Responses to Stakeholder Comments on 2050 Transmission Study Final PAC Presentation and Report

ISO New England gave a final presentation to the Planning Advisory Committee (PAC) on the 2050 Transmission Study on October 18, 2023, and released a draft 2050 Transmission Study Report for stakeholder review and comment on November 1, 2023. A draft Technical Appendix to the 2050 Transmission Study Report was subsequently released on December 4, 2023.[1] In response to these documents, written feedback was received from several stakeholders. The following stakeholders provided written feedback:

- Ørsted (via email from Eric Wilkinson on October 19, 2023)
- Anbaric (via emails from Peter Shattuck on November 1, 2023 and December 1, 2023)
- Avangrid (via email from Zach Teti on November 8, 2023)
- NESCOE (via email from Sheila Keane on December 1, 2023)
- The Nature Conservancy (via email from Bruce Clendenning on December 1, 2023)
- RENEW (via email from Francis Pullaro on December 1, 2023)
- Eversource (via email from Robin Lafayette on December 1, 2023)
- Boreas Renewables (via email from Abigail Krich on January 4, 2024)

This document contains ISO-NE's responses to this feedback, including information on upcoming report revisions or additional analysis where applicable. Due to the extent and format of stakeholder comments received, this document is not intended to address feedback on a point-by-point basis; however, all feedback received is addressed herein. The written comments received are included as appendices to this document.

Further Analysis to Address Stakeholder Feedback

The Tariff revisions associated with Longer-Term Transmission Study Phase 2 will be the topic of stakeholder discussions throughout early 2024, and a FERC filing on these changes is expected to occur in mid-2024. Further pursuit of transmission solutions associated with the concerns identified

[1] The presentation slides, draft report, and draft technical appendix were posted on the ISO-NE website at: https://www.iso-ne.com/system-planning/transmission-planning/longer-term-transmission-studies/

in the 2050 Transmission Study, such as a request for proposals (RFP) for new transmission, cannot proceed until these Tariff provisions are in place.

In their feedback, multiple stakeholders including NESCOE raised questions that would benefit from additional analysis in order to address them. ISO-NE plans to study two topics during 2024 to provide additional information to New England stakeholders.

The first topic for further analysis is related to the location of the Gulf of Maine offshore wind lease area, and likely on-shore points of interconnection (POIs) for wind in that region. The original assumptions for the 2050 Transmission Study, as specified by the Massachusetts "Energy Pathways for Deep Decarbonization" study, included many offshore wind farms with points of interconnection in Maine and New Hampshire. Since that time, the plans for the Gulf of Maine offshore wind lease area have become more specific and fully developed. As multiple commenters point out, parts of the Gulf of Maine lease area are physically located as close to onshore locations in Boston and northeastern Massachusetts as they are to onshore locations in Maine. Wind developers may opt to connect to POIs in Massachusetts rather than New Hampshire and Maine, in order to avoid North-South constraints in the onshore transmission system. ISO-NE plans to examine the effects of relocating the POIs of a small number of wind farms assumed to be in the Gulf of Maine lease area from Maine to Boston, and relocating the POIs of a small number of wind farms assumed to be in the Southeast Massachusetts lease area from Boston to points in Connecticut (which are a similar distance from the Southeast Massachusetts lease area as they are to Boston).

The second topic for further analysis relates to the exact choice of substations for offshore wind POIs, rather than the state or region in which these facilities interconnect. While the 2050 Transmission Study focused on relocating offshore wind to minimize the need for transmission upgrades for serving peak loads, it did not examine the ability for offshore wind interconnections to run at full output during off-peak load conditions. The winter snapshots studied in the 2050 Transmission Study assumed that only 40% of the offshore wind farm's nameplate was produced, and the summer snapshots assumed that only 5% of the offshore wind farm's nameplate was produced. This means that while ISO-NE has analyzed the reliability implications of the wind farms producing at these studied outputs, there is no information related to the offshore wind farms' ability to operate above these levels. ISO-NE is considering examining the impacts of the offshore wind producing at 100% of nameplate based on the 2050 Transmission Study analysis, together with completed interconnection studies, to evaluate the degree to which major transmission upgrades would be required at various offshore wind POIs.

While neither of these topics will be specifically aimed at the design of a networked offshore transmission grid (or Roadmap #4 for North-South/Boston Import concerns in the 2050 Transmission Study), ISO-NE expects that the POIs identified could inform both offshore wind facility radial connections and terminals for an offshore grid.

To address stakeholder questions on the 2050 Transmission Study analysis, ISO-NE will begin further analysis on these two topics in 2024, including an initial presentation at an upcoming PAC meeting.

Ongoing and Future ISO-NE Initiatives

Multiple commenters expressed interest in further development of concepts for new transmission projects to address the concerns identified in the 2050 Transmission Study, up to and including construction of new transmission facilities. ISO-NE is currently pursuing Tariff revisions associated

with Longer-Term Transmission Study Phase 2. These Tariff changes are intended to create a process by which ISO-NE, at the request of NESCOE, would run an RFP for transmission projects that would address needs chosen by NESCOE, in consultation with ISO-NE. Discussions on these Tariff changes are underway at the Participating Transmission Owners Administrative Committee (PTO AC), NEPOOL Transmission Committee (TC) and other related stakeholder groups. ISO-NE expects to file revisions to the OATT with FERC in Q2 of 2024 that would implement this process.

Following the implementation of the LTTS Phase 2 process, ISO-NE and NESCOE plan to begin stakeholder discussions on rules and implementation guidelines for "right-sizing" transmission upgrades. These rules and guidelines would ensure that, when transmission lines are modified or added, the structures and conductors are sized to meet future needs beyond the ten-year planning horizon.

Multiple commenters pointed to a need for better inter-area coordination. The Massachusetts "Energy Pathways to Deep Decarbonization" study, which formed the basis for input assumptions to the 2050 Transmission Study, assumed that New England's capability to import from New York would be increased from 1,400 MW to 1,850 MW, allowing New England to benefit from diversity in renewable resource performance by exchanging more power with other regions. A new 1,000 MW HVDC line assumed to bring power from Quebec into Vermont was also assumed in this study. These assumed increased transfers were both accounted for in the 2050 Transmission Study. Additionally, ISO-NE has been working with NYISO and PJM through the Joint ISO/RTO Planning Committee (JIPC) to determine the feasibility of raising the 1,200 MW source-loss limit that currently constrains the size of offshore wind farms and other large energy sources. This inter-area study effort addresses comments from two stakeholders regarding a desire to remove today's 1,200 MW limit. The 1,200 MW limit will remain in place until the JIPC study is concluded and any necessary upgrades are placed in service. Any further action regarding this limit will be informed by the outcome of this JIPC study.

Offshore Grid Modeling and Planning

The 2050 Transmission Study report includes an Offshore Grid roadmap to examine the changes in onshore transmission upgrades needed for reliability if a networked offshore HVDC system is implemented in New England. Multiple commenters pointed out that the technology necessary for networked HVDC systems, including protection and control, is still under development and somewhat uncertain. The specific technical challenges, and a pathway to actually implementing an offshore HVDC system, is beyond the scope of the 2050 Transmission Study. However, many questions regarding technology availability, standards, and cost have been addressed in the US Department of Energy's Atlantic Offshore Wind Transmission Study (AOSWTS). Stakeholders are encouraged to consult this study for further detail on these topics.

In their comment, the Nature Conservancy pointed out that offshore grids do not necessarily have to be limited to three onshore points of interconnection. ISO-NE agrees that grids with a greater number of onshore connections could be possible. However, control and protection issues become more complex in larger HVDC grids, and the consequence of a loss of the entire offshore HVDC network (whether due to control failures, protection system failures, or other common-mode failure risks) becomes greater. Analysis performed in the 2050 Transmission Study found that grids with a greater number of onshore connection points were not necessary for load serving, and thus were beyond the scope of this study. The use of three onshore connection points also matches the level

of complexity of offshore grids examined in the AOSWTS and those that have been proposed in Europe.

Additional Data and Report Clarifications

This section addresses a number of stakeholder comments on subjects other than those described above.

- Ørsted points out that offshore availability tends to be higher during the winter than onshore wind, and questions the assumption of 40% nameplate output during winter peak conditions. While the average capacity factor of offshore wind is generally higher than that of onshore wind, ISO-NE's analysis of weather data for the specific locations of offshore wind in New England has shown that variability of offshore wind is higher, especially under winter peak conditions. ISO-NE must ensure that the system can be operated reliably, even when wind output is low. The 40% output assumption reflects a low-wind winter peak condition. While wind output may exceed this level during some winter peaks, ISO-NE does not believe that it is prudent to rely on higher offshore wind output during winter peak conditions when planning the transmission system. Additional detail on the analysis leading to this conclusion may be found in slides 46-47 and 54-55 of the November 2021 2050 Transmission Study scope presentation.[2]

- The Nature Conservancy raised concerns that, by studying a 51 GW winter peak, ISO-NE is not planning for a fully-electrified future that would meet the policy goals of the New England states. The inclusion of this 51 GW snapshot in the study is not meant to suggest that peak load cannot grow beyond this level. Instead, it is meant to analyze one of many possible futures, and contrast the rate of growth of transmission costs between these different futures across the multiple study years. The 2050 Transmission Study did study, and propose solutions for a 57 GW winter peak as well. Additionally, it is possible that a 51 GW winter peak may represent a fully-electrified future with significant increases in demand response and energy efficiency measures. The types of measures that would be needed for this amount of load reduction was not a component of this study.

