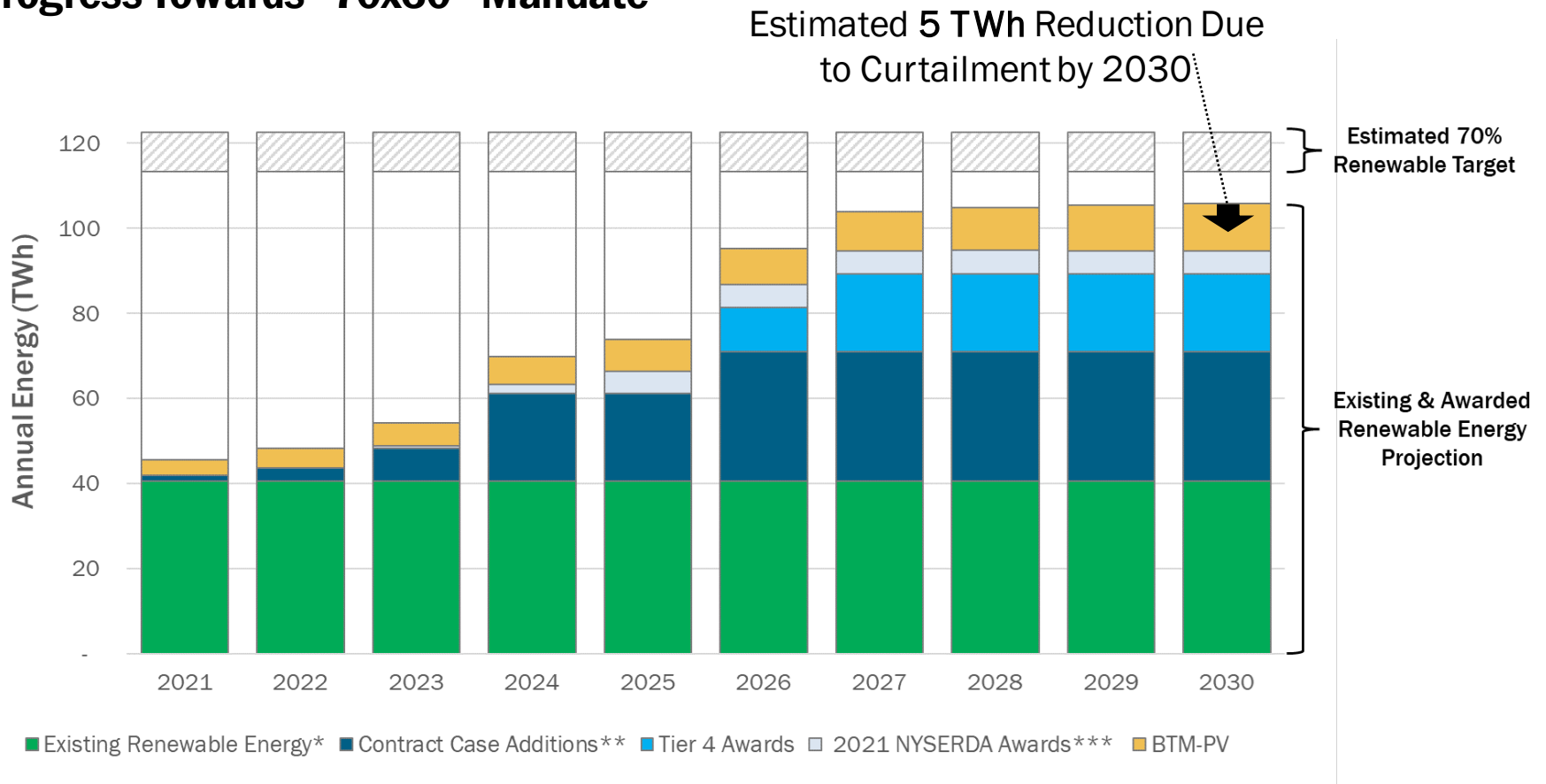
Progress Towards “70x30” Mandate



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Key Finding 7:

✓ **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 currently required policy objectives. Some renewable generation pockets throughout the State already face curtailments, more curtailments will be experienced in the future and will become more constrained as an increasing number of intermittent generation resources interconnect.

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Key Finding 8:

✓ **Four pockets will particularly benefit from transmission expansion.**

The Finger Lakes (Z1), Southern Tier (Z2), Watertown (X3), and Long Island. Without investment in transmission, these areas of the New York grid will experience persistent and significant limitations to deliver the renewable power from these pockets to consumers in the upcoming years.

