

# New England's Changing Resource Mix; Challenges for Power System Operations and Market Design

---



*Harvard Electricity Policy Group*

Gordon van Welie

PRESIDENT AND CEO



# Key Issues/Questions

- **Extensive Analysis Is Underway:** ISO New England is studying the reliability of a future grid under a range of scenarios
  - This will help the ISO and stakeholders understand the implications for operations, transmission planning, and market design
- **Risks Are Increasing:** Existing reliability risks during extreme weather (including fuel-delivery limitations and equipment outages) will be amplified by increasing restrictions on carbon emissions and a prevalence of limited-energy resources (gas/renewables/batteries)
  - There are limits to how much risk can be mitigated through the market



# Key Issues/Questions, cont.

- **Adapting the Market Design and Mitigating Risk:**
  - What are the appropriate reliability standards and market design features for the grid of the future that will power most of the economy?
  - How much “societal insurance” for contingencies should be provided through wholesale markets, and/or locally at the distribution level?
- **Transmission Expansion:** More transmission will be needed to interconnect and deliver the scale of renewable energy envisioned to meet state policy goals
  - Transmission expansion can mitigate risk
  - How should we strike the balance between in-region energy adequacy and reliance on imports in extreme weather events?
  - How does the region address challenges of siting infrastructure?



# ACHIEVING STATE POLICY GOALS WILL FUNDAMENTALLY CHANGE THE DEMAND FOR ELECTRICITY AND THE RESOURCE MIX

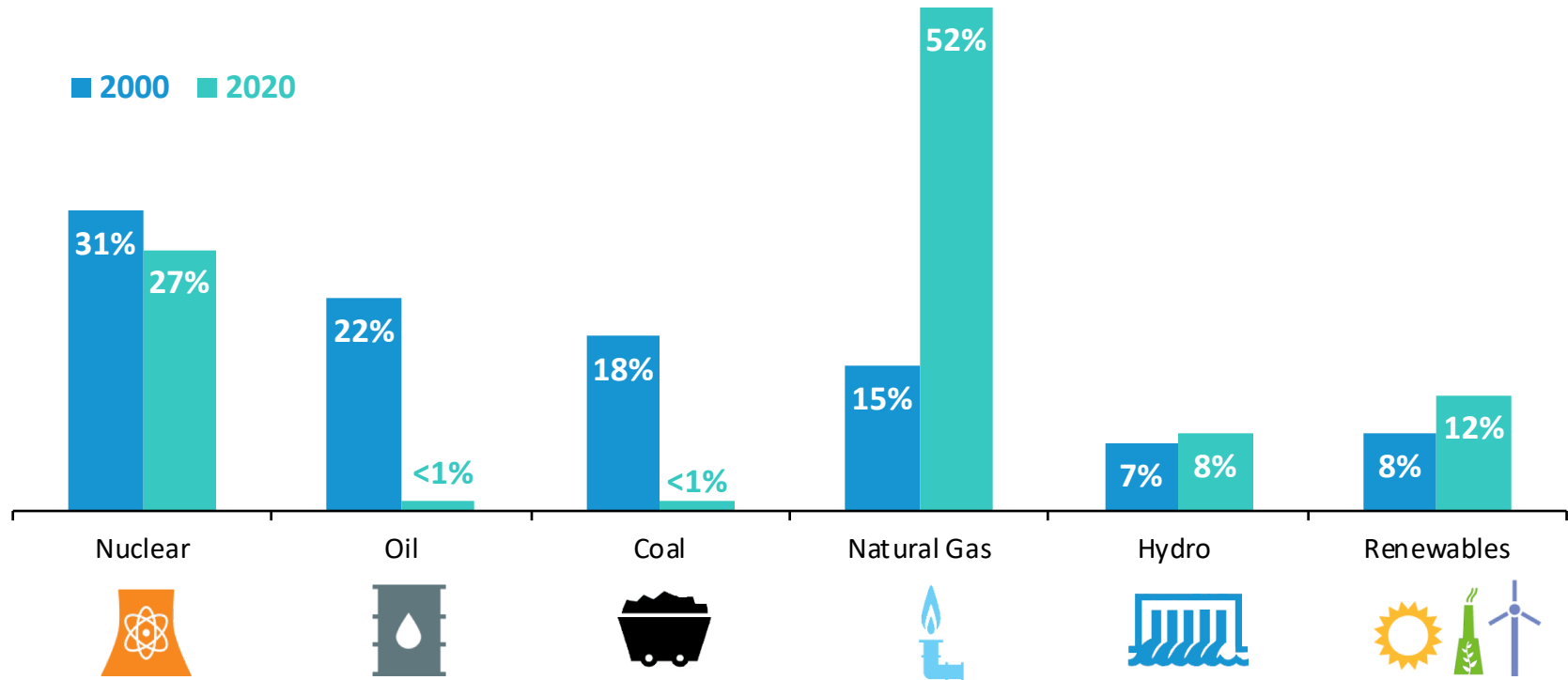
*This will ultimately affect the entire economy as states seek to use clean energy from the grid to electrify the heating and transportation sectors*



