New York Power Grid Study: Transmission Implications

PRESENTED BY

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Note

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It is, in part, based on the Initial Report on the New York Power Grid Study, published in **Case 20-E-0197**, under the Title of Matter: **Proceeding on Motion of the Commission to Implement Transmission Planning Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act**, on January 19, 2021 at:

http://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=259215&MatterSeq=62480

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Background

New York's Climate Leadership and Community Protection Act (CLCPA)requires:

- 70% renewable generation by 2030
- Zero-emission electricity by 2040
- 85% economy-wide reduction in greenhouse gas emissions by 2050

The CLCPA also specifies minimum amounts of certain types of resources including:

- 6,000 MW of distributed solar resources by 2025
- 3,000 MW of storage by 2030
- 9,000 MW of offshore wind (OSW) generation by 2035
- Much more renewable generation is necessary to achieve the 2040 and 2050 mandates

Meeting these milestones will require significant investments in:

- Renewable generation, storage, energy efficiency measures
- Electrification of the transportation and heating sectors
- Electric transmission and distribution (T&D) infrastructure

Overview of the Power Grid Study

To meet state policy directives, the PSC, through the Department of Public Service and in consultation with NYSERDA, initiated the **New York Power Grid Study (PGS),** which consists of **three component studies:**

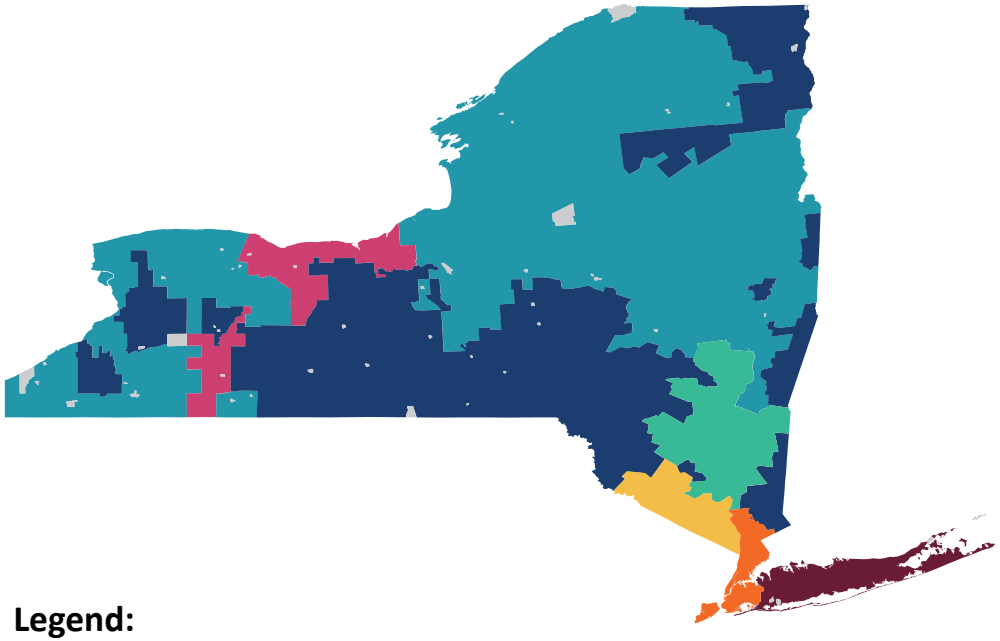
- **Utility Study**: Conducted by the Joint Utilities on local transmission and distribution (LT&D) needs;
- **Offshore Wind (OSW) Study**: Study of offshore and onshore bulk-power transmission scenarios to illustrate possible solutions to integrate the mandated 9,000 MW of offshore wind
  - Conducted by DNV-GL, PowerGem, and WSP for NYSERDA
- **Zero Emissions Study:** Scenario-based study to analyze transmission, generation, and storage options for achieving 70% renewable generation by 2030 and a zero emissions grid by 2040
  - Conducted by Siemens for NYSERDA

Utility Study

New York's utilities undertook a joint study, filed in November 2020, to identify local transmission and distribution (LT&D) upgrades necessary to achieve 70% renewable generation by 2030