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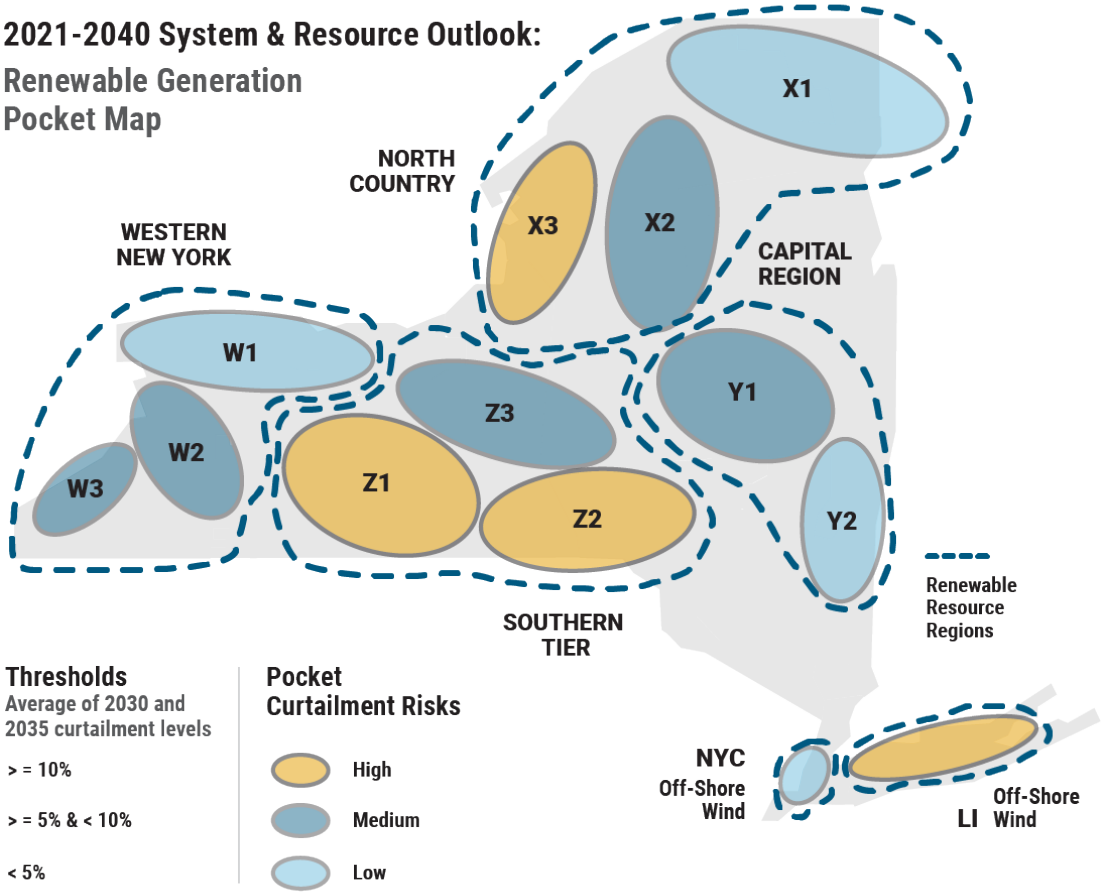
2021-2040 System & Resource Outlook:

Renewable Generation Pocket Map



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Questions, Feedback, Comments?

Email additional feedback to:
JFrasier@nyiso.com

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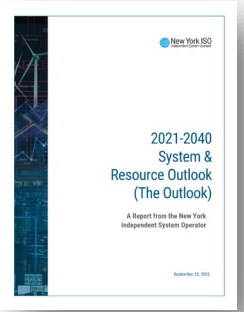
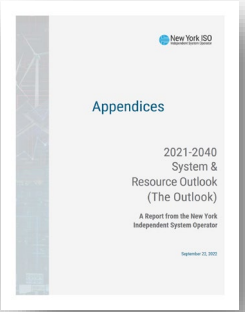
2021-2040 System & Resource Outlook Data Catalog

Report





Supporting Documents

- Capacity Expansion Assumptions Matrix
- Production Cost Assumptions Matrix
- Fuel Price Forecast
- Emissions Price Forecast
- Contract Case Renewable Projects
- Hourly Load Forecasts
- Detailed Model Output Data File
- MMU Renewable Profiles
- MMU Hourly LBMPs
- Outlook Policy Case Additions
- Policy Case LBMP Summary

Stakeholder Presentations

May 20, 2021
- Model Benchmark Results

September 22, 2021
- System & Resource Outlook Update

October 25, 2021
- Capacity Expansion Model Primer
- System & Resource Outlook Update

November 19, 2021
- System & Resource Outlook Update

December 19, 2021
- System & Resource Outlook Update

January 25, 2022
- System & Resource Outlook Update

February 9, 2022
- System & Resource Outlook Update
- Base & Contract Case Results

February 25, 2022
- System & Resource Outlook Update

March 8, 2022
- System & Resource Outlook Update

March 24, 2022
- System & Resource Outlook Update
- Contract Case Congestion Analysis

April 1, 2022
- System & Resource Outlook Update

April 26, 2022
- System & Resource Outlook Update

May 23, 2022
- System & Resource Outlook Update

June 2, 2022
- System & Resource Outlook Update

June 8, 2022
- System & Resource Outlook Update
- Updated 6/2 Presentation

June 21, 2022
- System & Resource Outlook Update

August 8, 2022
- System & Resource Outlook Update

August 17, 2022 (BIC)
- System & Resource Outlook Update

August 31, 2022 (MC)
- System & Resource Outlook Update

October 25, 2022 (Public Information Session)
- System & Resource Outlook

New York ISO

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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