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# Transmission Planning in New England

*New England Energy Vision for a 21st Century Electric Grid Technical Forum*

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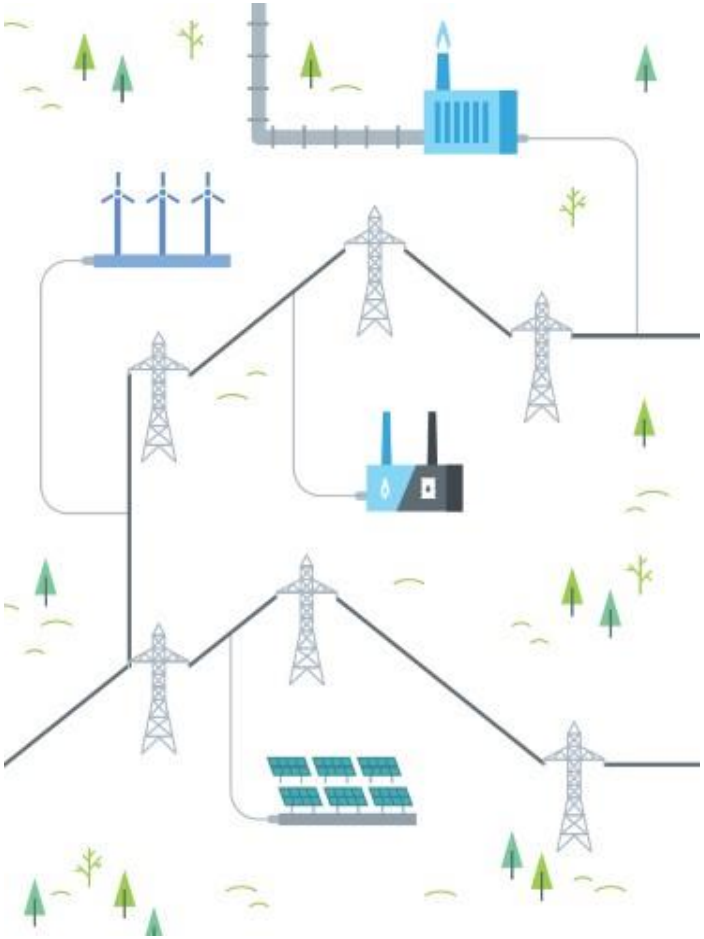
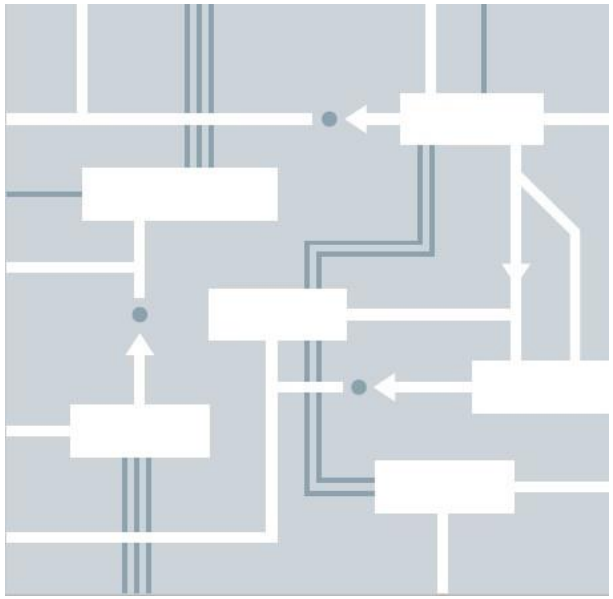
# Key Themes

- **The focus of most planning to date**: Transmission upgrades driven by clear, narrow scope to address reliability needs and interconnect new resources
- **How the system is changing:** Integration of renewables and storage to meet policy goals may significantly change transmission system flows
- **How planning could change:** Meeting policy goals in a timely and efficient way will require new planning, approval, and funding approaches. Future transmission planning would be driven by both reliability standards and other policy objectives; this will require greater engagement with states and stakeholders