# New England's Power System Has Already Experienced Dramatic Changes in the Energy Mix

*The region is highly dependent on natural gas, which is constrained during cold snaps  
Output from oil-fired steam units is currently critical during these periods*

Percent of Total **Electric Energy** Production by Fuel Type  
(2000 vs. 2020)



Source: ISO New England [Net Energy and Peak Load by Source](#); data for 2020 is preliminary and subject to resettlement

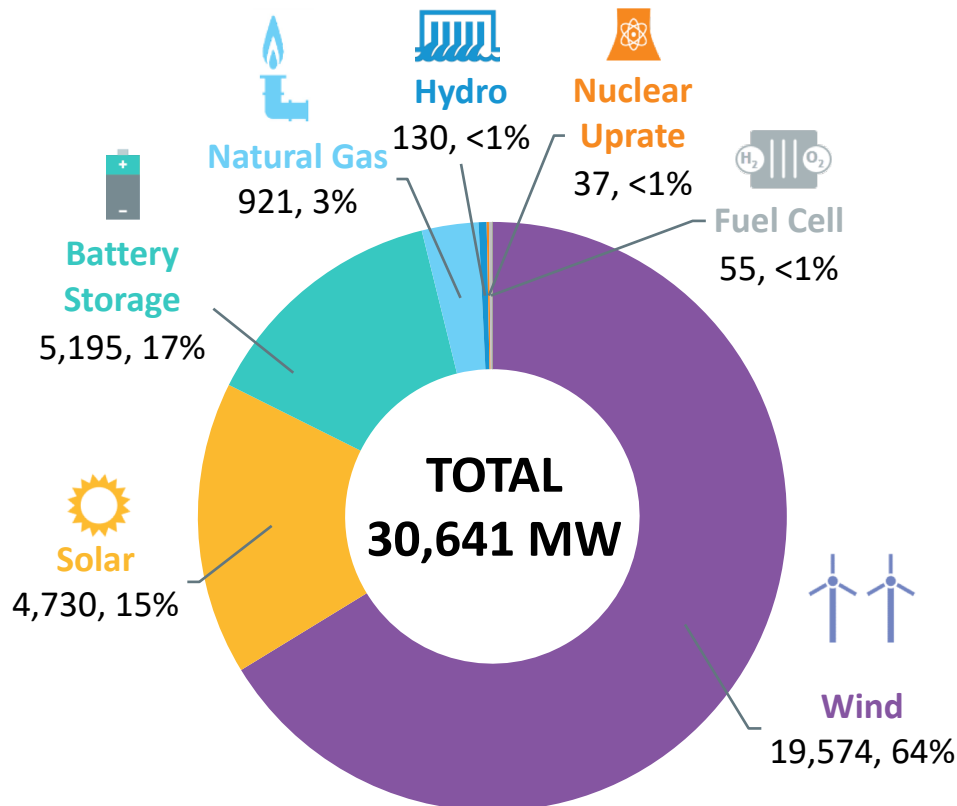
Renewables include landfill gas, biomass, other biomass gas, wind, grid-scale solar, municipal solid waste, and miscellaneous fuels.

This data represents electric generation within New England; it does not include imports or behind-the-meter (BTM) resources, such as BTM solar.

