2050 Transmission Study

Further Analysis to Address Comments on Study

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Overview

- Background
- Additional Offshore Wind Point of Interconnection (POI) Changes
- Offshore Wind POI Screening and Constraint Identification
- Feedback and Next Steps

BACKGROUND

Background

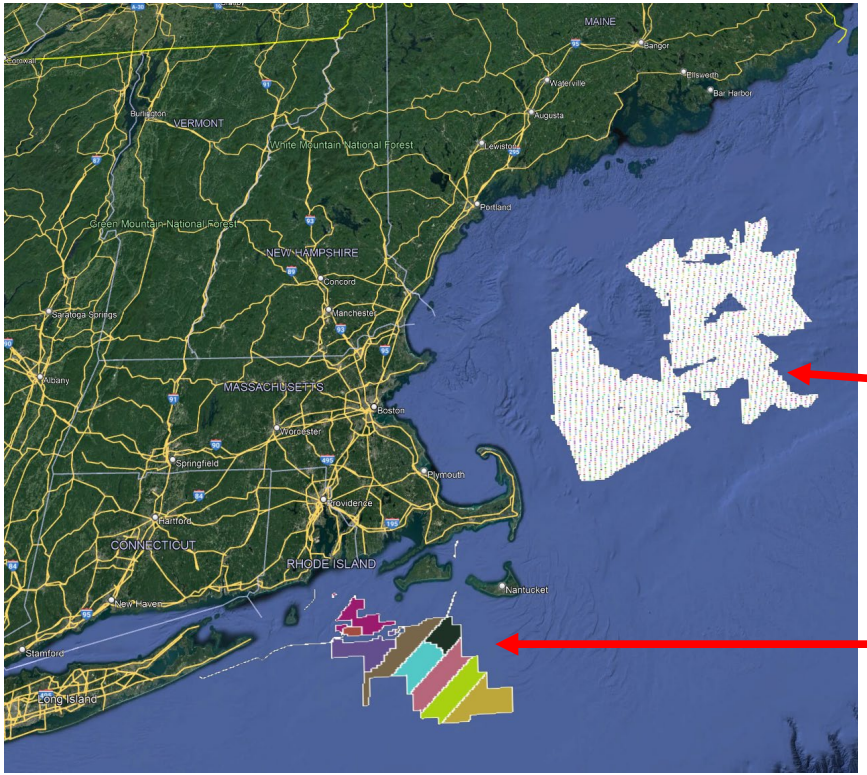
- In accordance with a recommendation from NESCOE's October 2020 "New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid," ISO-NE conducted the 2050 Transmission Study, posting a final report in February 2024
  - Links to other materials on the 2050 Transmission Study, including PAC presentations, can be found in the appendix to this presentation
- ISO-NE received a variety of stakeholder questions and feedback on the study, including two areas that merit further analysis in order to respond:
  - Large amounts of offshore wind interconnecting to northern New England led to severe overloads across the North-South interface; connecting this wind further south may help to mitigate these overloads
  - Analysis of offshore wind points of interconnection (POIs) could provide high-level screening information on the interconnection and operation of offshore wind

ADDITIONAL OFFSHORE WIND POI CHANGES

Additional Offshore Wind POI Changes

- Original assumptions for the 2050 Transmission Study were taken from the Massachusetts-commissioned "Energy Pathways to Deep Decarbonization" study, including state-by-state total amounts of interconnected offshore wind
  - As this study was conducted, the exact location of the Gulf of Maine offshore wind lease area was not fully defined
- The draft Gulf of Maine lease area reaches fairly far south
  - Much of the lease area is as close, or closer, to Boston as it is to Maine
  - North-South overloads may be mitigated by interconnecting some Gulf of Maine offshore wind to Massachusetts rather than Maine

Offshore Wind Energy Areas (WEAs)



Gulf of Maine
Draft Wind Energy Area

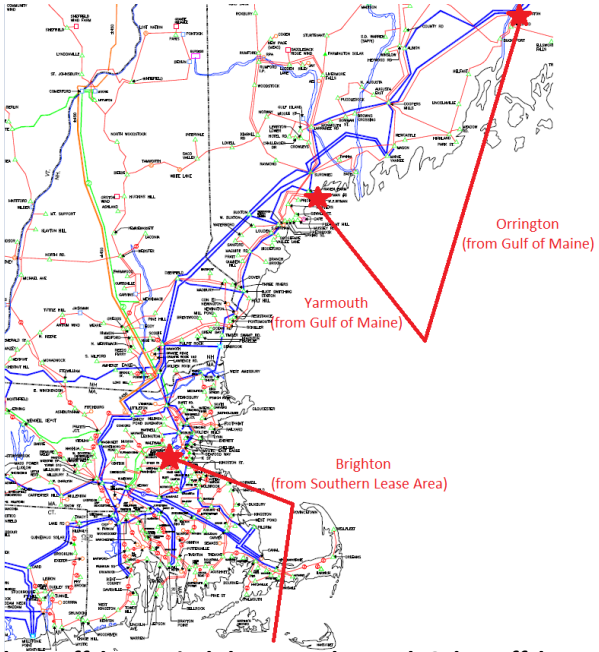
Massachusetts &
Rhode Island
Wind Energy Area