# Three Transmission-Related Questions for Envisioning a Decarbonized Electric System

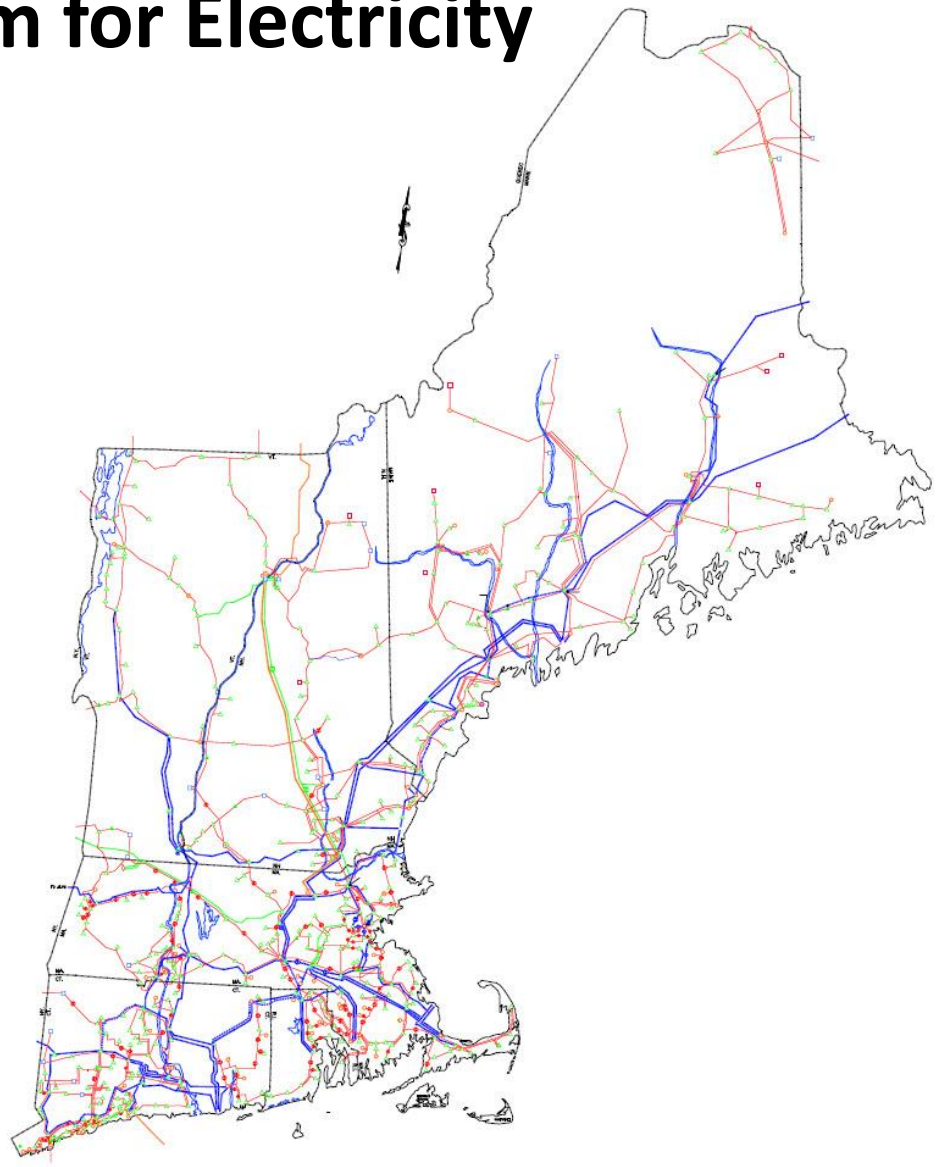
- How does transmission planning work **today**?
- What **transmission infrastructure** do we need to build to support a fully decarbonized electric grid?
- What **processes** do we need to put in place to get there?