- Avangrid raised questions concerning the strategy of rebuilding existing lines for higher capacity. Unless specifically stated otherwise, this solution refers to larger conductor sizes for higher current-carrying capability, and not increases in operating voltage. Further information on this proposal, including the maximum possible ratings assumed for each operating voltage, may be found in Table 5-1 of the Technical Appendix to the 2050 Transmission Study report.

- Eversource raised a concern that rules regarding cost allocation in New England do not support the purchase of transformers in advance of a definite plan for their installation. The Nature Conservancy also requests the consideration of tax credits and subsidies for transmission development in this study. As cost allocation is beyond the scope of the 2050 Transmission Study, these questions will not be addressed at this time.

[2] This presentation is posted on the ISO-NE website at: https://www.iso-ne.com/static-assets/documents/2021/12/draft_2050_transmission_planning_study_scope_of_work_for_pac_rev2_clean.pdf

- The Nature Conservancy requested that the study examine the connection and integration of resources to allow 100% decarbonization and strategies to optimize the location and timing of generation. Coordinated interconnection planning, and integration of renewable resources beyond the extent to which their output was required to serve peak loads, was beyond the scope of the 2050 Transmission Study. ISO-NE focused the analysis in the 2050 Transmission Study on peak load hours rather than on fully integrating renewable resources during other hours of the year. However, some of the information requested here may be provided as part of the further analysis to address stakeholder comments, as described above.

Report Revisions and Other Stakeholder Activities

In the final version of the 2050 Transmission Study Report, ISO-NE will incorporate three revisions suggested by Avangrid. The first is a clarification regarding the treatment of demand response and load flexibility in the "Energy Pathways to Deep Decarbonization" report, and consequently in the input assumptions to the 2050 Transmission Study. While the report suggests that demand response and load flexibility could be one path to limiting peak load growth to 51 GW, ISO-NE agrees that it does not sufficiently acknowledge the extent to which these strategies are already incorporated in the input assumptions. The second revision suggested by Avangrid is a correction to the title of Table 5-6. Finally, ISO-NE will add an acknowledgement, suggested by Avangrid, that advanced conductor types may be a way to increase line capacity in place of replacing structures and increasing conductor size.

RENEW, in their feedback, suggests using Figure 4-10 to represent individual roadmaps one at a time, rather than combining all roadmaps into a single figure. ISO-NE will create new geographic maps showing individual transmission roadmaps, and include these in the final version of the 2050 Transmission Study report.

Anbaric and Boreas Renewables both requested more detailed information about specific overloads that were seen in the 2050 Transmission Study results, along with their causes, and more clear information on the exact interconnection locations that were assumed for new resources in the 2050 Transmission Study. ISO-NE plans to publish detailed contingency analysis results for the pre-solution snapshots, the PSS/E base cases that were used to study each pre-solution snapshot, and any additional study files that were used to produce the initial results. All of this information will be published under CEII protections. Additionally, a non-CEII posting will be made containing more information about specific generator interconnection locations that were assumed. These postings will be made in early 2024.

Additionally, NESCOE's comments suggested two opportunities for further stakeholder outreach and information. The first is a brief, non-technical summary document to make the study's conclusions accessible to a wider audience. ISO-NE is currently assembling such a document and plans to release it in February 2024. Secondly, NESCOE requested a webinar to present the results in a non-technical manner, similar to webinars that have already been held on the Future Grid Reliability Study and on an overview of the ISO-NE system planning process. ISO-NE does plan to hold a webinar on the 2050 Transmission Study in early 2024. ISO-NE will update NESCOE, PAC, and other interested stakeholders on the exact timing of this webinar when it is determined.

New England States Committee on Electricity

To:	**ISO New England (ISO-NE)**
From:	**New England States Committee on Electricity (NESCOE)**
Date:	**December 1, 2023**
Subject:	**Feedback on the Draft 2050 Transmission Study and Request to Prepare for an Actionable Path Forward**
CC:	**Planning Advisory Committee (PAC)**

NESCOE appreciates the opportunity to provide feedback on the draft 2050 Transmission Study (Study), issued on November 1, 2023. The Study provides critical visibility into potential future transmission system needs and the cost of integrating clean energy resources to ensure a reliable transition to our future grid. We couple our feedback with a request for ISO-NE to (i) identify any further analysis that may be needed to allow the region to move to actionable transmission solutions as soon as possible and (ii) consider whether it can commence work with states and stakeholders in the nearest term on elements of a solicitation not dependent on such advance analysis to help move toward issuance as soon as possible.[1] In addition, we suggest some next steps regarding public presentation of the Study results.

First and foremost, NESCOE thanks ISO-NE for its responsiveness to our call for longer-term, repeatable transmission planning.[2] We especially appreciate ISO-NE staff's hard work and collaboration on the Study. This Study is the first longer-term transmission study (LTTS) in New England and represents an important step for the region as it seeks to better understand how system needs will evolve during the clean energy transition.

Feedback on Draft 2050 Transmission Study

NESCOE offers the following high-level observations as we continue to digest the considerable amount of information contained in the Study and its technical appendices. First, the Study clearly highlights the potential value of limiting load growth in the future, whether through

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[1] The Federal Energy Regulatory Commission (FERC) referenced the complementary interaction between the Section 4A process of Attachment K of ISO-NE's Open Access Transmission Tariff (OATT) and the longer-term transmission study (LTTS) process in accepting ISO-NE's filing establishing the first phase of the LTTS procedures. *ISO New England Inc. and New England Power Pool Participants Committee*, Letter Order, 178 FERC ¶ 61,137 (2022) at PP 4, 15.

In comments on ISO-NE's Draft 2024 Work Plan, NESCOE noted that two states had earlier indicated a possibility of asking ISO-NE to pursue the existing public policy transmission study process in 2024 as needed to advance transmission development. See https://nescoe.com/wp-content/uploads/2023/08/NESCOE-Comments-on-ISO-NE-2024-Work-Plan.pdf at 2. That process would require ISO-NE to trigger provisions of Section 4A by January 15, 2024. ISO-NE's prompt response to these requests will inform states' consideration regarding the effectiveness of pursuing action under Section 4A in 2024.

[2] NESCOE, *New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid* (Oct. 2020), at https://nescoe.com/wp-content/uploads/2020/10/NESCOE_Vision_Statement_Oct2020.pdf.

energy efficiency, demand response, or other measures.[3] We appreciate that the Study incorporated an alternate 2050 winter peak load level of 51 gigawatts (GW) to explore the impact of load reduction on transmission needs, in addition to using the assumptions provided by NESCOE, which included an assumed 57 GW winter peak load.[4] Other recent studies also point to potential significant benefits from varying types of load reduction.[5] NESCOE looks forward to working with ISO-NE and stakeholders to explore ways to leverage load-reducing opportunities, such as demand response, to benefit all consumers.

Continuing Work to Lead to a Transmission Procurement in the Nearest Term

The Study results indicate that New England will need incremental transmission as soon as 2035. In light of this, NESCOE appreciates ISO-NE's current focus on the second phase of the LTTS tariff changes (Phase 2), which will establish a process for the states to operationalize the results of this Study and future longer-term studies. NESCOE looks forward to continuing to work with ISO-NE and stakeholders to expeditiously finalize those tariff changes for filing with FERC in April 2024, with the earliest possible effective date. The timing of this process, however, leaves a gap in moving toward actionable regional transmission solutions after the conclusion of the Study.

First, we request ISO-NE's guidance on the options to make productive use of the time before the Phase 2 effective date to position our region to act on a transmission solicitation as promptly as possible. A priority for states is understanding infrastructure needs to facilitate the interconnection of clean generation, such as offshore wind,[6] hydro, solar and storage in the near to medium term (e.g., by 2035).

For example, in locating generator interconnections for offshore wind and other resources, the Study sought to optimize points of interconnection to address system overloads.[7] To inform transmission investments that states may wish to pursue, NESCOE would like to understand from ISO-NE whether it believes advance analysis would be needed prior to any solicitation targeted at creating grid-ready points of interconnection that, among other things, also minimize costs and needed upgrades to deliver power to load centers and meet future load growth. In addition, we would like to understand what elements of the solutions reflected in the roadmaps

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3 ISO-NE, *Draft 2050 Transmission Study* (Nov. 1, 2023), at 16-17.

4 ISO-NE, *2050 Transmission Study Sensitivity Results and Solution Development Plans* (Apr. 2022), at https://www.iso-ne.com/static-assets/documents/2022/05/a13_2050_transmission_study_sensitivity_results_and_solution_development_plans.pdf.

5 ISO-NE, *Operational Impact of Extreme Weather Events: Probabilistic Energy Adequacy Tool (PEAT) Results of Stakeholder-Informed Winter 2032 Sensitivity Analysis* (Nov. 23, 2023), at https://www.iso-ne.com/static-assets/documents/100005/a08_operational_impact_of_extreme_weather_events.pdf.

6 Infrastructure to connect offshore wind to the regional power grid has been a shared priority of the New England states. (see e.g., New England States Transmission Initiative at https://newenglandenergyvision.com/new-england-states-transmission-initiative/).

7 ISO-NE, *Draft 2050 Transmission Study* (Nov. 1, 2023), at 19.

that ISO-NE produced in the Study need advance analysis to inform a solicitation and which do not.

Second, we request that ISO-NE consider whether it can commence work with states and stakeholders in the nearest term on those elements of a solicitation that are not dependent upon such advance analysis to help move toward issuance as soon as possible. The urgent need for transmission requires our collective efforts to forge ahead from study to solicitation. Beginning work with states and stakeholders on a solicitation instrument on an earlier calendar in 2024 best positions our region to move toward actionable transmission solutions.