- **Phase 1** LT&D projects for PSC approval to address existing reliability needs also provide CLCPA benefits
  - Local transmission projects to unbottle **6.6 GW** of renewable generation
  - Distribution projects to unbottle **2.0 GW** of renewables
- **Phase 2** LT&D proposals for further evaluation, including with new CLCPA benefit-cost analysis (BCA)
  - Local transmission projects would provide **12.7 GW** of additional renewable-integration headroom benefits
  - Distribution projects would support **2.8-4.3 GW** of additional renewable integration headroom benefits

New York State Electric Utility Territories



Utility Study: Local Transmission Takeaways

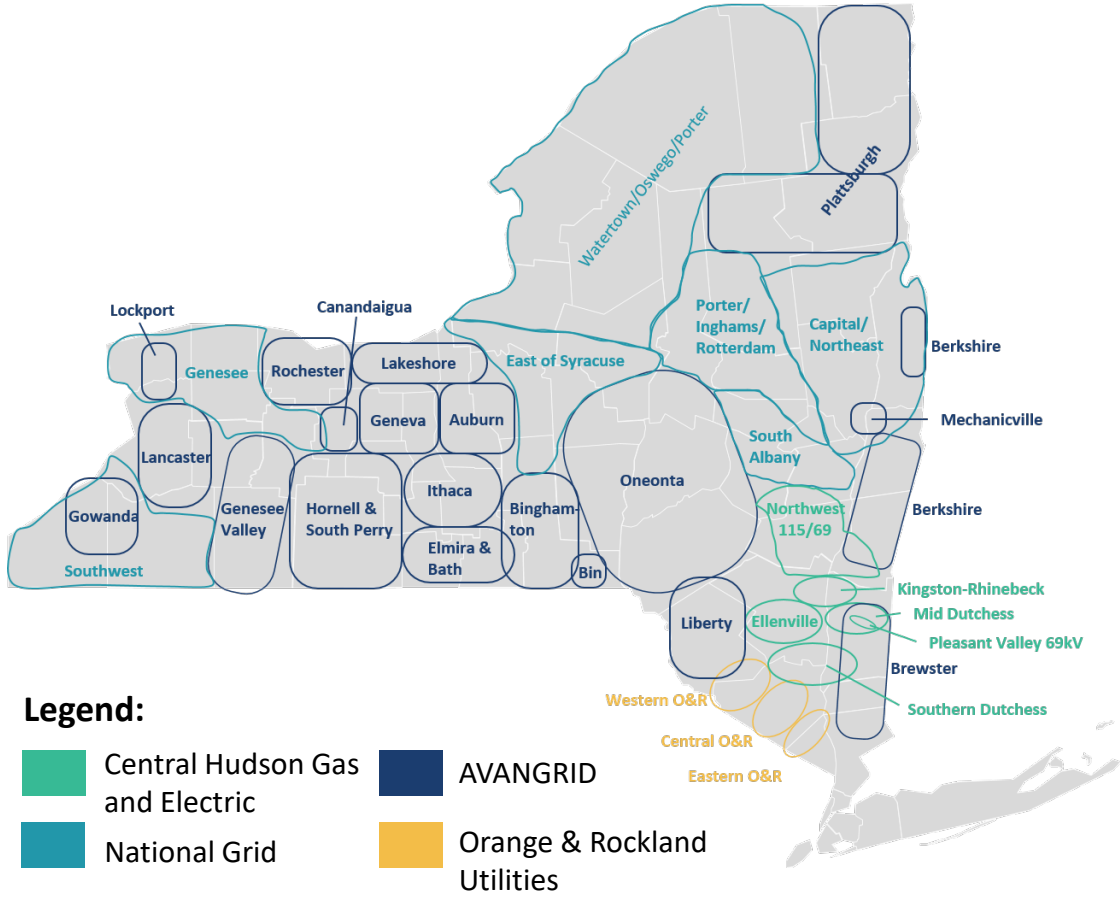
The total LT&D headroom created by the proposed Phase 1 projects appears sufficient to support the integration of land-based renewable resources needed to meet the State's 2030 objective. However:

- The headroom created by Phase 1 projects <u>does not</u> adequately address specific local transmission needs in certain attractive renewable development areas

Recommendations:

- Consider approval of Phase 1 projects
- Accelerate some Phase 1 projects and develop priority Phase 2 projects for attractive renewable locations (**Hornell, Watertown/Oswego/Porter, Genese/Lockport/Lancaster, Central Hudson**)
- Consider developing local **<u>renewable energy zones</u>** (REZs)
- Accelerate implementation of **<u>advanced technologies</u>**
- **<u>Improve planning framework</u>** for Phase 2 projects

Local Transmission Areas in Upstate Utilities' Service Territories



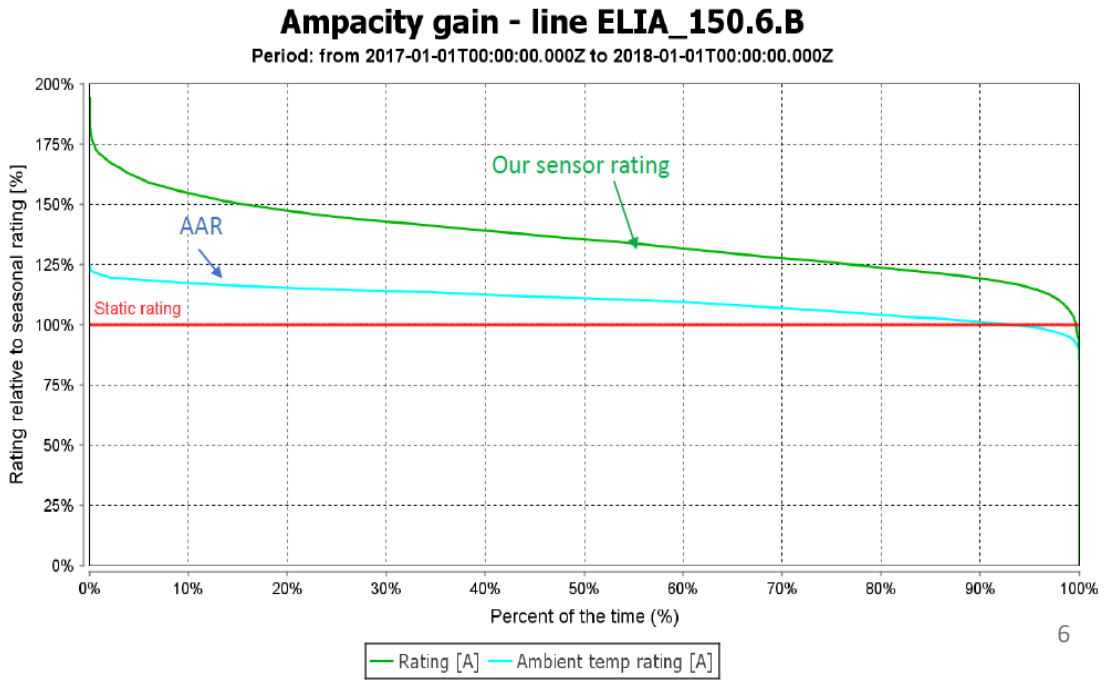
Advanced Grid Technologies

The Utility Study recommendations on advanced technologies do not go far enough

- The State should encourage the Utilities and transmission owners to more expeditiously evaluate and deploy well-tested advanced transmission technologies that could quickly provide CLCPA benefits and reduce costs
- Both Utility and NYISO transmission planning processes should be improved to recognize the unique advantages that advanced technologies can provide
- Cost recovery mechanisms will need to be clarified for storage facilities that address T&D needs but also participate in wholesale power market

Example: Dynamic Line Ratings (DLR)

- DLR can increase transmission ratings above static ratings by 25-30% on average over a year
  - Increase exceeds 10% during 90% of the year, 25% during 75% of the year, and 50% during 15% of the year
  - Only during 2% of the year dynamic line ratings are below static ratings, increasing reliability.
- Particularly effective in reducing (on-ramp-related) curtailments of wind energy
- Elia, the grid operator in Belgium, has successfully used DLR since 2008; now used on 35 major transmission lines