*As the **Regional Transmission Organization**, the ISO is required to identify transmission infrastructure solutions that are essential for maintaining power system reliability in New England*

# New England's Transmission Grid Is the Interstate Highway System for Electricity

- **9,000 miles** of high-voltage transmission lines (115 kV and above)
- **13 transmission interconnections** to power systems in New York and Eastern Canada
- **21%** of region's energy needs met by imports in 2020



# TRANSMISSION PLANNING TODAY

*Transmission planning under the current ISO-NE Tariff*

# Transmission Needed for Reliability

- **The ISO has specific, limited authority to trigger construction of regionally funded transmission**
  - The ISO does periodic studies of sub-areas (e.g. Western MA) to identify violations of reliability standards within a ten year horizon
  - Needs driven by changing load and generation patterns; solutions put on the RSP Project List
  - Historically, the ISO designed upgrades with the relevant Transmission Owner(s)
    - **$11.3 billion** invested to date to strengthen transmission system reliability since 2002 (e.g., Greater Boston, Southeast Massachusetts, Southwest Connecticut, Maine Power Reliability Program); an additional **$1.1 billion** is planned (ISO Transmission Project List)
  - Today and in the recent past the ISO identifies needs that occur either in the near term (i.e., within three years), or the longer term (beyond three years)
    - For near-term needs, the ISO designs upgrades with the relevant TO(s)
    - For longer-lead time needs, the ISO issues a competitive solicitation (RFP) for transmission solutions and then evaluates proposals submitted in response to the RFP (e.g., Boston Area)
  - New England has a regional cost-sharing arrangement for reliability projects
- Stakeholders have opportunities to be involved in the planning process through the Planning Advisory Committee ("PAC")
- **The ISO's role is to select a cost-effective and comprehensive solution to the reliability need**

# Developer-Sponsored Transmission

- **Developer-sponsored projects are voluntary and not related to regional reliability needs;** may be driven by economics or other factors (known as Elective Transmission Upgrades (ETUs) in the ISO Tariff)
  - For example, developers have proposed large-scale transmission projects to deliver clean energy in response to state RFPs
  - Costs are born by developers, who have required long-term contracts to provide funding
- **The ISO's role is to ensure that the interconnecting transmission project does not have an adverse impact on system reliability**
- *Currently, this is the primary mechanism that state-sponsored projects have used to expand access to clean energy resources* (e.g., Massachusetts solicitation for clean energy resources and the New England Clean Energy Connect (NECEC) project)
  - While a collection of states could also potentially use a unique arrangement (outside of the ISO Tariff) to fund an upgrade, this has not yet happened

# Competition for Transmission Solutions

- In December 2019, the ISO issued an RFP for competitive transmission solutions to identified reliability needs in the Boston Area
- Reliability needs are driven by the anticipated retirement of the Mystic Generating Station in the Boston area
- The ISO received 36 proposals from eight qualified entities
  - Costs ranged from $49M to $745M
  - In-service dates ranged from March 2023 to December 2026

- The ISO selected the lowest-cost solution that fully met the identified reliability needs in the area

# Transmission Planning for Public Policy

- **FERC initiated this mechanism through Order 1000**
  - In theory, intended to enable ISO to plan to meet public policy objectives
  - The ISO initiates the process every three years (2017, 2020)
  - Mapped out in ISO-NE *Transmission Planning Process Guide**
- The New England states, NESCOE, and stakeholders can provide input to identify public policy needs that may require transmission
- The process has not resulted in an identified public policy need; the states have indicated that they want to rethink this process

*https://www.iso-ne.com/static-assets/documents/2020/03/transmission_planning_process_guide_3_13_20.pdf

# ISO New England Performs Annual Economic Studies as Requested to Inform Policymakers and Stakeholders

*Three studies were requested in 2019: one was requested in 2020*
*No direct path to building transmission unless upgrades that sufficiently reduce regional production costs are identified (these upgrades could proceed as Market Efficiency Transmission Upgrades)*

| Sample Requester | Purpose of Request |
|---|---|
| 2019 New England States Committee on Electricity (NESCOE) | Impacts on transmission system and wholesale market of increasing penetrations of offshore wind resources ***Preliminary results show no major new transmission is needed for up to 7,000 MW of new offshore wind**** |
| 2019 Anbaric Development Partners (Anbaric) | Impacts on energy market prices, air emissions, and regional fuel security of large penetrations of offshore wind resources ***Results similar to NESCOE results*** |
| 2020 National Grid | Analyze potential pathways to best use the MWh of clean energy resources to meet state goals cost-effectively, leveraging transmission and/or storage as needed. ***Results pending*** |