Public Presentation of Study Results

Finally, NESCOE encourages ISO-NE to create a short summary document written in plain language and host a lunchtime webinar to present the Study results as it has done with other key studies, such as the Future Grid Reliability Study. The summary should provide a plainly stated explanation of the Study's purpose, and what the Study is (directionally informative) and is not (a definitive statement of need). Given the novel nature of the Study and the broad impact that transmission development can have on the public, it is particularly fitting for ISO-NE to provide accessible opportunities for the public to understand the Study and its implications.

NESCOE appreciates ISO-NE's concerted effort to finalize tariff changes to give states the ability to translate this longer-term planning into the development of transmission infrastructure in the coming months. We also appreciate ISO-NE's guidance in the nearest term on whether and by what means to conduct any incremental analysis and take other action to position the region to act on a Phase 2 transmission solicitation as promptly as possible. Going forward, NESCOE is also interested in discussing opportunities to better refine the assumptions as well as what additional types of data may be helpful to improve modeling in future longer-term studies and/or any follow-on work. We appreciate ISO-NE's partnership in preparing for an actionable path forward on beneficial transmission for the New England region as soon as possible.

December 1st, 2023

To: ISO-NE
From: Peter Shattuck, Anbaric
Re: 2050 Transmission Study

ISO-NE's 2050 Transmission Study provides valuable information to policymakers and stakeholders and will help increase the efficiency and pace of the region's transition to clean energy. Anbaric appreciates ISO-NE's work on the Study and receptivity to stakeholder feedback. The next step is to procure necessary transmission, and Anbaric supports the collaborative work by ISO-NE and the New England states to advance the Extended-Term/Longer-Term Transmission Planning Phase 2,[1] and related efforts to procure transmission. While the comments that follow suggest potential modifications to assumptions in the 2050 Transmission Study, further analysis should not stand in the way of procurement. Critical revisions to assumptions and findings of the study could be pursued on a targeted basis if undertaking such analysis enables procurement, or revisions could be incorporated into future analyses.

Anbaric's comments on the DRAFT 2050 Transmission Study (the "Full Report") echo comments provided on the October 18th presentation of study results, augmented with comments prompted by the greater level of detail in the Full Report. As in our prior comments, the main focus is on two topics:

1) Locations assumed for offshore wind injections, and
2) 1,200 MW source loss limit

Offshore Wind Injection Locations

As ISO-NE noted in the October 18th presentation to the Planning Advisory Committee (PAC) on the 2050 Transmission Study, "generator location matters" and that in the course of the study points of interconnection (POIs) for offshore wind were optimized "within reason."[2] Evaluating different POIs for offshore wind injections is prudent, as the injection locations for tens of thousands of megawatts (MW) of new generation will have major impacts on the need for transmission upgrades and the performance of the overall power system. Determining optimal injection locations for offshore wind is likely one of the most important contributions that the 2050 Transmission Study can make to planning optimized transmission solutions for the region. It is thus sensible for ISO-NE to evaluate the benefits of an offshore grid to address onshore grid constraints.

Additional refinement of assumed offshore wind POI locations merits evaluation to alleviate the North-South Transfer and Southwest CT High Likelihood Concerns. Specifically, relocating assumed POIs for floating offshore wind to South of the Boston Import interface would likely reduce North-South overloads, and increasing OSW injections in Southwest CT would likely reduce the need for terrestrial upgrades to import more electricity to the region.

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[1] See: https://www.iso-ne.com/static-assets/documents/100005/a02_2023_11_21_tc_ltts_presentation.pdf
[2] See slide 37, at: https://www.iso-ne.com/static-assets/documents/100004/a05_2023_10_19_pspc_2050_study_pac.pdf

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Revisiting assumptions related to offshore wind POIs is justified based on the time elapsed since initial assumptions were made, subsequent market developments, and based on the results of the 2050 Transmission Study itself. Offshore wind POI locations were established at the outset of the 2050 Transmission study based on the "All Options Pathway" of the Massachusetts Decarbonization Pathway report, which was published in 2020. As laid out in ISO-NE's November 17th, 2021 presentation on Preliminary Assumptions and Methodology for the 2050,[3] the following distributions of fixed bottom and floating offshore wind injections were assumed:

State	Resource Type	2031 NA Case (MW)	2050 Transmission Study 2035 (MW)	2040 (MW)	2050 (MW)
Connecticut	Fixed	0	472	636	1,872
Maine	Fixed	0	59	60	67
Massachusetts	Fixed	2,474	5,845	6,656	6,681
New Hampshire	Fixed	0	190	190	410
Rhode Island	Fixed	753	485	490	468
Vermont	Fixed	0	0	0	0
New England Total	Fixed	3,227	7,051	8,032	9,498

State	Resource Type	2031 NA Case (MW)	2050 Transmission Study 2035 (MW)	2040 (MW)	2050 (MW)
Connecticut	Floating	0	0	0	0
Maine	Floating	0	902	3,015	6,933
Massachusetts	Floating	0	302	2,667	9,791
New Hampshire	Floating	0	41	714	1,177
Rhode Island	Floating	0	1,153	2,205	4,555
Vermont	Floating	0	0	0	0
New England Total	Floating	0	2,398	8,601	22,456

As noted in the Full Report, this distribution of injection locations was determined ", in order to minimize the length of cables between the interconnection points and offshore wind locations."[4] This assumption results in injecting the vast majority (70%) of fixed bottom offshore wind in MA and injecting almost 7 GW of new floating offshore wind in ME. While the assumed POIs in the MA Decarbonization Roadmap may have been reasonable at the time they were made, recent market developments suggest that geographic proximity of offshore wind farms to onshore POIs is decreasing in importance. As the cost of HVDC export cables decreases, and as costs mount for onshore upgrades resulting from connections to nearshore locations (such as Cape Cod), it is reasonable to assume that offshore wind farms can be connected to more distant POIs. SouthCoast Wind is planning to connect via HVDC to Brayton Point, and Beacon Wind I is proposing a 202-mile HVDC export cable to connect to New York City.[5] Offshore wind farms are getting larger, and the cost of HVDC systems for projects over 1 GW is easier to bear than for smaller offshore wind farms that were being developed in the 2010s and informed the MA Decarbonization Roadmap. Accordingly, relocation of POIs to optimize injection of offshore wind should be considered between states, and limited to relocation within a given state, as it was in the 2050 Transmission Study.[6]

North-South Overloads

Relocating a large share of floating wind POIs from NH and ME to South of the Boston Import interface is reasonable in light of the above, and to reflect the location of proposed lease areas in the Gulf of Maine. As shown in the map below from the Bureau of Ocean Energy Management,[7] the proposed Gulf of Maine lease areas are roughly equidistant from MA and ME:

[3] draft_2050_transmission_planning_study_scope_of_work_for_pac_rev2_clean.pdf (iso-ne.com)
[4] Full Report, at 12.
[5] See: https://www.permits.performance.gov/permitting-project/fast-41-covered-projects/beacon-wind
[6] Full Report, at 12.
[7] Available at:
https://www.boem.gov/sites/default/files/images/GulfofMaine_draft_WEA_outline_SA_areas_nauticalchart.png

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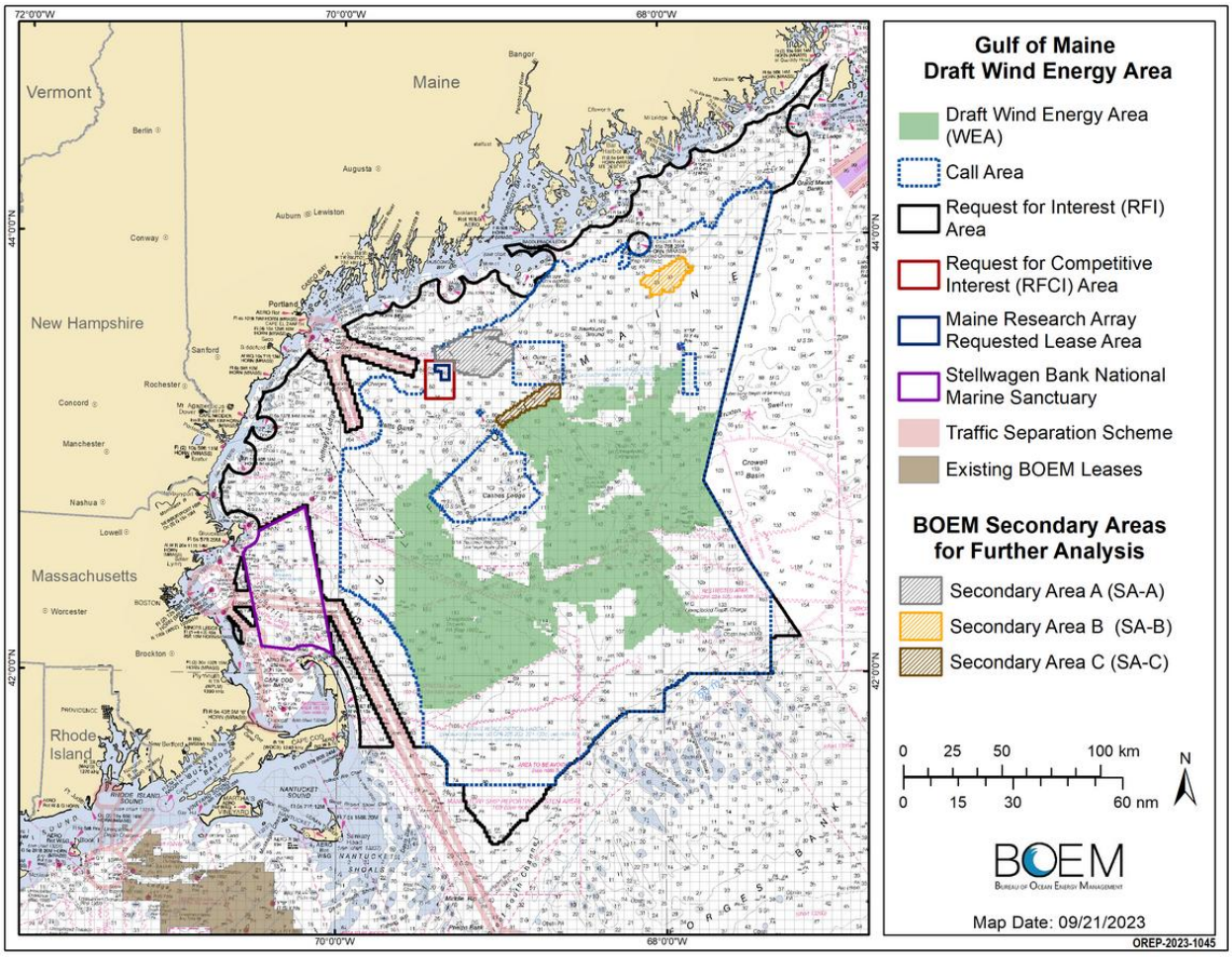