Proposed Offshore Wind POI Changes

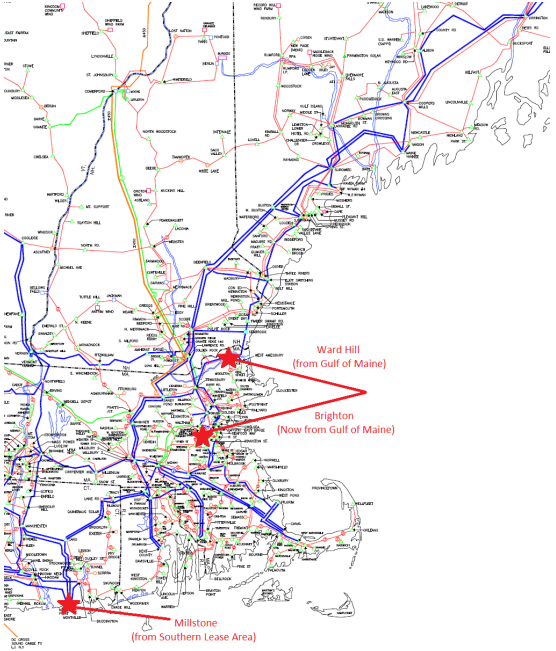
- ISO-NE proposes to study the effect of the following changes to the 2050 Transmission Study's offshore wind POIs:
  - Move one Gulf of Maine Draft WEA wind farm's POI from Yarmouth, ME to Brighton, MA
  - Move one Gulf of Maine Draft WEA wind farm's POI from Orrington, ME to Ward Hill, MA
  - Move one MA/RI WEA wind farm's POI from Brighton, MA to Millstone, CT
- These changes result in very little change in the mileage of offshore cables, but are expected to significantly reduce stress on the Maine-New Hampshire and North-South interfaces

Offshore Wind POI Relocations: Visualization

Originally Studied in 2050 Study



Proposed POI Relocations



These maps only show offshore wind that was changed. Other offshore wind not depicted here remains unchanged.

Scope of Offshore Wind Relocation Analysis

- In this portion of the proposed analysis, all 13 snapshots that were studied in the 2050 Transmission Study will be studied
  - The analysis will be similar to that of the original 2050 Transmission Study, meaning only DC steady-state N-1 and N-1-1 contingency analysis will be performed and only thermal violations on PTF elements will be reported
- All four North – South roadmaps will be analyzed for each of these 13 snapshots:
  - AC roadmap
  - DC roadmap
  - AC roadmap, minimizing construction of new lines
  - Offshore grid roadmap
- A new subset of solutions for the North – South roadmaps will be provided
  - It is anticipated that some solutions from the original packages will no longer be needed; however, the remaining upgrades will likely still be significant

OFFSHORE WIND POI SCREENING AND CONSTRAINT IDENTIFICATION

Offshore Wind POI Screening: Purpose

- Multiple stakeholders, including NESCOE, have requested information on the viability of various POIs for offshore wind, especially those studied in the 2050 Transmission Study
  - The 2050 Transmission Study modeled offshore wind at reduced output to ensure that load could be reliably served during low-wind peak conditions
  - No information has been provided yet on whether the POIs used in the 2050 Transmission Study could support a wind farm's full output, or whether significant transmission upgrades would be necessary to interconnect there
- Goals of this analysis:
  - Identify screening-level constraints on interconnecting individual offshore wind facilities to POIs near the shore, including those studied in the 2050 Transmission Study
  - Identify constraints on injecting OSW at multiple POIs simultaneously
  - Inform stakeholders, at a high level, about how much offshore wind can realistically be interconnected into different parts of New England before major transmission upgrades are required

Disclaimer: This analysis is not a full interconnection study and does not replace the need for such a study