Offshore Wind Study

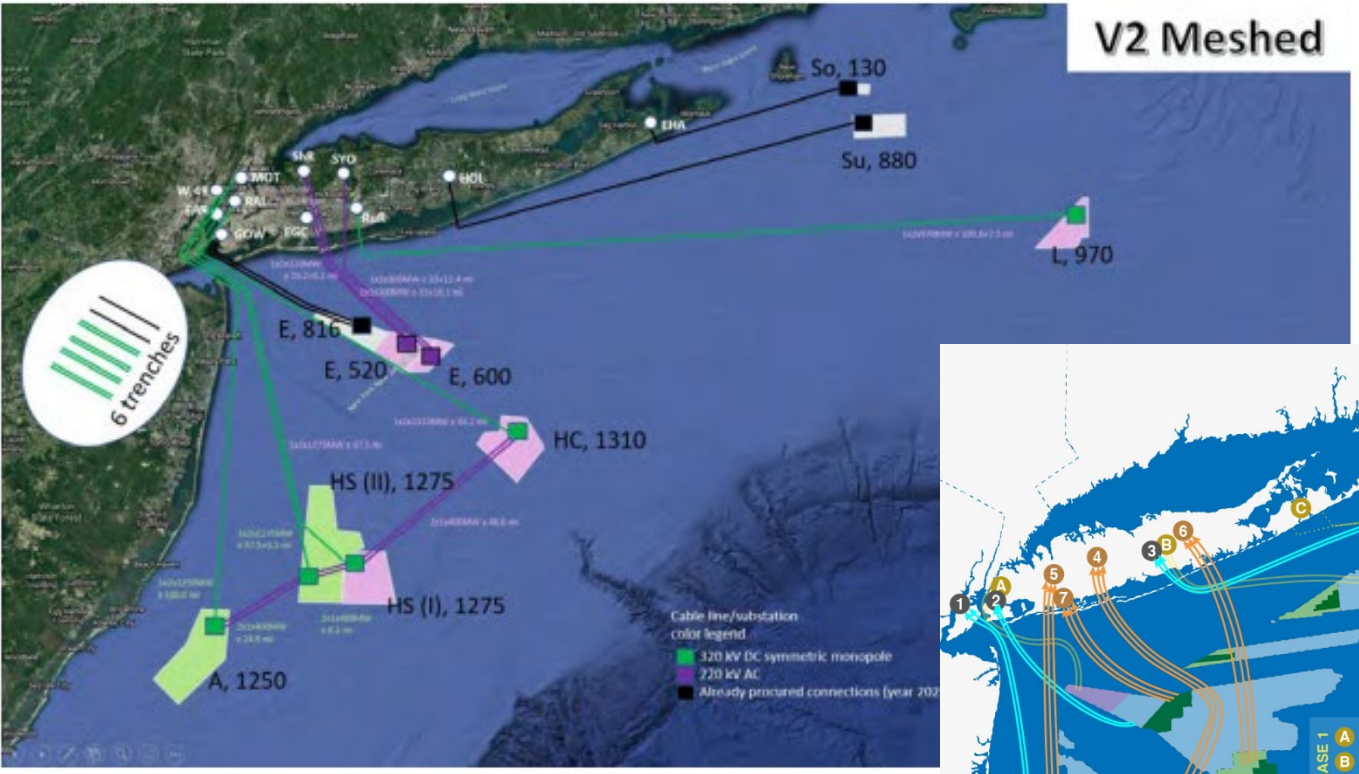
The Offshore Wind Integration Study (OSW Study) assesses bulk transmission needs relating to the integration of 9,000 MW (9 GW) of offshore-wind generation by 2035

- "**Onshore** assessment" to identify points of interconnection (POIs) and on-shore bulk-power transmission upgrades
- Development of **offshore** buildout scenarios from wind energy areas to selected POIs
  - Analyze offshore transmission to connect OSW plants
- Preliminary **permitting and feasibility** study of offshore cable routes and onshore landing points

Findings:

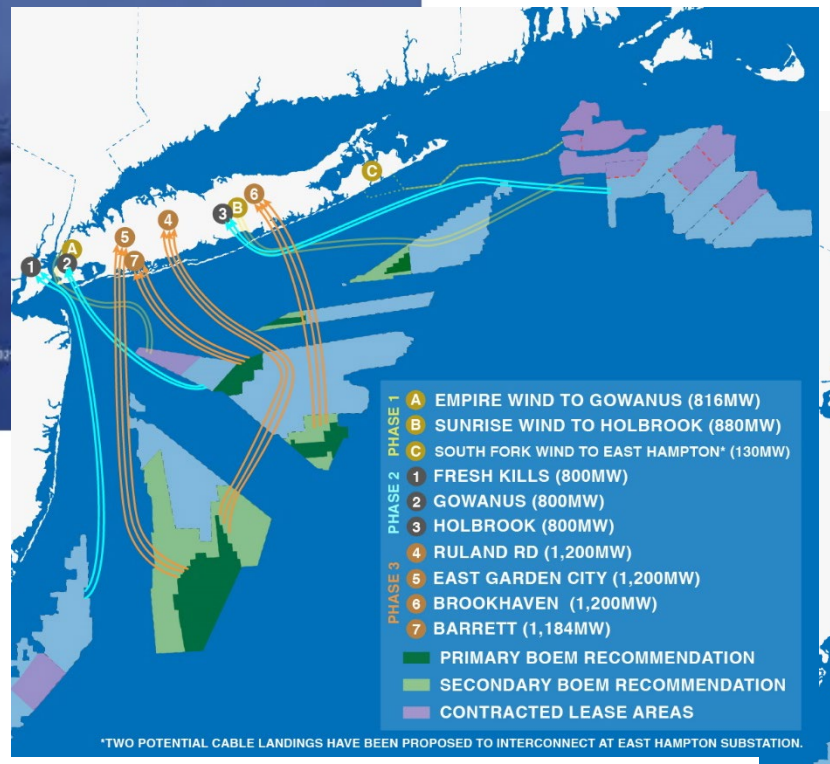
- Integrating 9 GW of OSW is feasible without major near-term bulk transmission upgrades if: 5-7 GW of OSW can be routed into NYC (so only 2-4 GW would need to connect to the grid on L.I.)
  - New transmission from Long Island likely needed by 2030-35 (sooner if more OSW connects on L.I.)
  - Significant uncertainty about most-likely and most-feasible POIs (OSW Study vs. related other studies)
- Requires careful planning of OSW procurement, battery deployment, and coordinated permitting
  - May warrant the development of "OSW hubs" to interconnect 5-7 GW in NYC (as proposed in Utility Study)
- Pursue options that allows for the creation of a more flexible and reliable "meshed" offshore grid

OSW Study vs. Similar other Studies

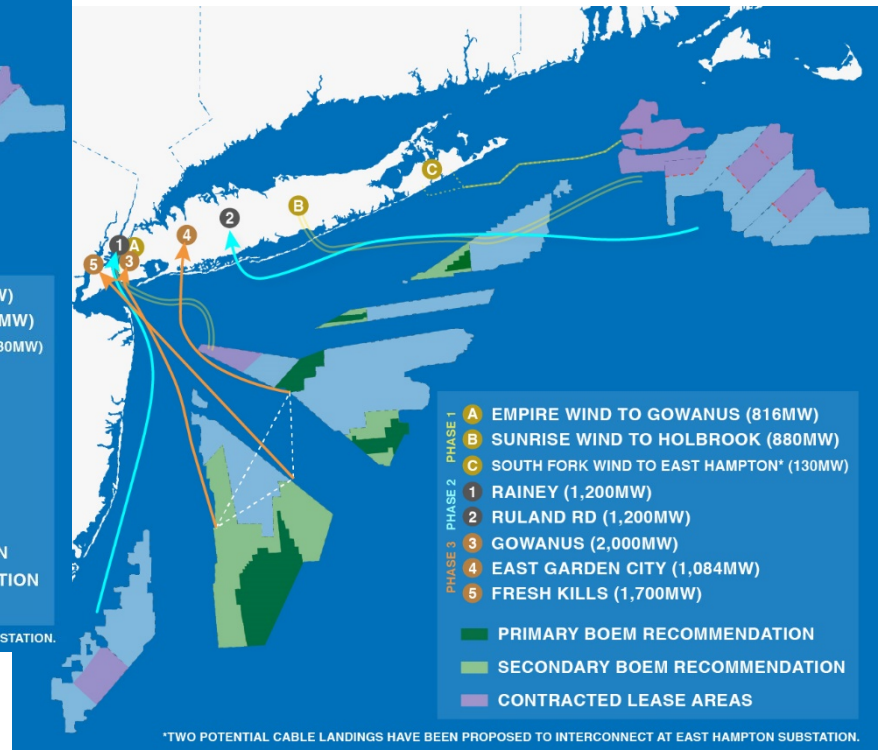


Source: OSW Study

Also note: the provisionally-awarded Beacon Wind project will support the responsible retirement of aging fossil fuel plants in Queens as part of the transition to clean energy; and the Empire Wind project may evolve to potentially support the retirement/repowering of the E.F. Barrett Generation Station in Nassau County