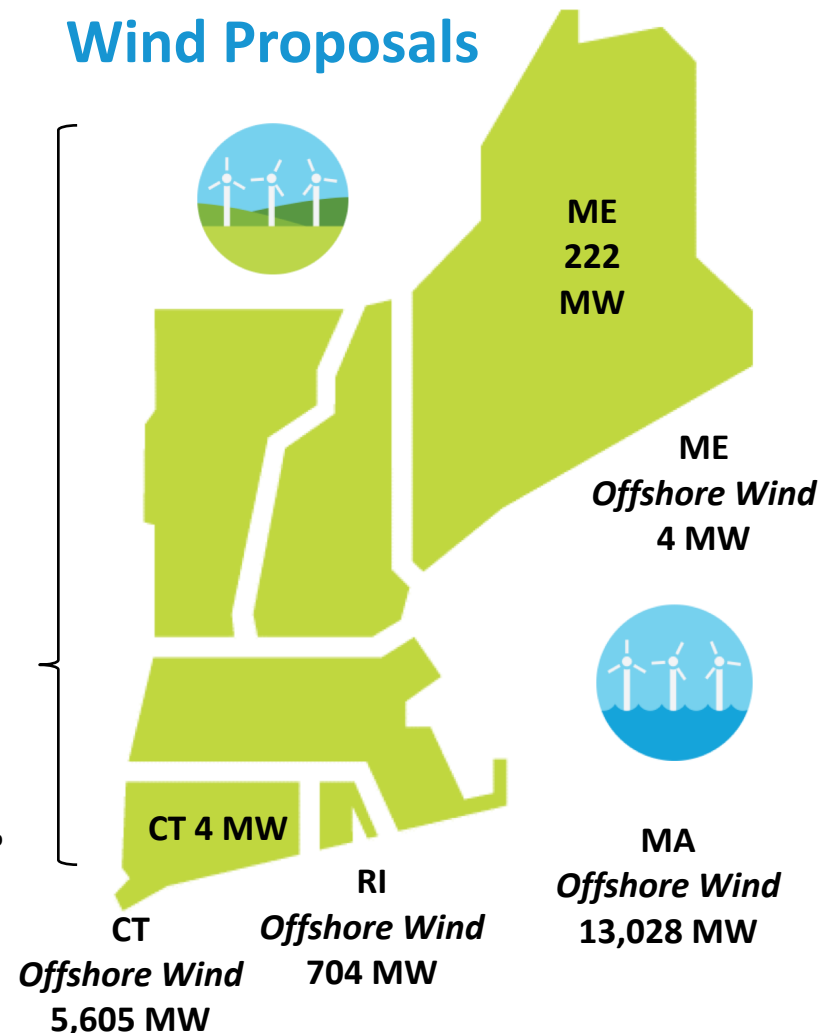


# Energy-Limited Resource Proposals Comprise the Vast Majority of the ISO Interconnection Queue

## All Proposed Resources



## Wind Proposals

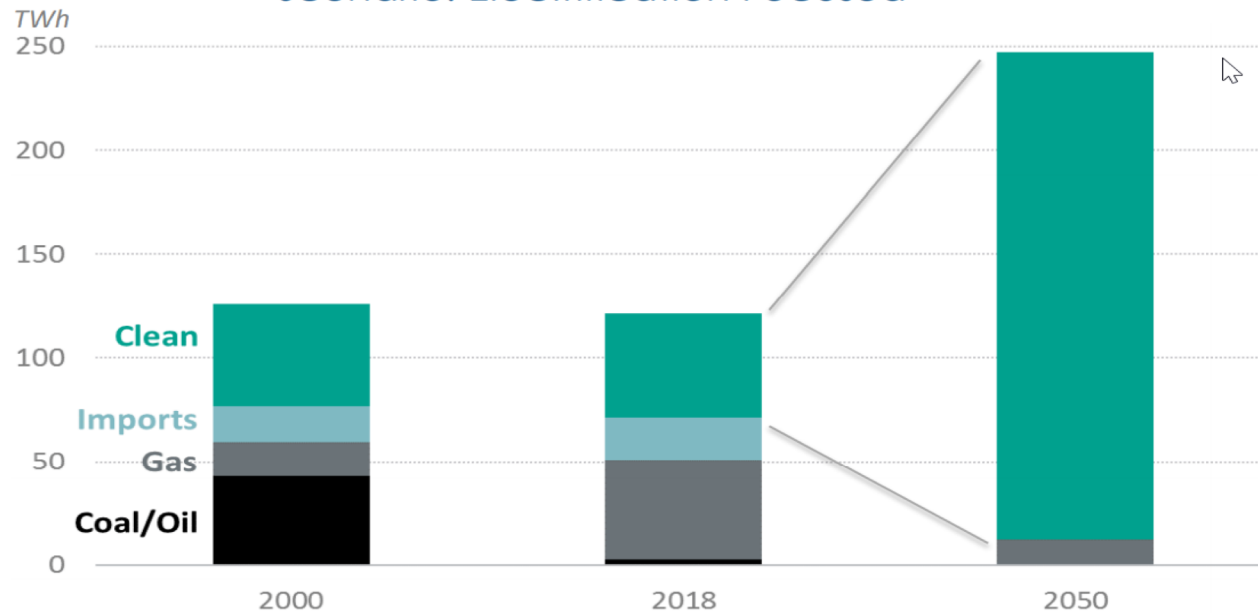


Source: ISO Generator Interconnection Queue (September 2021)  
FERC and Non-FERC Jurisdictional Proposals; Nameplate Capacity Ratings  
Note: Some natural gas proposals include dual-fuel units (with oil backup).  
Some natural gas, wind, and solar proposals include battery storage.

# Electrification Could Double Regional Electricity Demand by 2050: Brattle Group

*This demand will need to be supplied by clean energy resources to meet state objectives*

**Historical and Projected 2050 New England Generation Mix**  
*Scenario: Electrification Focused*



Source: ISO-NE, Key Grid and Market Stats, <https://www.iso-ne.com/about/key-stats/>, accessed June 28, 2019.

Source: [Achieving 80% GHG Reduction in New England by 2050](#), September 2019, The Brattle Group