Offshore Wind POI Analysis: Overview

- Questions to be answered:
  - Is it likely that an offshore wind plant could connect to a given station without major transmission upgrades?
  - As more offshore wind is interconnected, what system constraints may prevent all offshore wind from running at full output simultaneously?
  - How much offshore wind, in total, can reasonably be connected to POIs in New England before significant transmission upgrades are required?
- A full interconnection study would include voltage, stability, and electromagnetic transient analysis; these are beyond the scope of this analysis
- Non-electrical factors, such as permitting, land availability, and environmental impacts, are beyond the scope of this analysis

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Offshore Wind POI Analysis

- Steps for this analysis:
  - Identify possible POIs near the shore for MA/RI Wind Energy Area and Gulf of Maine Draft Wind Energy Area
  - Assemble existing data from System Impact Studies (SISs) and other sources on OSW POIs
  - Identify N-1 thermal overloads at POIs that have not yet been studied
  - Determine whether POIs (whether already studied in an SIS or not) can support larger/multiple OSW connections
  - Identify constraints that would limit the ability for multiple OSW facilities to run simultaneously
- At each POI, ISO-NE will determine an approximate maximum interconnection size before major transmission upgrades are required
  - Sizes up to 2,400 MW (representing two 1,200 MW wind farms) will be analyzed

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Offshore Wind POI Analysis, cont.

- Rather than using the 2050 Transmission Study's snapshots, this part of the analysis will use three 2033 snapshots:
  - 2033/2034 Winter Evening Peak
    - 31,296 MW net load
  - 2033 Summer Evening Peak, 92% of 90/10 peak load, 0% PV
    - 29,710 MW net load
  - 2033 Light Load
    - 12,500 MW net load
- These three snapshots are based on the Year 10 PSS/E base cases published as part of the 2023 Transmission Planning Base Case Library
- 2033 snapshots are being used for this analysis to evaluate offshore wind POIs in the near- to medium-term, not in the fully built-out system of 2050
  - The load and generation data in the 2033 models is more certain than data looking out to 2050

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Offshore Wind POI Analysis, cont.

- The snapshots studied will start from the base cases on the previous slide and will examine the effects of adding individual OSW interconnections at each POI
- Offshore wind at the POI will be increased, and existing non-renewable generation in the area will be reduced to balance generation and load, until N-1 thermal transmission constraints are found
- If N-1 thermal constraints can be easily resolved, further analysis may be performed to find the next most limiting constraint

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Offshore Wind POI Analysis, cont.

- After the initial N-1 contingency analysis has been performed on all of the potential offshore wind POIs, the list will then be narrowed down based on the results to get a subset of feasible POIs
  - This subset will contain POIs that showed either no N-1 thermal overloads or only minor overloads
- This subset of offshore wind POIs will then be studied in different combinations to determine which POIs can be operated together and which are mutually exclusive
  - For example, there may be two stations next to each other that can each handle a 1,200 MW injection on their own, but both 1,200 MW plants cannot run simultaneously due to transmission constraints

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FEEDBACK AND NEXT STEPS

Feedback and Next Steps

- Feedback on ISO-NE's proposed analysis to address stakeholder feedback is welcome
  - Please submit feedback to pacmatters@iso-ne.com by April 4, 2024
- Next Steps:
  - Perform analysis as outlined in this presentation
  - Publish a summary of results in Q3 2024