In the Notice for Comment[8] on the draft lease areas, BOEM notes the following distances from the lease areas to land:

- 23 miles east of Wellfleet, MA;
- 70 miles east of Boston, MA;
- 48 miles east of Rockport, MA;
- 56 miles east of Portsmouth, NH;
- 64 miles southeast of Portland, ME;
- 44 miles southeast of Monhegan Island, ME; and
- 57 miles south of Mount Desert Island, ME

Connecting offshore wind from lease areas in the Gulf of Maine to Orrington and Maine Yankee – as shown in the November 2021 ISO-NE presentation on Preliminary Assumptions[9] – would require longer

[8] Available at: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Notice%20for%20Comment%20for%20Gulf%20of%20Maine%20Draft%20WEAs_0.pdf
[9] See slides 50-52 at: https://www.iso-ne.com/static-assets/documents/2021/12/draft_2050_transmission_planning_study_scope_of_work_for_pac_rev2_clean.pdf

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export cables than connecting to MA. With limitations on North-South transfers already well established, such injections seem unlikely. While connections of some offshore wind from Gulf of Maine lease areas to Maine and New Hampshire is reasonable to assume, ISO-NE should seek to limit such injections as they are known to exacerbate existing constraints on the onshore grid, and are unlikely as developers seek to minimize costs and maximize deliverability.

Southwest CT Imports

Assuming that additional offshore wind is injected in CT will likely alleviate or mitigate the need for upgrades to the terrestrial grid to deliver more power to the region. In describing why Southwest Connecticut is a High Likelihood Concern in the 2050 Transmission Study, ISO-NE notes that "[g]eneration location had some effect on the overloads initially, Norwalk wind was then relocated from 345 kV to 115 kV" and that "[a]ny further overloads were not able to be mitigated with generation relocation, without adding generation beyond the input assumptions from the Energy Pathways study."[10] In the November 2021 presentation on assumptions, 672 MW of offshore wind is assumed to be injected at Norwalk in 2050. Limiting offshore wind injection to Southwest CT to 672 MW removes a key solution that should be further evaluated to address Southwest CT import constraints. As noted above, large projects are connecting to more distant POIs via HVDC, and as such assuming a larger injection of OSW in Southwest CT at an earlier date would be reasonable.

New transmission capacity connecting Long Island to Southwest Connecticut also merits consideration as a means to address the Southwest Connecticut High Likelihood Concern. New transmission connecting Long Island and Southwest Connecticut would provide the additional benefit of increasing interregional transmission capacity, and could help balance offshore wind injections between Long Island and New England. Analyzing transmission from Long Island may be beyond the scope of this phase of long-term planning, and if so the final 2050 Transmission Study should acknowledge that higher volumes of offshore wind injection and interregional transmission were not analyzed. More importantly, procurement of transmission to address the Southwest Connecticut High Likelihood Concern should be structure to enable proposals for offshore wind transmission and transmission from Long Island to compete with traditional onshore upgrades.

Reconfiguration of Offshore Wind POIs

To evaluate the benefits of more strategic offshore wind injections, in targeted or future analyses, ISO-NE could evaluate scenarios that rebalance injection of fixed bottom offshore wind to CT and that rebalance injection of floating wind to MA. In such a sensitivity and all modeling of offshore wind injections going forward, ISO-NE should assume 1,200 MW or 2,000 MW injections to match injection capabilities of 320 kV and 525 kV HVDC voltage systems, respectively, which have become industry standards.

Specifically, a sensitivity for fixed bottom wind could include:

- 1,200MW into Southwest Connecticut (Bridgeport) in 2035
- 1,200MW into to Southeast Connecticut (Montville) in 2035
- Additional 1,200MW into Southwest Connecticut (Bridgeport) in 2050

[10] See slide 58, at: https://www.iso-ne.com/static-assets/documents/100004/a05_2023_10_19_pspc_2050_study_pac.pdf

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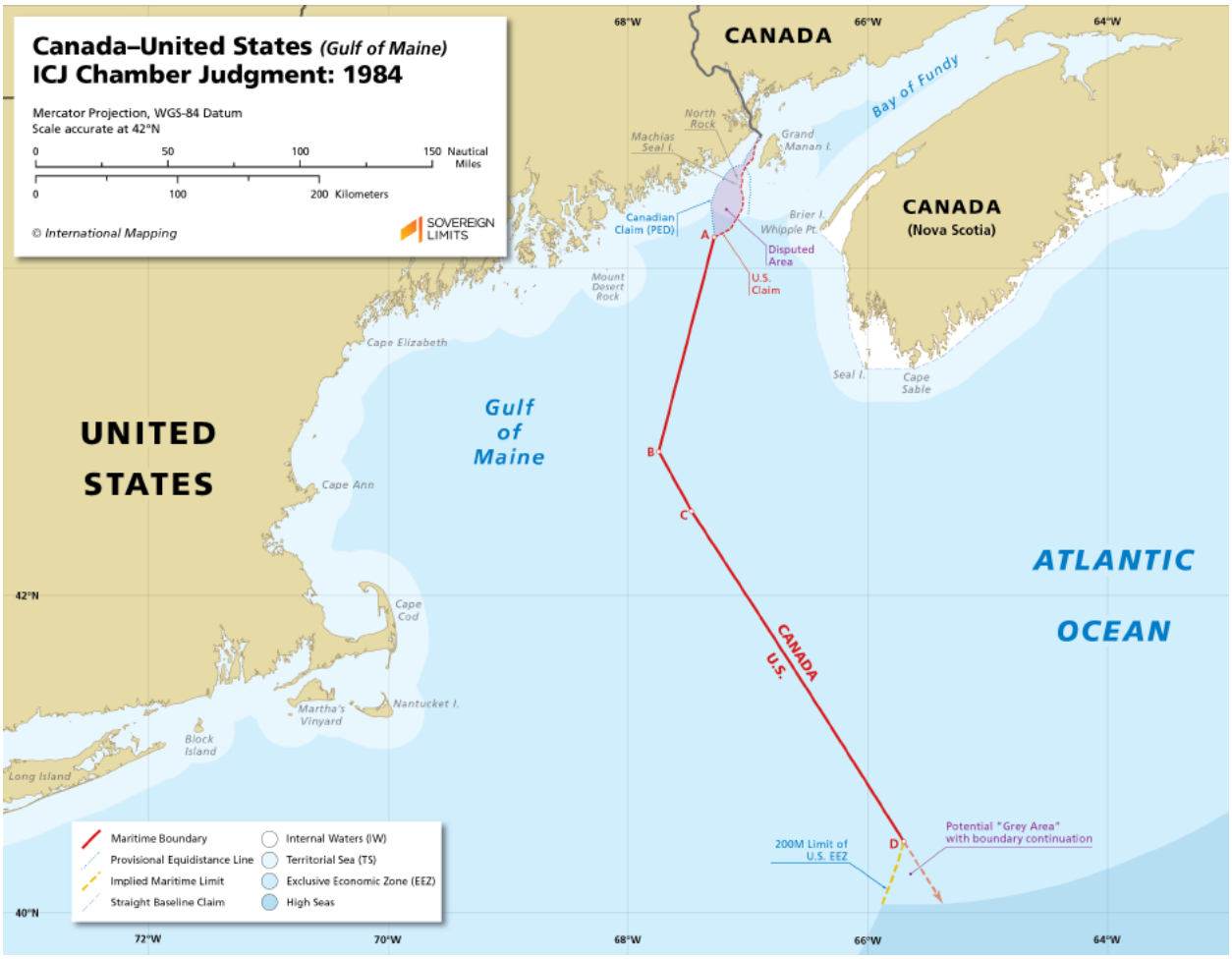
These injections could replace

- 472MW into Montville and 885MW into West Farnum (to match the 1,200MW increments)
- The 1,200MW injection at Pilgrim in 2040 (as Southeast Massachusetts is already saturated), and
- The 1,200MW injection at Ward Hill in 2050 (as Ward Hill is more distant from existing lease areas than Connecticut POIs and is more suitable for floating offshore wind from the Gulf of Maine).

A sensitivity for injection of floating wind could evaluate greater injections into Greater Boston and Connecticut, presuming some of the 22,456MW of floating wind will come from beyond the Outer Continental Shelf off Southeast New England (i.e. not all floating wind will be in the Gulf of Maine). This assumption would be reasonable, as the territorial boundary[11] between the U.S. and Canada cuts south through the Gulf of Maine, and floating wind in deeper waters would thus be located to the south and southeast of New England.