**New England is projected to become a winter-peaking system by ~2030**

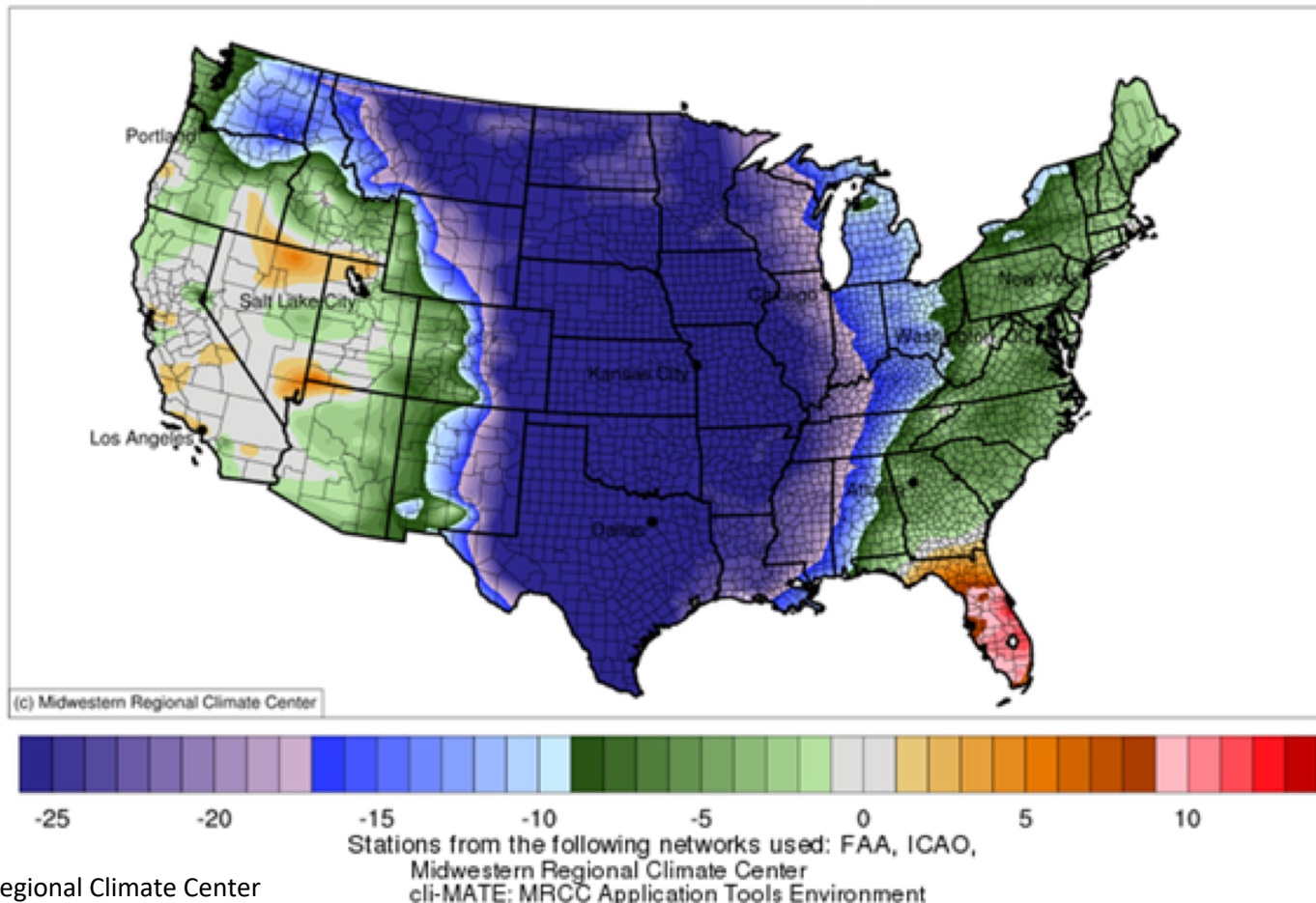


# RECENT EXTREME-WEATHER EVENTS PROVIDE LESSONS LEARNED FOR NEW ENGLAND



# Extreme Cold Was Widespread During Crisis in Texas

**Average Temperature (°F): Departure from 1981-2010 Normals**  
February 12, 2021 to February 18, 2021

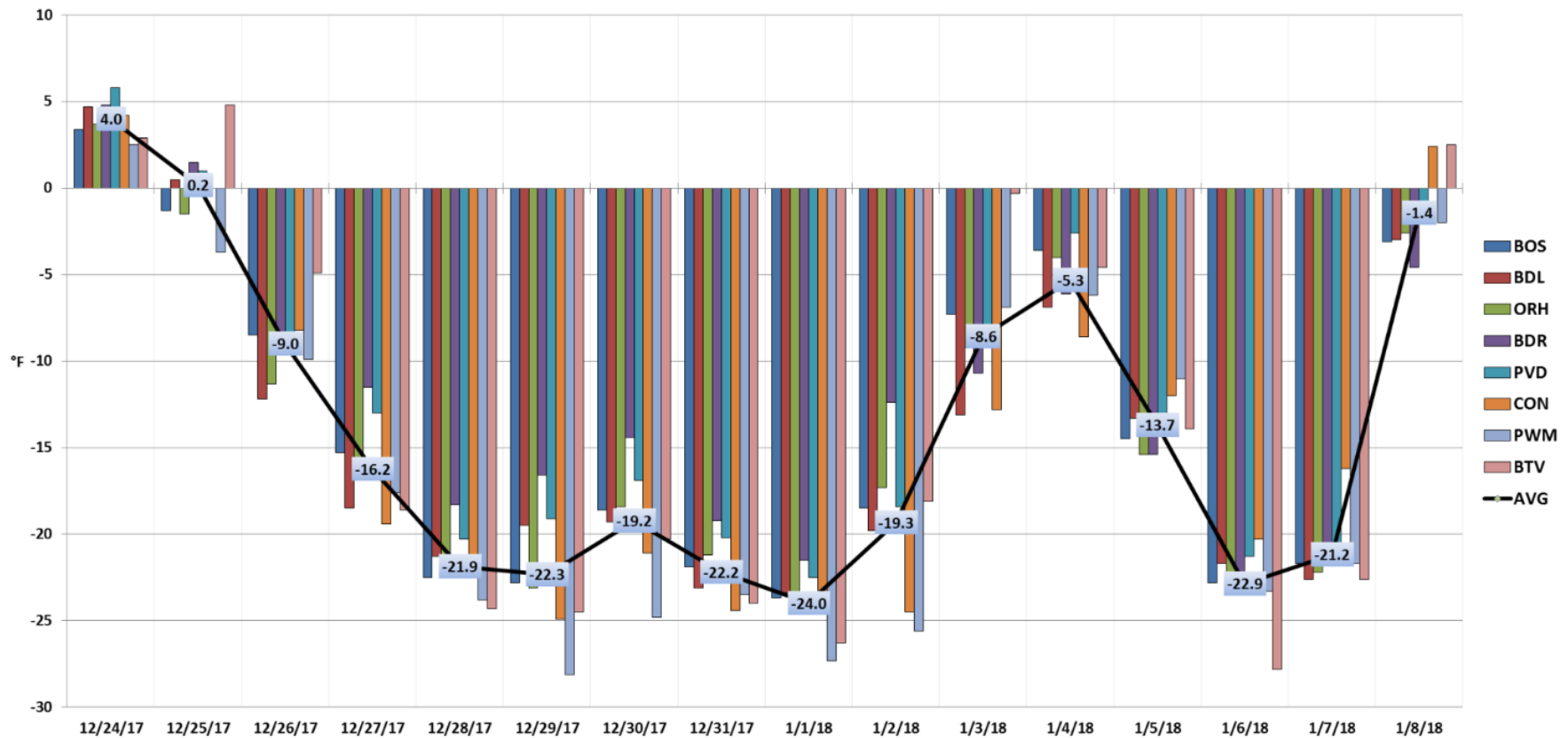


Source: Midwest Regional Climate Center

# New England Temperatures Fell Well Below the Winter Average in Late Dec., and Early Jan. 2018

*And temperatures stayed well below average for a two-week period*

8 New England Cities Mean Temperature Departure from Normal °F  
Dec.24, 2017 - Jan 08, 2018

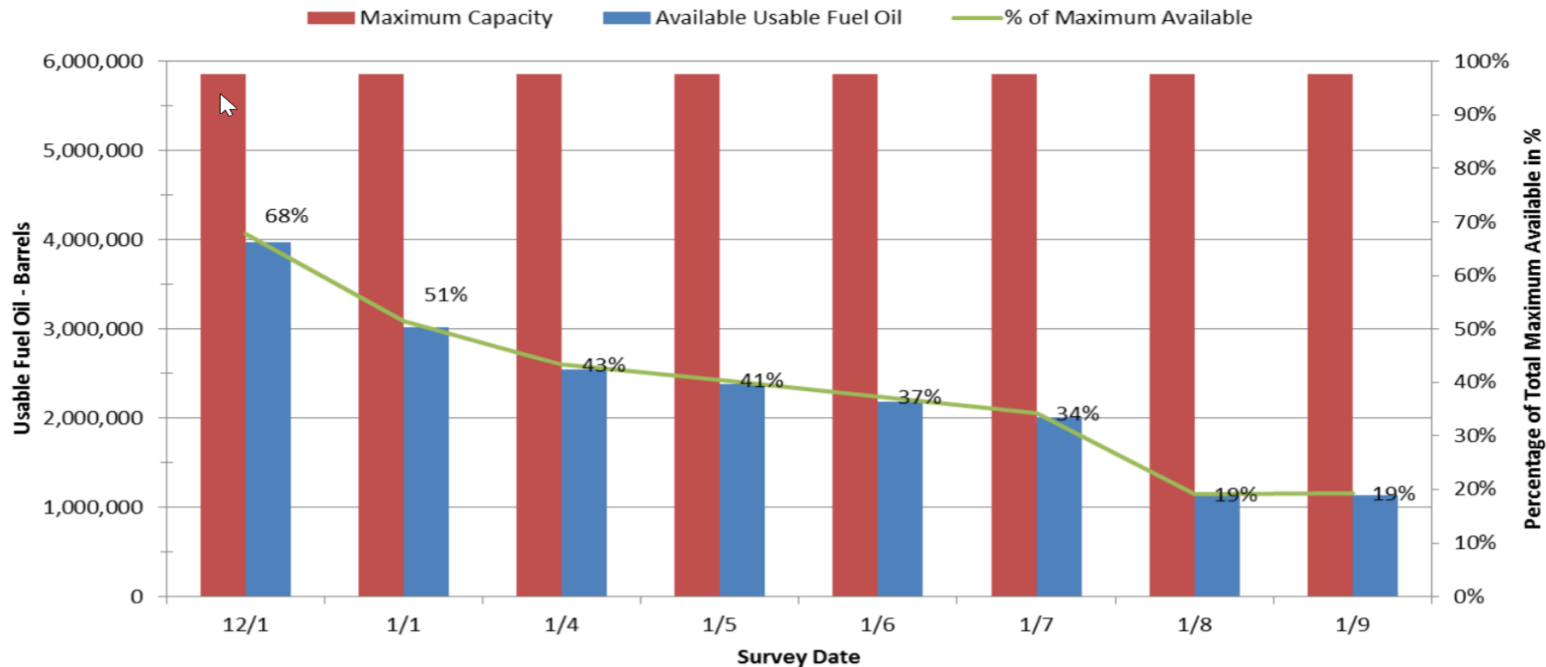


Source: ISO New England, *Post Winter 2017/2018 Review*, Electric/Gas Operations Committee

# Cold Weather Exposes Reliability Risks in New England

*In-region oil supplies dwindled during early January 2018 cold-weather event, and a few large contingencies would have forced us into controlled outages*