Source: Anbaric Study for New York State

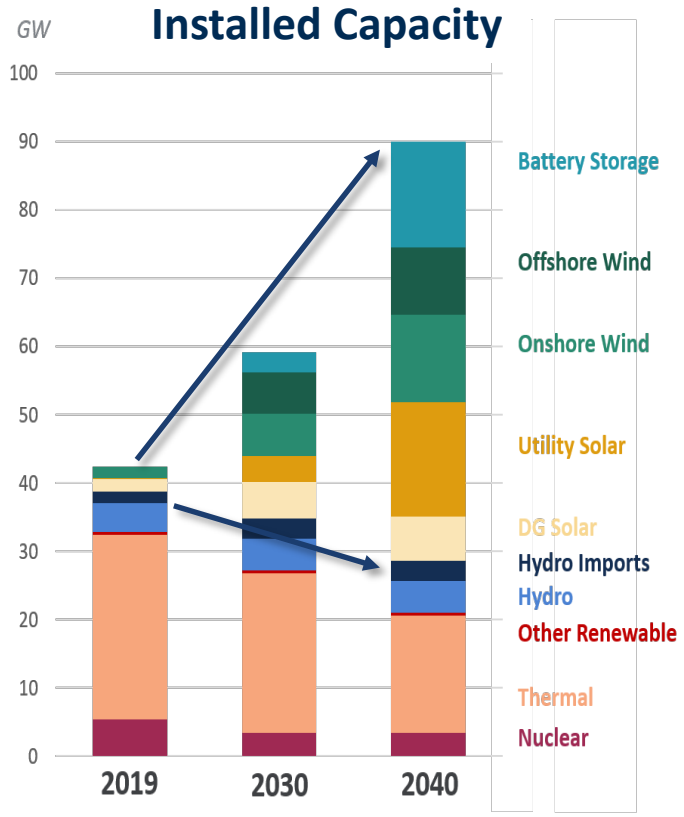


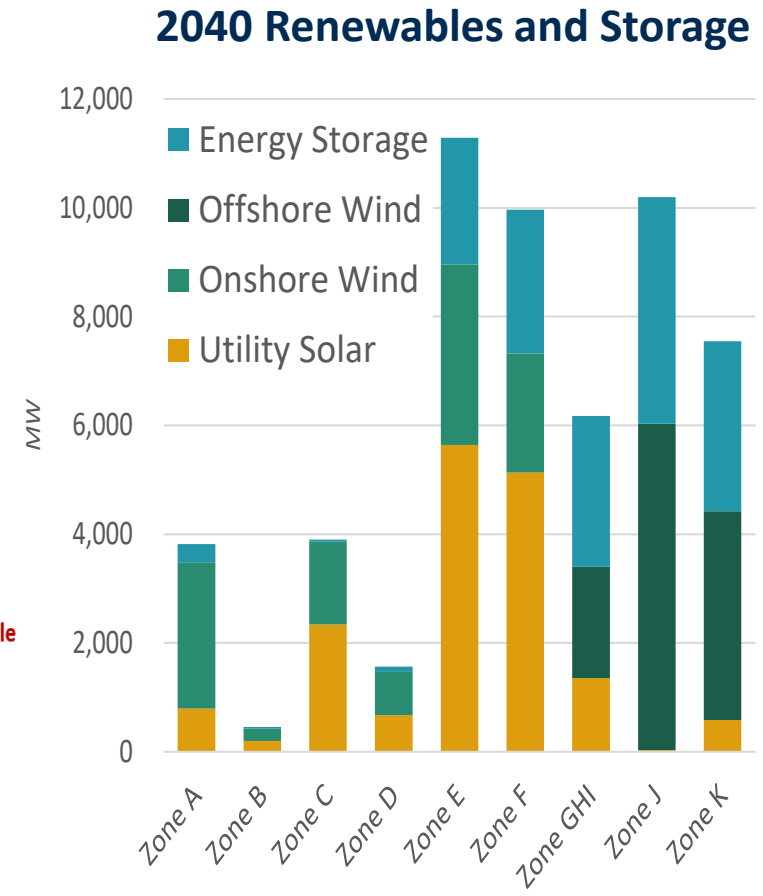
Zero Emissions Study

Analyzes transmission, generation, and storage scenarios for meeting NY's goals of zero-emission electricity by 2040 and 70% renewable generation by 2030 (drawing on New York Decarbonization Pathways Study)