[11] Map from: https://sovereignlimits.com/boundaries/canada-united-states-gulf-maine-maritime

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A sensitivity for floating offshore wind could include:

- 1,200MW into Ward Hill in 2040 instead of Orrington (replacing the 1200MW subtracted from Ward Hill for fixed bottom sensitivity)
- 1,200MW into Millstone in 2040 instead of Yarmouth
- Additional 1,200MW into Millstone in 2050 instead of Suroweic
- 1,200MW into East Shore in 2050 instead of Maine Yankee

If additional sensitivities are beyond the scope of this long-term transmission planning cycle, the 2050 Transmission Study should note that further relocation of offshore wind injections could alleviate or address the North-South and Southwest CT Import High Likelihood Concerns.

1,200 MW Source Loss Limit

In the presentation on results of the 2050 Transmission Study, ISO-NE notes that the 1,200 MW source loss limit was observed to continue to provide a fair comparison between AC and DC roadmaps. Ensuring comparability between roadmaps can also be achieved by assuming that an increase in the source loss limit applies equally to AC and DC solutions. In light of the initiative underway through the Joint ISO/RTO Planning Committee to increase the source loss limit to 2,000 MW,[12] the 2050 Transmission Study should acknowledge that higher capacity transmission could be utilized in the future to the extent practical for any of the roadmaps.

Thank you for the opportunity to comment; we look forward to continuing engagement in the 2050 Transmission Study and related efforts.

Peter Shattuck
President, New England
Anbaric

[12] See: https://www.iso-ne.com/static-assets/documents/2023/08/2023_08_23_jipc_response_to_iso_letter.pdf

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Avangrid Comments

- P 17 (Section 2.1) – "Alternately, more aggressive demand response (when customers reduce their electrical consumption for compensation) and peak shaving programs (e.g., smart thermostats that reduce the set temperature during a winter peak time) that could shift load to times of lower demand may also help maintain a 51 GW peak load level, thereby reducing transmission costs."
    - This statement may be misleading. The underlying load profile utilized is from the "All Options" pathway in the "Energy Pathways to Deep Decarbonization" study done in MA – the "All Options" pathway already assumes a degree of flexible load; namely, the study assumes 50% of the unmanaged electric vehicle charging shape delayable up to eight hours, with 15% of space heating and cooling load able to shift by one hour, and 25% of water heating load able to shift up to two hours. The statement should clarify that there is "more aggressive demand response than that already assumed in the "All Options" pathway."
- P 50 Table 5-6) – The title should be "Estimated Cumulative Costs for Miscellaneous High-likelihood Concerns."
- General:
    - From a recent working paper (attached): "Reconductoring with **advanced composite-core conductors raises the line conductor's thermal limit**, improving its ability to withstand higher temperatures of operation without compromising its structural integrity."
    - From the 2050 Transmission Study: "Many of the transmission system concerns identified in the 2050 Transmission Study could be addressed by **rebuilding existing transmission lines with larger conductors**, rather than expanding the transmission system into new locations. In many cases, replacing transmission lines with larger conductors and increasing their power transfer capability would allow the system to serve significantly higher peak loads. This type of conductor replacement, or reconductoring, may also require replacing some or all of a transmission line's structures in order to accommodate heavier, larger conductors. Other incremental upgrades could also be beneficial; examples include bundling multiple conductors per phase on 115 kV lines (already a common practice on 345 kV lines in New England) or rebuilding transmission lines to allow for a higher operating voltage."
    - It seems the thinking is in terms of size which would be modeled/represented as kV. I also understand the study is concerned with thermal violations/limits so this might be an important inquiry:
        - Curious, is there a mapping for kV to thermal limits? Can those thermal limits be improved with this style of conductor (ultimately improving their capability to an aggregate cut-off greater than 51 GW of load)?

Boreas Renewables Comments

From the PAC discussions, I had expected the technical appendix to list each of the overloaded elements that had been identified in the different cases. What I see in the appendix is a listing of the elements of the major solution roadmaps, but no identification of the violations these roadmaps are conceptually intended to address.

I had been looking forward to seeing the detailed “needs” identification in the report. I’m wondering if ISO would be able to include this information in the final version of the technical appendix.

Ørsted Comments

One question on slide #9: Looks like you are estimating onshore wind availability of about 65% in the winter compared to offshore wind availability of 40% in the winter. Could this possibly be an error? Generally, offshore wind has a significantly higher availability during the winter as compared to onshore wind.

Robin Lafayette
Manager, ISO Policy
Transmission Policy

EVERSOURCE COMMENTS ON 2050 TRANSMISSION STUDY DRAFT REPORT

Eversource Energy respectfully submits these comments in response to the November 1, 2023 2050 Transmission Study Draft Report ("Draft Report").

Eversource appreciates the substantial time and effort that ISO-NE invested in performing this Study and developing this Draft Report. This Study represents a significant milestone in the region's transition to a clean energy future by beginning to quantify the level of necessary investment in the transmission system to reliably operate the grid under a long-term, accelerated decarbonization scenario driven by state and local policies. In recent years, the region has recognized that substantial transmission development is needed to reliably operate an electric grid with significant load growth and powered by renewable resources. This report takes the important step of identifying discrete needs on the system and identifying tangible roadmaps to solving those concerns.

The Draft Report outlines several potential pathways to solving the identified transmission needs. Eversource strongly supports the Minimize New Lines roadmap, which would involve prioritizing line rebuilds and maximizing use of existing rights-of-way and encourages ISO-NE and other stakeholders to consider policies that further that solution development approach.

Comment 1: The Draft Report demonstrates that prioritizing line rebuilds and maximizing the utilization of existing rights-of-way are the most practical approach to solving the needs addressed in this study. Eversource strongly supports this approach.

The Draft Report highlights the distinct advantages of utilizing existing rights-of-way and prioritizing line rebuilds in order to address the needs detailed in the report. In the Draft Report, ISO-NE has identified four High-Likelihood Concerns – North-South, Boston Import, Northwestern Vermont, and Southwest Connecticut – and lays out multiple roadmaps for potential solutions. In each High-Likelihood Concern, the "Minimizing New Lines" roadmap represented the least-cost pathway to addressing the needs.

Moreover, the savings associated with prioritizing line rebuilds may actually be understated in the Draft Report. As noted in Section 2.3, there is a significant opportunity to pursue "right-sizing" of asset condition projects. New England has some of the oldest transmission infrastructure in the nation, which is maintained through the Transmission Owners' asset management programs. When replacement or refurbishment of a transmission asset inevitably becomes necessary, there is an opportunity to account for other future needs, including those identified in a Longer-Term Transmission Study. Co-optimizing or right-sizing solutions to address long-term reliability, asset condition, and public policy needs yields several efficiencies,

including cost savings in engineering, permitting, and civil construction activities. Importantly, the cost estimates to solve the needs identified in the Draft Report are *incremental*, meaning that they do not account for anticipated asset condition or regular reliability work. Therefore, ratepayers would benefit significantly from any opportunity to incorporate upgrades to address longer-term reliability needs into the scope of needed asset condition projects.

In addition to the financial advantages, prioritizing line rebuilds reduces environmental and community impacts, therefore further minimizing siting risks. Siting greenfield transmission lines is notoriously difficult and especially so in a densely populated region such as New England. Rebuilding transmission lines allows construction activities to take place largely on existing rights-of-way, minimizing impacts to communities and the environment. Nationally, stakeholders are also emphasizing the advantages of utilizing existing rights-of-way. For instance, White House national climate adviser, Ali Zaidi, explicitly noted these benefits when discussing the Department of Energy's recent awards of Bipartisan Infrastructure Law funds, stating that "The approach to finding existing rights-of-way or creative rights-of-way that are less disruptive is one that we are finding successful across the country… As we build out, I think that will be an area of lower friction."[1]

Eversource strongly encourages ISO-NE to continue exploring a tariff mechanism to allow right-sizing of planned asset condition projects. Such a mechanism would send a clear signal to prioritize projects that address multiple needs (including asset condition) over more complex and expensive greenfield development options that focus on a single objective. In Section 2.3, ISO-NE highlights timing flexibility as an advantage of focusing on incremental upgrades and line rebuilds. Eversource agrees that prioritizing line rebuilds enables the region to be more expedient in addressing needs because the projects can typically be executed more quickly.

Comment 2: Stockpiling transformers (or other equipment) will require consideration of additional complexities, and in some cases, there may be better alternatives.

In Section 2.5, the Draft Report correctly identifies that transformer capacity is crucial to ensuring that the increased energy needed to meet future load projections can be delivered to customers. The Draft Report also correctly notes that the long lead-time to procure transformers is an ongoing challenge in the industry. The Draft Report's suggestion that "it may be prudent to start ordering transformers ahead of time and determining their exact locations later on" is worthy of further consideration but will have additional complexities that will require careful thought.

For example, transformers experience some degree of degradation during storage. Even if transformers are not in service, other factors such as weather and ambient temperatures

[1] *See:* Zack Hale, "US DOE announces up to $1.3 bil in funding for 3 interregional grid projects," Platts Connect (October 30, 2023). https://plattsconnect.spglobal.com/web/index.html#platts/insightsArticle?articleID=b1bb48c1-e43d-4d1f-8bd6-584c61e170da

contribute to age-related wear on the devices and shorten the useful life of the assets. While Eversource maintains some spare transformers near critical locations in case of emergencies, the practice may not be easily expandable to a larger-scale capital program that would require additional property for storage purposes. Transformers are expensive and logistically challenging to obtain and transport due to their size and weight and may not be universally interchangeable across the region. Cost allocation mechanisms for transformers would also need to be developed for stockpiling transformers in this manner. There may also be effective procurement approaches to address the issue of long lead times for transformers (and other equipment) that could be used instead of stockpiling. For instance, there may be opportunities to reserve the option to purchase transformers or reserve production capacity at a future point in time. Eversource would be happy to discuss these considerations further with ISO-NE.