Questions

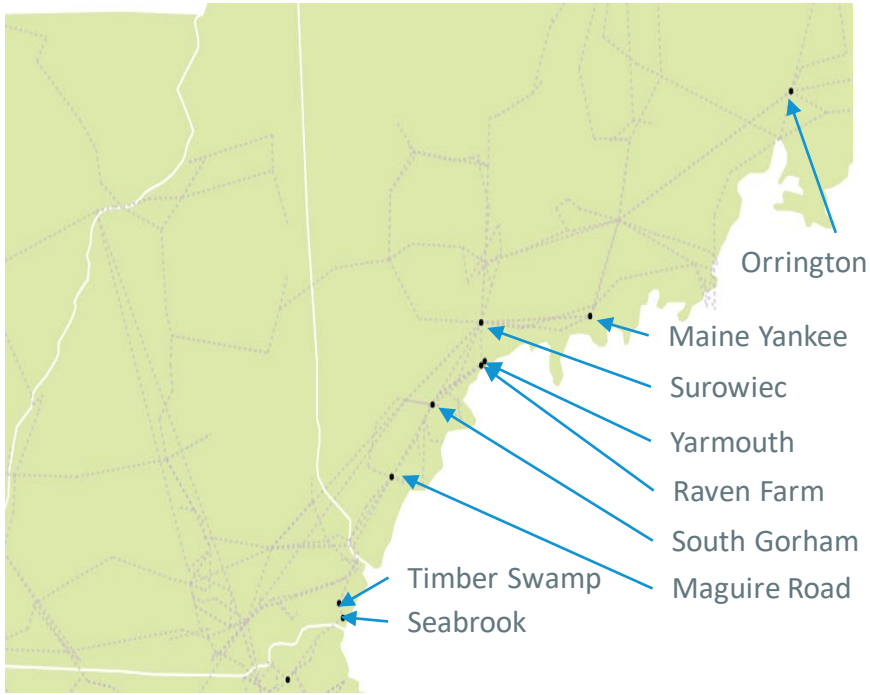
APPENDIX

Previous 2050 Study Presentations & Reports

- November 2021: Preliminary Assumptions & Methodology
- March 2022: Preliminary N-1 and N-1-1 Thermal Results
- April 2022: Sensitivity Results and Solution Development Plans
- July 2022: Updated Results and Approximate Frequency of Overloads
- December 2022: Solution Development Update
- April 2023: Solution Development Update
- July 2023: Key Takeaways and Transmission Development Roadmaps
- October 2023: Final Results and Estimated Costs
- February 2024: Final Report, Fact Sheet, and Technical Appendix (CEII access required)

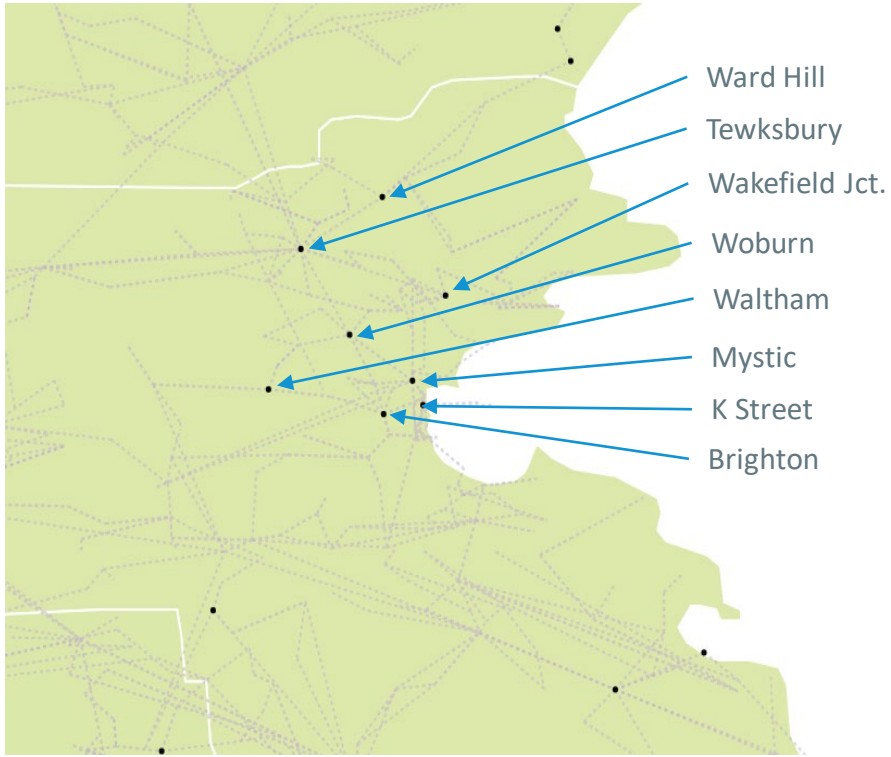
Preliminary List of POIs To Be Studied: ME, NH

Station	Voltage	State
Orrington	345 kV	ME
Maine Yankee	345 kV	ME
Raven Farm	345 kV	ME
Yarmouth	345 kV	ME
Surowiec	345 kV	ME
South Gorham	345 kV	ME
Maguire Road	345 kV	ME
Seabrook	345 kV	NH
Timber Swamp	345 kV	NH