*The 7,000 MW was in addition to 1,000 MW of offshore wind assumed in the base case

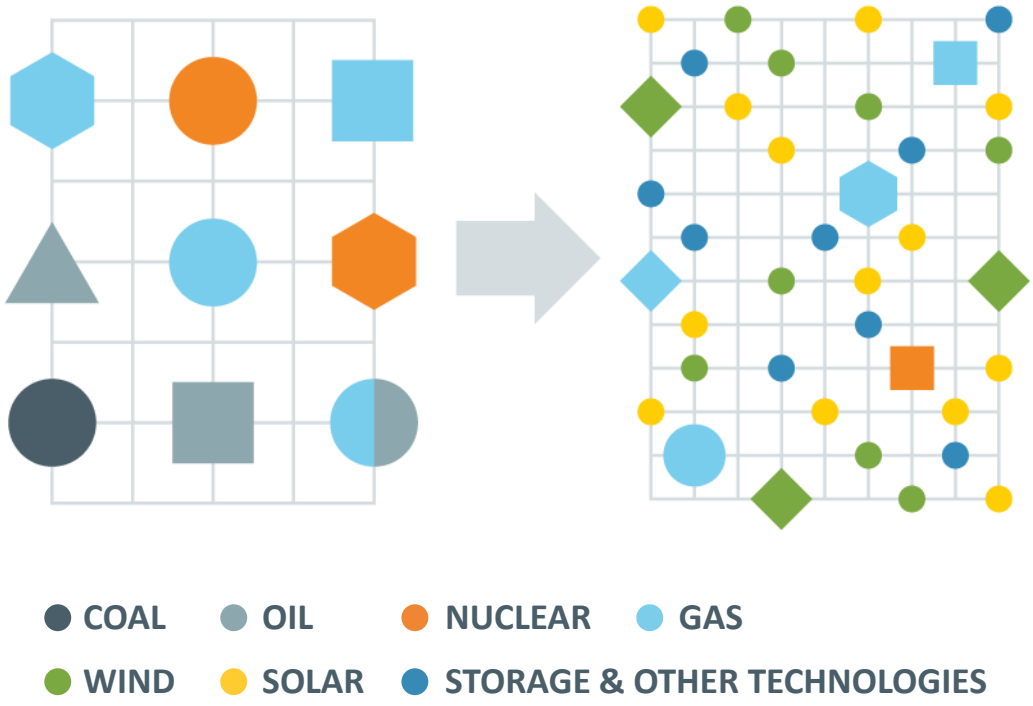
# TRANSMISSION PLANNING IN TRANSITION

*Trends already underway will likely accelerate in the future*

# New England Is Moving Toward a Hybrid Grid

*There are two dimensions to the transition, happening simultaneously…*

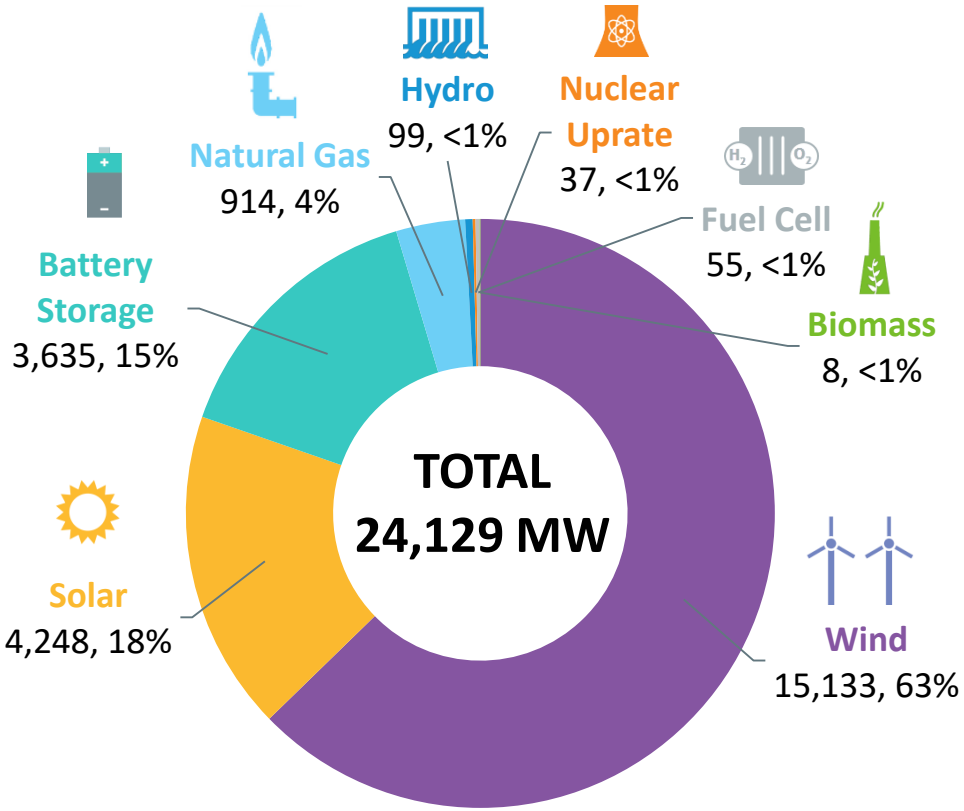
1. **A shift from conventional generation to renewable energy far from loads**
2. **A shift from centrally dispatched generation to distributed energy resources on distribution system**




*Maintaining reliable power system operations becomes **more complex** with the shift to greater resources that face constraints on energy production*