Comment 3: The Draft Report understates the cost and viability of constructing an offshore grid.

As noted on page 31 of the Draft Report, the offshore grid costs shown in Table 5-3 do not include the costs associated with the construction of new HVDC lines between the offshore lease areas and points of interconnection with the onshore AC transmission system. These costs are likely to be significant – in the tens of billions of dollars. Eversource understands that ISO-NE excluded these costs based on an assumption that the costs would be borne by OSW generators, included in their PPA prices, and not seen by customers as a traditional "transmission costs." However, the costs of these new HVDC lines may need to be reallocated at some point in the future. Essentially, the Draft Report assumes that these lines would be first constructed as radial transmission facilities, and later converted to networked (i.e., PTF) transmission facilities. Such a conversion would likely also require a change in cost allocation and/or cost recovery.

While consideration of cost allocation and cost recovery scenarios is beyond the scope of the Draft Report, Eversource suggests that ISO-NE should still provide an estimate of the total costs of the radial HVDC facilities, in addition to the incremental costs of additional upgrades needed to convert the radial HVDC facilities to networked facilities. These estimates would help the region to understand the scale of costs potentially subject to reallocation for this roadmap.

The draft report also does not consider the technical challenges associated with making the offshore wind farms and offshore HVDC facilities inter-operable or whether there are sufficient *uncommitted* lease areas off the southern coast of New England to connect seven wind farms together into three networks. Eversource therefore suggests that ISO-NE include an assessment of these factors in its final Report. One of the Draft Report's stated objectives is to develop roadmaps while considering the feasibility of constructing such solutions. Assessing these factors and the associated challenges would help the region to better understand the viability and benefits of an offshore grid.

Conclusion

Eversource thanks ISO-NE for the significant effort put forth in this study and looks forward to continuing to engage in discussions on the 2050 Transmission Study and subsequent Longer-Term Transmission Planning Initiative.

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December 1, 2023

By email to PACmatters@iso-ne.com

Jill Macura
Secretary, Planning Advisory Committee
ISO New England Inc.
One Sullivan Road
Holyoke, MA 01040

Subject: Comments on the draft 2050 Transmission Study report

RENEW Northeast, Inc. ("RENEW")[1] submits these comments in response to ISO New England's ("ISO-NE") 2050 Transmission Study opportunity for written comment. RENEW's members have a variety of positions on transmission and individual members may submit comments separately on the matter.

I. Introduction

RENEW strongly supports the efforts of ISO-NE and the New England states to work cooperatively on regional transmission planning to ensure the most cost-effective and reliable deployment of renewable energy resources. The need for expanded transmission has never been clearer, and a decade's worth of studies tell us how to prepare the power system for renewable energy. The 2050 Transmission Study is an important step in this process and builds on an extensive list of studies over the past decade identifying current and anticipated transmission constraints and in many cases identifying solutions.[2]

RENEW's comments are rooted in core principles related to offshore wind transmission and build on RENEW's longstanding advocacy to address onshore grid constraints. RENEW supports outcomes arising from the 2050 Transmission Study that enable competition, optimize interconnection of new resources particularly offshore wind, and increase the single contingency limit for new resources to at least 2,000 megawatts.

RENEW supports offshore wind transmission development policies that: (1) are most likely to enable responsible development of offshore wind at the lowest cost and risk to ratepayers; (2) give the leaseholders and independent transmission developers discretion on interconnection points for them to select the most cost-effective, environmentally friendly, and reliable interconnection for their projects; (3) maintain existing contractual arrangements; (4) recognize the situation of generation projects in advanced permitting and interconnection queue processing; and (5) achieve near term state offshore wind goals while enabling full development of the Northeast's offshore wind resource.

II. Comments

A. Competitive Options

RENEW appreciates the analytical approach utilized in the 2050 Transmission Study. Evaluation of multiple solutions to address identified needs is a prudent approach that will maximize competition and yield the most efficient and cost-effective transmission projects. For example, consideration of marine HVDC solutions to North-South constraints alongside traditional HVAC upgrades demonstrates the viability of different solutions and facilitates an open bidding process that will reduce costs and maximize benefits of new transmission.

B. Sequencing Project Development

RENEW supports ISO-NE's has approach of differentiating which concerns are of high likelihood to occur, and also which concerns need to be addressed sooner because they occur sooner and require new transmission (as opposed to rebuilds). The task at hand is large, and figuring out how to prioritize/sequence the work is valuable.

C. Optimizing Interconnections

Optimizing interconnection of new resources – particularly offshore wind – is one of the most important contributions that the 2050 Transmission Study can make to planning transmission solutions for the region. In pursuing optimized transmission, it is important to account for material developments that have occurred since assumptions underlying the 2050 Transmission Study were made. Many assumptions were taken from the Massachusetts Decarbonization Roadmap, which was published in 2020, and for which assumptions were made in 2018/2019.[3] In the years since that study, transmission technology has matured and the location of new offshore wind generation from the Gulf of Maine has become clearer. Offshore wind projects have gotten larger and are utilizing HVDC transmission to interconnect to the terrestrial grid. Offshore wind from the Gulf of Maine could thus interconnect to southern New England to avoid onshore grid constraints in Maine, while also meeting increasing electricity demand in the Boston area. If further refinement of offshore wind injection locations is beyond the scope of this phase of long-term planning, ISO-NE should acknowledge in the 2050 Transmission Study that further refinement of assumed locations of new generation could alleviate the need for onshore upgrades (e.g., in Maine) and meet projected increases in electricity demand (e.g., in Boston and Southwest Connecticut).

D. The Map Showing All Transmission Upgrades Should Be Broken into Multiple Maps for Each Roadmap

RENEW recommends ISO-NE revise Figure 4-10 in the draft report showing all the transmission upgrades and additions of all the various roadmaps developed. While it is helpful to

see the possible scope, it is also confusing and misleading to see all the roadmaps on one map, given that only a subset would be needed to address the identified needs. Also, it is not clear from the description whether this map shows only the upgrades included in the "roadmaps" ISO-NE developed, if it also includes the "miscellaneous" high likelihood concerns, or if it also includes the non-high likelihood concerns.

E. The Regional RTOs Should Accelerate Efforts to Overcome the 1,200-MW Single Contingency Limit

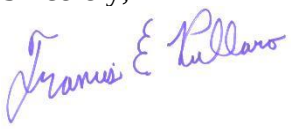
To optimize the transmission buildout, ISO-NE should accelerate efforts to reevaluate and update its single contingency loss of source limit placed on new interconnections. ISO-NE restricts new interconnections to a 1,200-MW single contingency loss of source limit to protect neighboring control areas from the impact of losing too much supply at once.[4] Given the scale at which new clean energy development will be taking place, as seen in the 2050 Transmission Study, the region should explore all options to enable building fewer, larger transmission facilities to improve cost effectiveness while reducing environmental impacts. So long as offshore wind continues to interconnect using radial cables, the existing 1,200-MW limit would, for example, require seven separate undersea circuits to interconnect 8,000 MWs of offshore wind to southeast New England.[5] If the 1,200-MW limit on new interconnections were raised to 2,000 MWs, four undersea circuits could be sufficient to interconnect 8,000 MWs. Allowing for these larger interconnections could enable offshore wind projects to capture further economies of scale, reduce total costs to consumers, and lessen the environmental impact to the region.[6]

Based on the annual reports ISO publishes on external interface metered data, the Phase I/II tie line between ISO-NE and Hydro Quebec, which is rated at 2,000 MWs, operated above 1,200 MWs in approximately 93 percent of hours in 2021.[7] Clearly, the region and its neighboring systems are regularly able to manage a loss of source in New England that exceeds 1,200 MWs, even if this is not possible in all hours. Given the increasing frequency with which ISO-NE has been able to reliably allow existing resources to operate above 1,200 MWs, the region should revisit the need to restrict new interconnections to 1,200 MWs. We appreciate the initiative underway through the Joint ISO/RTO Planning Committee consisting of ISO-NE, NYISO and PJM to determine the feasibility of raising the minimum source loss limit to 2,000 MWs.[8] We encourage ISO-NE and the New England states to request expedited completion of necessary studies and any regulatory reforms and system upgrades need to enable 2,000-MW interconnections. Any new resource over 1,200 MWs could, in the short term, be subjected to the same operational limitations placed on existing resources over 1,200 MWs to maintain system reliability. Even with such operational restrictions, it may still be financially and environmentally advantageous to the region to be able to interconnect new resources using fewer radial transmission lines.

III. Conclusion

On behalf of its members, RENEW appreciates the opportunity to comment on the 2050 Transmission Study. We look forward to continuing engagement in the transmission planning process as the region moves towards implementation.

Sincerely,



Francis Pullaro
Executive Director

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[1] The comments expressed herein represent the views of RENEW and not necessarily those of any particular member.