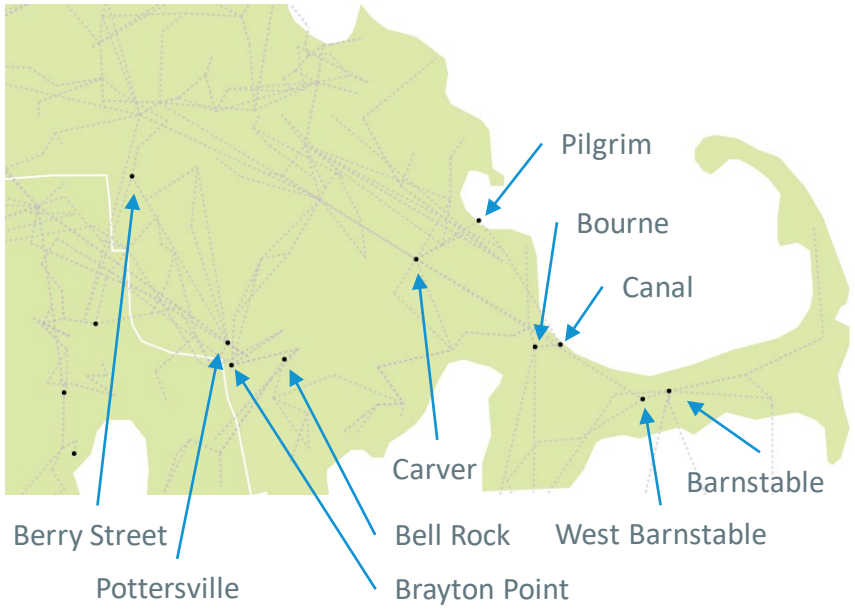
Preliminary List of POIs To Be Studied: NEMA, Boston

Station	Voltage	State
Mystic	345 kV	MA
Mystic	115 kV	MA
K Street	345 kV	MA
K Street	115 kV	MA
Brighton	115 kV	MA
Waltham	115 kV	MA
Woburn	345 kV	MA
Woburn	115 kV	MA
Ward Hill	345 kV	MA
Wakefield Junction	345 kV	MA
Tewksbury	345 kV	MA



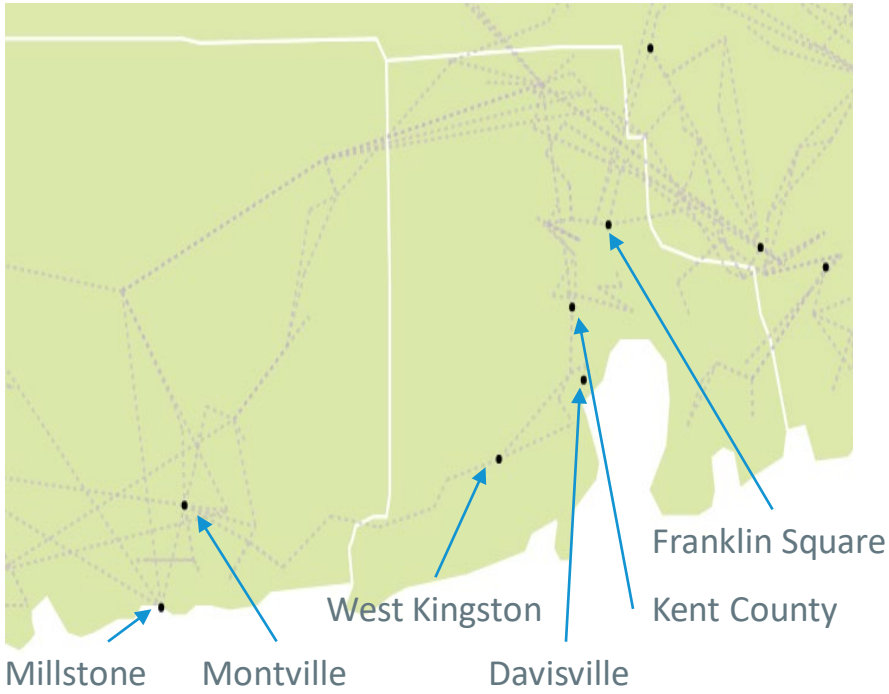
Preliminary List of POIs To Be Studied: SEMA

Station	Voltage	State
Pilgrim	345 kV	MA
Berry Street	345 kV	MA
Brayton Point	345 kV	MA
Brayton Point	115 kV	MA
Bell Rock	115 kV	MA
Bourne	345 kV	MA
Bourne	115 kV	MA
Pottersville	115 kV	MA
Barnstable	115 kV	MA
West Barnstable	345 kV	MA
Canal	345 kV	MA
Carver	345 kV	MA



Preliminary List of POIs To Be Studied: RI, Eastern CT

Station	Voltage	State
Kent County	345 kV	RI
Kent County	115 kV	RI
Franklin Square	115 kV	RI
West Kingston	115 kV	RI
Davisville	115 kV	RI
Millstone	345 kV	CT
Montville	345 kV	CT



Preliminary List of POIs To Be Studied: Western CT

Station	Voltage	State
Beseck	345 kV	CT
Scovill Rock	345 kV	CT
Haddam Neck	345 kV	CT
East Shore	345 kV	CT
Singer	345 kV	CT
Norwalk	345 kV	CT
Norwalk	115 kV	CT
East Devon	345 kV	CT