# Wind Power Comprises Two Thirds of New Resource Proposals in the ISO Interconnection Queue

## All Proposed Resources




Source: ISO Generator Interconnection Queue (January 2021)
FERC and Non-FERC Jurisdictional Proposals; Nameplate Capacity Ratings
Note: Some natural gas proposals include dual-fuel units (with oil backup).
Some natural gas, wind, and solar proposals include battery storage.

## Proposals by State

(all proposed resources)

| State | Megawatts (MW) |
|---|---|
| Massachusetts | 12,565 |
| Connecticut | 7,457 |
| Maine | 2,142 |
| Rhode Island | 1,287 |
| New Hampshire | 572 |
| Vermont | 105 |
| **Total** | **24,129** |

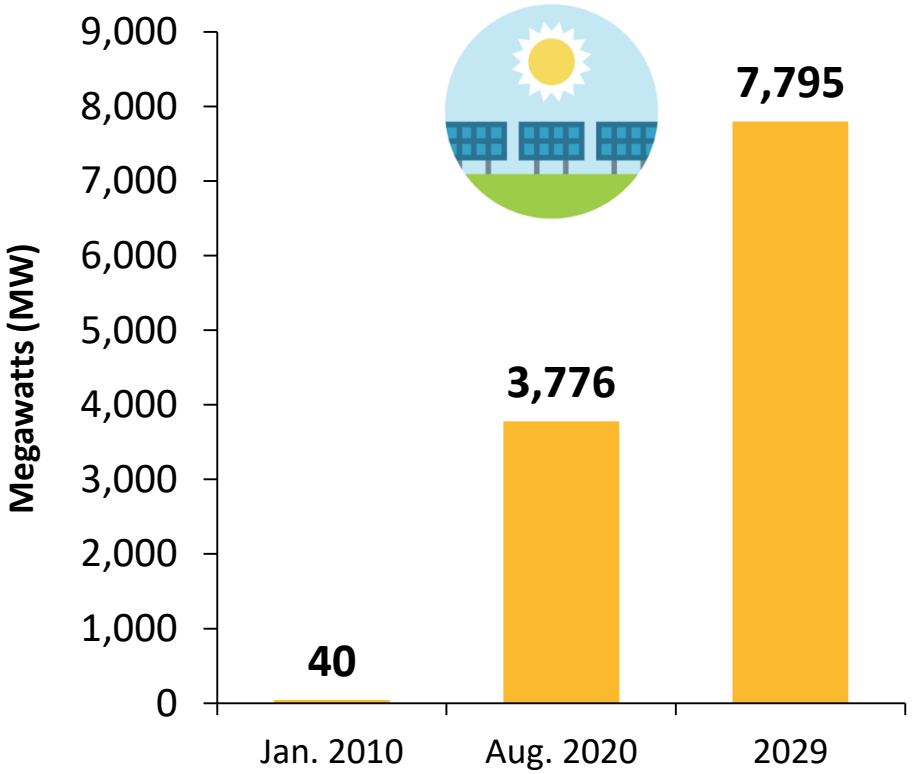
Source: ISO Generator Interconnection Queue (January 2021)
FERC and Non-FERC Jurisdictional Proposals