[2] The most recent studies include: ISO-NE, *2015 Economic Study Evaluation of Increasing the Keene Road Export Limit* (September 2, 2016), https://www.iso-ne.com/static-assets/documents/2016/09/2015_economic_study_keene_road_increased_export_limits_fina.docx
ISO-NE, *2015 Economic Study Strategic Transmission Analysis—Onshore Wind Integration* September 2, 2016), https://www.iso-ne.com/static-assets/documents/2016/09/2015_economic_study_onshore_wind_integration_final.docx
ISO-NE, *2016 Economic Study: NEPOOL Scenario Analysis* (November 17, 2017), https://www.iso-ne.com/static-assets/documents/2017/11/final_2016_phase1_nepool_scenario_analysis_economic_study.docx
ISO-NE, *2019 Economic Study: Economic Impacts of Increases in Operating Limits of the Orrington-South Interface* (October 30, 2020), https://www.iso-ne.com/static-assets/documents/2020/10/2019-renew-es-report-final.docx
ISO-NE, *2016/2017 Maine Resource Integration Study* (March 12, 2018), https://smd.iso-ne.com/operations-services/ceii/cluster-studies/final_maine_resource_integration_study_report.pdf (requires access to Critical Energy Infrastructure Information)
ISO-NE, *Final Second Maine Resource Integration Study* (October 30, 2020), https://www.iso-ne.com/static-assets/documents/2021/01/second-maine-resource-integration-study-report-non-ceii-final.pdf
RLC Engineering, *QP639 Elective Transmission upgrade Interconnection System Impact Study Final Report* (May 7, 2020))(prepared for ISO-NE), https://smd.iso-ne.com/planning/ceii/studies/me/qp639-etu-1200-mw-hvdc-sis-report_may072020.pdf and associated *QP889 Elective Transmission Upgrade Interconnection System Impact Study Final Report* (September 24, 2021), https://smd.iso-ne.com/planning/ceii/studies/me/qp889-etu-sis-report.pdf
ABB Inc., *QP506 Internal HVDC North to South Flow System Impact Study Report* (July 28, 2017)(prepared for ISO-NE), https://smd.iso-ne.com/planning/ceii/studies/ma/qp506-internal-hvdc-north-to-south-flow-sis-report_jul282017.pdf (requires access to Critical Energy Infrastructure Information)
ISO-NE, *2019 Economic Study: Offshore Wind Integration* (June 30, 2020), https://www.iso-ne.com/static-assets/documents/2020/06/2019_nescoe_economic_study_final.docx
ISO-NE, 2019 *Economic Study: Significant Offshore Wind Integration* (October 5, 2020), https://www.iso-ne.com/static-assets/documents/2020/10/2019-anbaric-economic-study-final.docx
ISO-NE, *First Cape Cod Resource Integration Study Redacted Non-CEII Version* (July 30, 2021), https://www.iso-ne.com/static-assets/documents/2021/07/cape-cod-resource-integration-study-report-non-ceii-final.pdf

ISO-NE, *Second Cape Cod Resource Integration Study Preliminary Results* (April 28, 2022), https://smd.iso-ne.com/operations-services/ceii/pac/2022/04/a6_second_cape_cod_resource_integration_study_preliminary_results_ceii.pdf
ISO-NE, *New Generation Curtailment Analysis—Pilot Study Preliminary Results* (April 28, 2022), https://www.iso-ne.com/static-assets/documents/2022/04/a5_new_generation_curtailment_analysis_pilot_study_preliminary_results.pdf

[3] See: draft_2050_transmission_planning_study_scope_of_work_for_pac_rev2_clean.pdf (iso-ne.com)

[4] ISO New England Planning Procedure No. 5-6 Interconnection Planning Procedure for Generation And Elective Transmission Upgrades, Appendix A "Interconnection Design – Loss-of-Source: The interconnection shall be designed such that, with all lines initially in service, there is no normal design contingency or common mode transmission system, station, or internal plant failure which could result in a net loss of more than 1,200 MW of resources, except in the case of an increase of no more than 2% above the maximum capability, in place at the time of the original incorporation of this provision into PP5-6 in June 2016, of an existing facility that already corresponded to a loss of more than 1,200 MW of resource for a normal design contingency."

[5] For example, when ISO performed the first cluster study for interconnecting Northern Maine wind generation, the cluster size was limited to 1,200 MW despite approximately 2,000 MW of wind being in the queue in that area at the time. When ISO evaluated the transmission needs for interconnecting offshore wind as part of the NESCOE 2019 offshore wind economic study, each undersea circuit bringing power to shore was limited to a maximum of 1,200 MW.

[6] *See e.g.*, Dr. Biljana Stojkovska, presentation to New England Energy Vision Transmission Planning Technical Forum (February 2, 2021), https://newenglandenergyvision.com/transmission-planning. (Optimized transmission planning in the United Kingdom would in some cases utilize 1,500 to 1,800-MW HVDC cables to interconnect offshore wind. Utilizing these larger circuits resulted in lower costs and reduced environmental impact by reducing the number of circuits needed).

[7] External Interface Metered Data available at https://www.iso-ne.com/isoexpress/web/reports/grid/-/tree/external-interface-metered-data.

[8] Brent Oberlin, ISO New England, Letter to Joint ISO/RTO Planning Committee (JIPC) (March 27, 2023), https://www.iso-ne.com/static-assets/documents/2023/03/jipc_loss_of_source_limit_final.pdf

December 1, 2023

By email to PACmatters@iso-ne.com

Jill Macura
Secretary, Planning Advisory Committee
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Comments on the ISO-New England 2050 Transmission Study Draft Report released on November 1, 2023.

Please accept The Nature Conservancy's (TNC) comments regarding ISO-New England's (ISO-NE) 2050 Transmission Study Draft Report ("Draft Report") and the need for regional collaboration and longer-term planning for a future electric grid that supports an accelerated pathway to decarbonization of the New England energy system and is a model for other ISO/RTOs to follow.

TNC's mission is to conserve the lands and waters on which all life depends. We work in more than 70 countries and all 50 states in the United States. With the support of more than one million members globally, TNC has been working to conserve, protect, and restore ecosystems and species for over six decades around the world. Climate change threatens to undo decades of our successful conservation work and fundamentally alter our future. TNC is committed to helping reduce global greenhouse gas emissions to limit global warming to no more than 1.5° Celsius above pre-industrial temperatures. This goal cannot be achieved without a rapid transition to a clean energy economy. A clean energy future will require a different approach to energy and transmission planning and procurement and a predictable and flexible energy system. Modifying the current approach is essential to the well-being of nature, our economy, our communities, and our planet.

Ensuring a cost-effective, equitable, and timely clean energy transition that meets the New England states' decarbonization goals will require long term planning. The existing transmission system in New England is currently unable to integrate and utilize the amount of clean energy required to achieve a net zero carbon energy system by 2050. Additionally, curtailment of renewable energy resources will

continue to happen, costing ratepayers millions of dollars annually.[1,2] Planning today for New England's transmission needs through 2050 (including the new and upgraded lines, transformers, generators and battery storage) will reduce costs[3] and support system reliability in our clean energy transition.

In accordance with a recommendation from New England States Committee on Electricity's (NESCOE) October 2020 "New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid,"[4] ISO-NE's Draft Report proposes scenarios based on state mandates and policies beyond the current ten year planning horizon to project potential transmission needs to meet anticipated peak loads while satisfying regional, national, and multinational reliability criteria. TNC appreciates ISO-NE's willingness to engage in this initial planning process and future planning phases, and to seek public comments.

With respect to the Draft Report, we submit our comments and suggestions on these elements of the November 1st draft:

- Comprehensive and Long-term Transmission Planning
- Offshore Wind Transmission
- Further Transmission Analysis

Comprehensive and Long-Term Transmission Planning

TNC strongly supports ISO-NE efforts regarding regional collaboration on procurement and cost allocation for interstate transmission pathways. We believe that this work will be critical for transmission planning across multiple grid operator footprints, particularly if the formation of the Northeast States Collaborative on Interregional Transmission is successful. The U.S. Department of Energy's (DOE) Draft National Transmission Needs Study as well as DOE's Atlantic Offshore Transmission Study identified the anticipated need for substantial new transfer capacity between various regions such as New England, New York and the Mid-Atlantic, as well as system and governmental needs for the successful integration of new resources throughout the Northeast and Mid-Atlantic.[5] A transmission

[1] S&P Global Nov 2023 article: Curtailment, congestion costs rise as transmission upgrades lag renewable growth, outlines national energy curtailment due to rapid growth of renewable energy deployment. https://www.spglobal.com/marketintelligence/en/news-insights/research/curtailment-congestion-costs-rise-as-transmission-upgrades-lag-renewable-growth#:~:text=Curtailment%2C%20congestion%20costs%20rise%20as%20transmission%20upgrades%20lag%20renewable%20growth,-Share&text=Transmission%20and%20distribution%20constraints%20remain,interconnection%20queues%20across%20the%20country.

[2] The Benefit and Urgency of Planned Offshore Transmission: Reducing the Costs of and Barriers to Achieving U.S. Clean Energy Goals, Brattle Group, Jan. 2023)

[3] RENEW Northeast white paper on transmission, A Transmission Blueprint for New England: Delivering on Renewable Energy, released May 2022, discusses cost and benefits of rapid and extensive transmission buildout and upgrades: https://renewne.org/wp-content/uploads/2022/05/RENEW-Northeast-Transmission-Blueprint-2022-05-23.pdf

[4] The New England Vision Statement released in Oct 2020, recommended that the ISO work with stakeholders to conduct a comprehensive long-term regional transmission study.

[5] U.S. Department of Energy, National Transmission Needs Study: Draft for Public Comment, Feb. 2023, at https://www.energy.gov/sites/default/files/2023-02/022423- DRAFTNeedsStudyforPublicComment.pdf; U.S. Department of Energy, Atlantic Offshore Transmission Study, at https://www.energy.gov/gdo/offshore-wind-transmission-federalplanning-support.

planning process that results in little regional (or interregional) capacity and only plans local or incremental regional upgrades at a time— in response to a specific generator interconnection request or a single other need—will result in expensive and inefficient solutions.[6] Increased interregional transmission capacity through planning and coordination could lower electricity prices through renewable energy market expansion, increased reliability during extreme weather and grid stress, and accelerated decarbonization across the Northeast and beyond.