2040 Results:

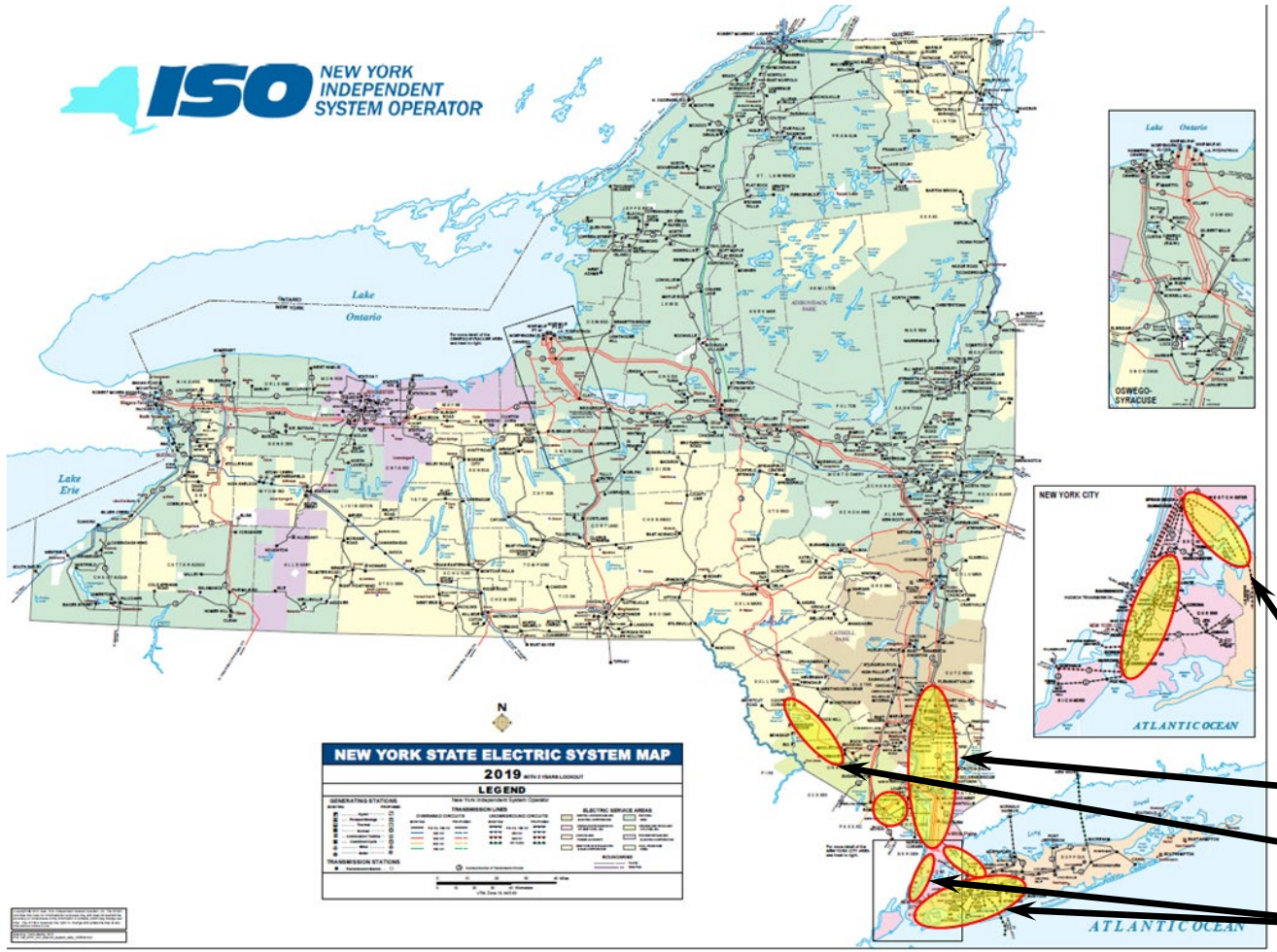
- Installed capacity more than double today's
- 10-15 GW each onshore wind, offshore wind, solar, and storage
- Ideally developed in certain areas:
  - Onshore wind primarily in western and northern NY (NYISO Zones A-F)
  - Offshore wind downstate (I, J, K)
  - Solar in central NY
  - Storage in central and downstate NY
- 17 GW of "thermal" backup generation fueled by renewable natural gas (as placeholder until more clarity exists about future technologies)