# ISO-NE Forecasts Continued Strong Growth in Solar Photovoltaic (PV) Resources

## August 2020 Solar PV Installed Capacity ($MW_{ac}$)

| State | Installed Capacity ($MW_{ac}$) | No. of Installations |
|---|---|---|
| Connecticut | 636.28 | 50,351 |
| Massachusetts | 2,480.05 | 109,959 |
| Maine | 60.35 | 5,572 |
| New Hampshire | 116.44 | 10,300 |
| Rhode Island | 175.89 | 9,028 |
| Vermont | 379.41 | 14,658 |
| **New England** | **3,776.41** | **199,868** |

## Cumulative Growth in Solar PV through 2029 ($MW_{ac}$)




Note: The bar chart reflects the ISO's projections for nameplate capacity from PV resources participating in the region's wholesale electricity markets, as well as those connected "behind the meter." The forecast does not include forward-looking PV projects > 5 MW in nameplate capacity. Source: Final 2020 PV Forecast (March 2020) and August 2020 Distributed Generation Survey Results; MW values are AC nameplate.

# FUTURE TRANSMISSION PLANNING

# What Will the Transmission System Look Like in the Future?

- How will the region accommodate the next wave of large-scale renewable energy deployment after using up the initial points of interconnection (i.e., generator retirement sites)?
- Should the region proceed with ad hoc interconnection studies to integrate renewables or consider proactive plans to integrate renewable energy on a larger scale?
- How will the distribution systems evolve to accommodate growth of distributed resources and electrification of transportation and heating sectors?

**The ISO looks forward to working with the New England states to reliably plan and build a decarbonized transmission grid**

# Future Transmission Planning Considerations

- If the region wants to integrate large amounts of wind or grid-scale renewables in a timely and cost-effective manner, the ETU and Public Policy Process may need to be revised or may not be sufficient
- A regular study process focused on public policy goals can provide detailed information
  - E.g., proposed 2050 Transmission Study requested by certain states
- Integration of/coordination between the reliability-based upgrade process and any long-term public policy development process is needed
  - E.g., to make sure reliability upgrades are an appropriate technology and sized to meet public policy goals
- A defined process for approving public policy upgrades and determining cost allocation is essential
  - Unlikely that sufficient specific criteria can be identified to allow the ISO to simply add public policy projects to the Project List
  - Experience with cluster studies show that identifying the needed upgrades may not be fruitful if the procurement process is not ready to fund the cost of the upgrades along with the new resources themselves
    - There are many cases of completed interconnection studies in the ISO queue where no upgrades are required – but the project is not moving forward because the generator itself cannot secure funding
  - Some formal state approval likely needed
    - Combined with siting?
    - Combined with cost allocation?