The creation of the New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid was an important first step in informing regional stakeholders about the amount and type of transmission infrastructure needed to support the clean energy transition and the alignment and leadership that would be needed to plan for and build that infrastructure. TNC is encouraged by ISO-NE's ongoing coordination with NESCOE and state agencies to establish the scope, assumptions, and methodology used in this initial planning study, which was important in laying the foundation for the Draft Report.

Building on this foundation, we believe that a comprehensive and long-term transmission plan can address multiple transmission needs and establish how transmission investments can reduce system-wide costs of delivering reliable clean energy. TNC strongly recommends that ISO-NE build on this initial study and clearly outline next steps for expanding the scope of this study to address costs and savings associated with a whole system approach to transmission expansion investments needed to support 2050 clean energy targets.

For several reasons, the Draft Report needs improvement in this respect. First, the *Roadmaps* identified in the Draft Report do not go far enough to provide clear recommendations about: how to connect and integrate the necessary amounts of clean energy to achieve 100% decarbonization; alternatives to incremental solutions to various individual needs over time; the system-wide cost comparisons associated with planning for transmission expansion across multiple time horizons; and strategies optimize the location and timing of load and generation with transmission upgrades and builds. Next, instead of developing a number of scenarios designed to upgrade the grid to accommodate the peak anticipated load needed to achieve 100% electrification and a fully decarbonized energy system by 2050, the Draft Report focuses on recommendations to keep peak load below 51 GW. While energy efficiency and demand response initiatives and incentives must be foundational parts of meeting our future energy needs at the lowest economic and environmental costs, long-term planning must also enable states to achieve their goals while evaluating multiple pathways to integrating the clean energy needed to achieve the region's goals.

Offshore Wind Transmission

The potential of OSW to decarbonize New England and transform it into a region sustained by local renewable energy is tremendous. But that potential will effectively remain trapped at sea if our regional transmission challenges and generation interconnection policies are not coordinated and addressed. ISO-NE's 2019 study on OSW integrations concluded that any significant quantity beyond 5,800 MW of OSW may not be able to interconnect into the regional grid without significant transmission upgrades

[6] The Benefit and Urgency of Planned Offshore Transmission: Reducing the Costs of and Barriers to Achieving U.S. Clean Energy Goals, Brattle Group, Jan. 2023)

and that the already contracted OSW would consume existing capacity at the most easily accessible interconnection points along the southern New England coast.[7]

The time for planning for these upgrades is now, and the Draft Report does not go far enough in establishing a clear path for connecting at least 35 GW of OSW by 2050. Numerous studies have indicated that coordinated transmission for OSW must be identified sufficiently in advance of generation procurements to mitigate risk and enable generators to utilize transmission facilities. Unless both near-term and long-term needs are addressed through comprehensive planning: 1) using the best Points of Interconnection (POIs) and transmission corridors for early OSW projects, without considering long-term needs, can severely limit future options; 2) the best transmission solutions for individual projects may not be the best options to address long-term needs and 3) technology choices made for individual OSW projects may not allow future interoperability and integration into an offshore network.[8]

ISO-NE should consider a proactive planning framework for the generation interconnection process, which could address the fact that generation interconnections are unfairly placed on generators when large benefits accrue to the system as a whole. A planned offshore transmission system along with careful planning of the onshore points of interconnection can also significantly reduce onshore upgrade costs. One published report indicates that developers face up to $787 million in onshore upgrade costs at these limited interconnection sites and that continuing this piecemeal approach for even the next 3,600 MW of procurement could lead to an additional +$1.7 billion in onshore upgrades.[9]

When considering the existing capacity constraints and regional decarbonization goals, the role of OSW is clear. For these reasons, TNC strongly recommends that ISO-NE, in collaboration with NESCOE and other stakeholders, further analyze and build on Roadmap Pathway #4 in the Draft Report, which would make use of an offshore grid framework by connecting multiple OSW plants. We believe that Pathway #4, if further developed, has the greatest potential to deliver cost-effective, carbon-free, and reliable wind energy into the New England grid, especially considering potential funding and planning at the federal level.[10] However, the Draft Report is not entirely clear regarding how much OSW energy Pathway # 4 is designed to be brought into the system. Pathway #4 contemplates making use of an offshore grid framework by connecting up to three OSW plants, but this is inadequate in achieving economies of scale and meeting decarbonization targets. The Massachusetts' Decarbonization Roadmap[11] and a 2019 Brattle Group study[12] state that in order for New England to achieve an 80% GHG reduction by 2050, the region will need between 30 and 45 GW of OSW by 2050. To this end there

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[7] 2019 *Economic Study: Offshore Wind Integration*, ISO New England Inc., June 30, 2020.

[8] The Benefit and Urgency of Planned Offshore Transmission: Reducing the Costs of and Barriers to Achieving U.S. Clean Energy Goals, Brattle Group, Jan. 2023)

[9] The Brattle Group, *Offshore Transmission In New England: The Benefits of A Better Planned Grid*, May 2020, at Slide 5. The Brattle report was prepared for Anbaric.

[10] Biden-Harris Administration Announces $30 Million from Bipartisan Infrastructure Law to Speed Up Wind Energy Deployment | Department of Energy

[11] Massachusetts Decarbonization Roadmap report was released in December 2020, with the intent to identify strategies to reduce greenhouse gas emissions sector-wide by 85% by 2050 https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download

[12] Brattle Group 2019 report, Achieving 80% GHG Reduction in New England by 2050: Why the Region Needs to Keep its Foot on the Clean Energy Accelerator, https://www.brattle.com/wp-content/uploads/ 2021/05/17233_achieving_80_percent_ghg_reduction_in_new_england_by_20150_september_2019.pdf

is no greater climate action, and therefore no greater conservation action in New England than resolving the challenge of connecting and utilizing OSW in the regional grid.

We also recommend that Pathway #4 reference and utilize concepts and technological advancements recommended in the DOE-backed National Renewable Energy Laboratory (NREL) Atlantic Offshore Wind Transmission Study.[13] This study has found that using a networked approach, with fewer higher capacity lines, results in lower costs and reduces environmental impacts. An offshore networked approach also makes the single source loss limit less of an issue as the power will automatically reroute to other parts of the system, aided by advances in high-voltage direct current (HVDC) technology which can automatically reroute through modern circuit breakers. Additionally, while the current standard OSW interconnection in New England is 1,200 MW, this could change[14]. TNC suggests consideration for OSW transmission developers to utilize new, higher-capacity transmission cables beyond the 1,200 MW limit, which could further reduce costs and impacts to communities and the environment. Future OSW connections in the North Sea will use the TenneT Standard 2,000 MW, 525 kV bipole lines, and this should be considered for Atlantic OSW development.

The limitations of the existing onshore points of interconnection, along with the need to address generator interconnection costs and crediting the value to the whole system costs, the 1,200 MW cable load limit, and need for a pace and scale of offshore wind build-out beyond connecting up to three offshore wind projects - *all must be addressed*. Without solving these challenges, we cannot build out the clean energy and transmission infrastructure needed to achieve our climate goals in time. We are hopeful that these challenges and more will be examined in the next phase of transmission planning, ISO-NE Extended-Term/Longer-Term Transmission Planning Phase 2: Additional Discussion of Concepts work.

Further Transmission Analysis

We recognize that there are limitations to this study in that it only examined the thermal performance of the transmission system under peak load snapshots, but we believe that this study can be the basis for further analysis regarding non-wires alternatives, grid enhancing technologies, dynamic line ratings and reconductering, as well as intrastate efforts regarding local transmission and distribution upgrades. Future transmission studies that can build on this effort should examine these complex issues and consider adjacent ISO/RTO efforts as well as national/international transmission planning.

Finally, we are concerned that this Draft Study was not robust in its modeling framework, and as such, draft results were generally not very for policy implementation. Of particular interest would be multiple input scenarios, possibly from work being done in Massachusetts[15] regarding grid modernization to further explore the informative necessary transmission build-out for a clean energy future. Accounting for federal and multi-regional actions (e.g., tax credits and federal programs) in the cost analysis is

[13] The Atlantic Offshore Wind Transmission Study, co-led by NREL, evaluates coordinated transmission solutions to enable offshore wind energy deployment along the U.S. Atlantic Coast, addressing gaps in existing analyses. https://www.nrel.gov/wind/atlantic-offshore-wind-transmission-study.html

[14] This is a reference to a March 2023 letter to the Joint ISO/RTO Planning Committee by B. Oberlin, Director of Transmission Planning at ISO-NE, with support from NYISO and PJM counterparts

[15] The MA Grid Modernization Advisory Council is reviewing and providing recommendations on Massachusetts' forthcoming electric-sector modernization plans. https://www.mass.gov/info-details/grid-modernization-advisory-council-gmac

another topic we would like to see analyzed in this or future studies, to aid in state and multi-state transmission procurement processes.

We plan to follow actions in the ISO-NE Extended-Term/Longer-Term Transmission Planning Phase 2: Additional Discussion of Concepts, and contribute to making future transmission planning processes done by the New England states and ISO-NE cost-effective, timely, and equitable. Thank you again for the opportunity to submit these comments on the 2050 Transmission Draft Report Study. We are pleased to support the continued evolution of transmission planning in the Northeast.

Sincerely,

Bruce Clendenning
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The Nature Conservancy