Zero Emissions Study: Transmission Needs

2040 Projected Congestion Areas



2030 goals can likely be met at low levels of curtailment and congestion without significant bulk-power transmission beyond those already planned and under development

- Contingent on study's renewable/storage buildout
- Lower-voltage system needs are assessed in NYISO's CARIS and the Utility Study

- By 2040, high congestion and some curtailments point to the potential for cost-effective bulk transmission upgrades
- High projected 2040 congestion costs can be mitigated cost-effectively with bulk transmission projects in four specific grid locations:
  - at the Dunwoodie to Shore Rd cables
  - at the Millwood South Interface
  - downstream of Coopers Corner into Zone GHI
  - at NYC and west Long Island area

Additional Findings and Recommendations

Future NY **transmission needs will depend on** total load and which new resources are developed where over next 20 years—all major uncertainties

- The Zero Emissions Study's renewables and storage investments were optimized to the grid's capabilities but differ from similar other studies (CARIS, E3, Brattle), illustrating uncertainty
- Renewable generation ranges 29-42 GW in 2030, and 53-66 GW in 2040 across studies
- Different load, renewable generation, and battery investment locations will affect grid needs

Achieving the Study's high level of **coordinated development of location-specific renewable generation, storage, and transmission** may be challenging. It requires:

- More coordinated planning for bulk transmission, local transmission, and distribution infrastructure
- Careful planning and contracting for timely and location-specific optimization of storage deployment
- Updating wholesale market rules to support this market evolution (including to allow storage facilities to capture the full value they are assumed to provide in the study)
- Development of retail regulations that support distributed renewable generation and storage and allow for their contribution to wholesale market needs

Additional Findings and Recommendations (cont'd)

- Study reflects an optimistic view of congestion, curtailments, operational challenges
  - Significant congestion and curtailments may result from constraints on the lower-voltage transmission (rated at 115/138 kV) and during outages on the bulk transmission system
- Continue to **improve studies and planning processes** to better coordinate NYISO, Utility, and NYSERDA efforts and periodically reassess transmission needs
  - Address OSW-related transmission on/from Long Island and initiate multi-disciplinary planning and coordination to develop cost-effective options for routing up to 6 GW of OSW into NYC
  - Develop more detailed and consistent studies to quantify existing and new headroom in various transmission-constrained areas on both the local and bulk transmission systems
  - Conduct further studies to better understand future generation and long-duration storage technology options available after 2035 to achieve a zero emissions grid by 2040
- NYISO's economic and public-policy planning processes provide effective mechanisms for identifying bulk needs and developing innovative, integrated solutions

About the Presenter

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Johannes (Hannes) Pfeifenberger, a Principal at The Brattle Group, is an economist with a background in electrical engineering and over twenty-five years of experience in wholesale power market design, renewable energy, electricity storage, and transmission. He also is a Senior Fellow at Boston University's Institute of Sustainable Energy (BU-ISE), a Visiting Scholar at MIT's Center for Energy and Environmental Policy Research (CEEPR), and serves as an advisor to research initiatives by the Lawrence Berkeley National Laboratory's (LBNL's) Energy Analysis and Environmental Impacts Division and the US Department of Energy's (DOE's) Grid Modernization Lab Consortium.

Hannes specializes in transmission and wholesale power markets. He has recent studied New York power grid needs, evaluated offshore wind transmission options in New York State and New England, analyzed the role of renewable generation and transmission in economy-wide decarbonization, and presented renewable integration challenges at a number of industry meetings, including the Atlantic Council and the Harvard Electricity Policy Group.

Mr. Pfeifenberger received an M.A. in Economics and Finance from Brandeis University's International Business School and an M.S. and B.S. ("Diplom Ingenieur") in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria.

Additional Reading on Transmission

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