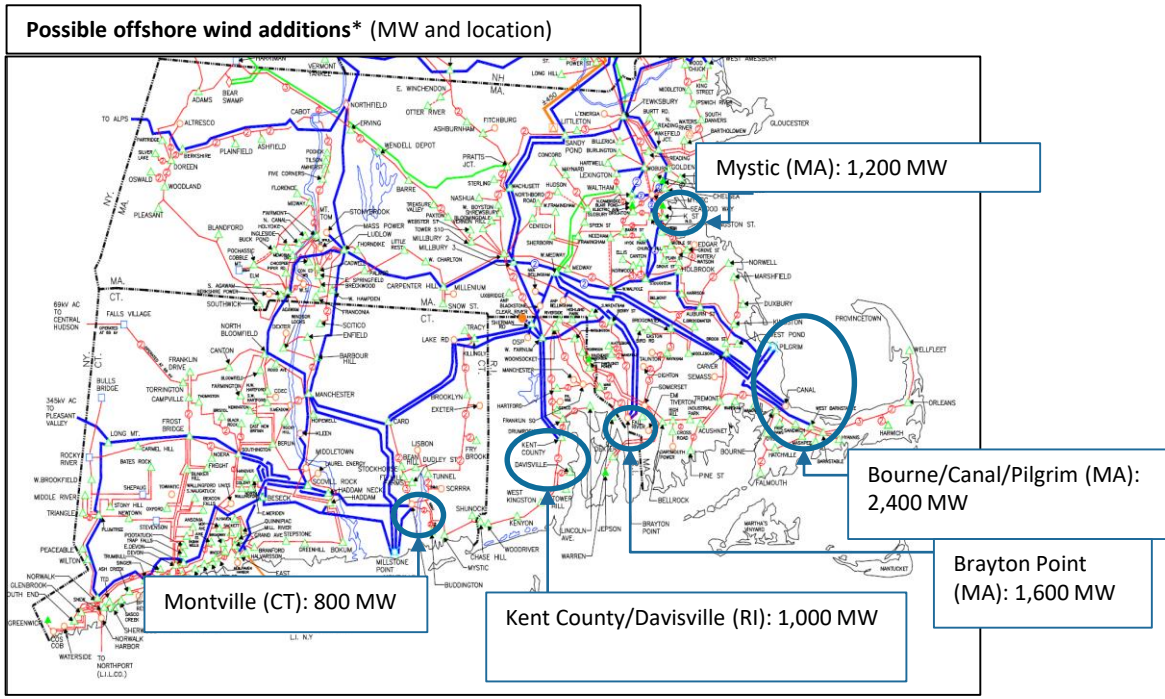
# Questions

# APPENDIX

# 2019 NESCOE Economic Study of Potential Interconnections for Offshore Wind

*Considered in economic studies for NESCOE and Anbaric*

- Based on the currently expected transmission system for 2030, the ISO anticipates that **approx. 7,000 MW** of offshore wind additions have the potential to avoid major additional 345 kV reinforcements*
- The transmission system was modeled using 2030 internal transmission-interface transfer capabilities
- Assumes certain resource retirements have occurred, including Mystic 8 & 9




*Some 345 kV reinforcement/expansion may still be needed for this scenario. This anticipation is preliminary (system impact studies have not been completed for all of these MW). This anticipates minimal interconnection at nameplate levels and capacity interconnection at intermittent capacity values – does not anticipate all of the MW being able to run simultaneously at nameplate levels at all times on the system. The 7,000 MW was in addition to 1,000 MW of offshore wind assumed in the base case

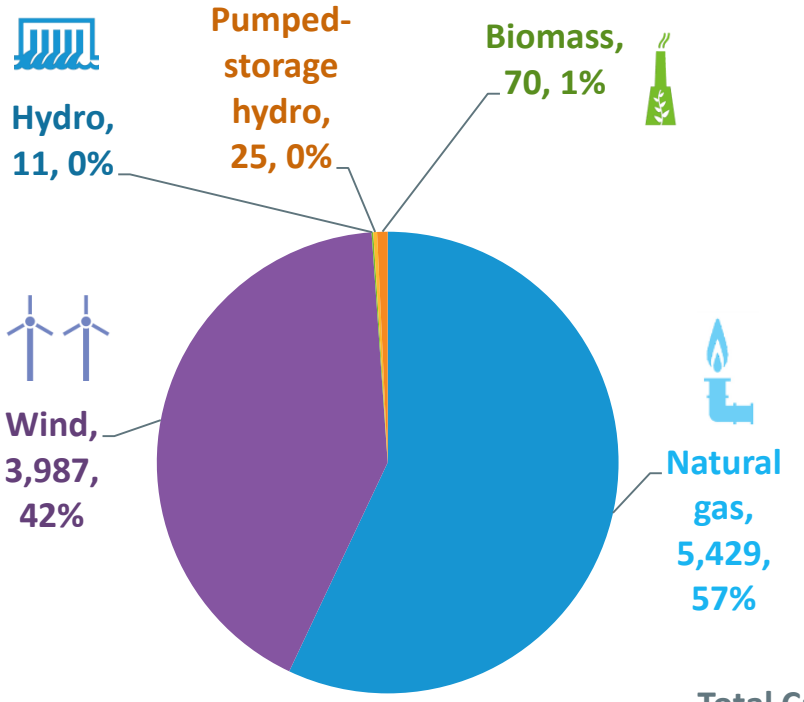
# Western MA Distributed Energy Resource (DER) Cluster Case Study

- The Transmission Owners, coordinating with the ISO, have completed group studies of DERs (known as cluster studies) seeking to interconnect to the Western MA distribution system, with a subsequent cluster studies ongoing
- While first study enabled most resources to interconnect with minimal upgrades, many resources have withdrawn from second study, possibly after seeing upgrade costs
  - First Western MA cluster study (approved at the November 2019 NEPOOL Reliability Committee (RC)) accommodated 312 MW of DERs with few upgrades
  - The second round studied an additional 391 MW (May 2020 RC), identifying significant transmission and distribution upgrades
  - 157 MW withdrew from this second round, resulting in a revised cluster study (October 2020 RC), with fewer upgrades
- Lessons learned
  - Region is quickly hitting limits of the distribution system to accommodate additional DERs without costly upgrades
  - Developers often withdraw rather than pay for upgrades
  - Distribution flows are creating issues on the transmission system
- How to accommodate public policy on the distribution system
  - Do we need a public policy expansion process for the distribution system that parallels the one we develop for the transmission system?
  - Do we needed a smarter distribution system, the development of which is coordinated with the transmission system?

# The ISO Interconnection Queue: *Looking Back to 2015*

*Natural gas was the primary fuel, and the total queue was half of 2020*

## All Proposed Resources

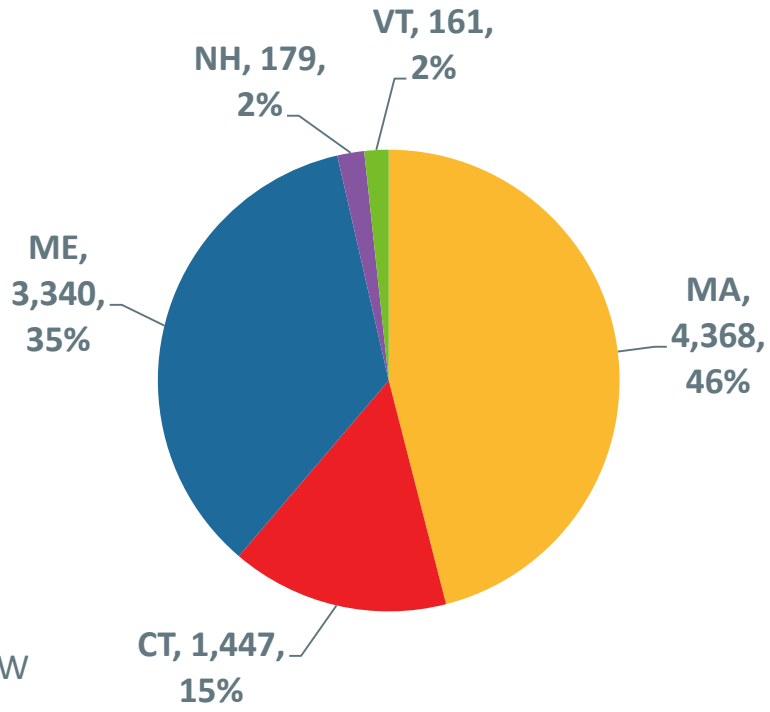



*Key*:
**Technology**, Megawatts, Percentage

**Total Capacity:**
Approx. 9,500 MW

Note: Some natural gas include dual-fuel units (oil)

## Proposals By State




Source: ISO Generator Interconnection Queue (January 2015)
FERC Jurisdictional Proposals Only