**Total Amount of Usable Fuel Oil in New England**



## Retirements could outpace new entry, and market frictions exacerbate reliability risks

- Firm energy supplies are needed to replace the output of the oil-fired units as they retire
- The region will lose the LNG-fueled 1600 MW Mystic unit in June 2024
- Further retirements may occur, depending on market conditions and emission restrictions
- Planned clean-energy projects are experiencing delays

# Texas Events Hold “Lessons Learned” for New England

- Truly extreme weather may be **beyond current ISO planning** for winter conditions
  - Should we plan for colder extremes?
  - How should we account for low-probability events (a.k.a. “tail risks”)?
- New England infrastructure is relatively well **winterized**
  - However, regional infrastructure may not be prepared for more regular instances beyond current (“90/10”) planning assumptions
- In the future, New England could face **increased energy adequacy risks** from the simultaneous loss of energy inputs to both gas-fired and renewable generation
  - New England has long had some form of an energy adequacy problem

# Texas Events Hold “Lessons Learned,” cont.

- The **underestimated demand from electric heating** exacerbated the imbalance between supply and demand
  - New England is planning to electrify much of its heating and transportation, which will increase demand, particularly in the winter
- We are supporting FERC/NERC’s efforts to create **new reliability standards** to address winterization, as well as an assessment of energy adequacy
  - Regions will all need to assess how much risk they want to mitigate versus accepting the risk of controlled outages
- If controlled outages are needed to maintain bulk power system reliability, can the electric distribution companies **rotate outages when required?**
  - Do the EDCs have effective load-shedding plans and the ability to sectionalize feeders to promote feeder rotation?
  - Are there effective conservation or curtailment solutions that EDCs can communicate to customers to reduce the severity of outage risks?
- The ISO has well-developed **cold weather protocols**, but we continue to assess the unique risks for New England

# ISO New England Publishes 21-Day Energy Assessment

*How should this information be incorporated in the market design?*

- The **energy assessment** is based on New England generators' reports of their fuel inventories, emissions limitations, and other factors that could limit their availability
- Hourly forecast results compared against established thresholds to trigger the declaration of:
  - **Energy Alerts** (declared in Day 6-21 timeframe), or
  - **Energy Emergencies** (declared in Day 1-5 timeframe)
- Energy assessments are published to the ISO website ([iso-ne.com](http://iso-ne.com))
  - **Weekly**, during winter months (**December – March**)
  - **Bi-weekly**, during non-winter months (**April – November**)
- During Energy Alert or Energy Emergency conditions, the ISO will publish energy assessments **on a daily basis**
- What is the best way to signal and mitigate an impending energy adequacy problem through market pricing?
  - ISO New England proposed, then shelved, a multi-day forward optimization of energy
  - The states opposed, and FERC rejected, the expanded ancillary services proposal (ESI)



# Regional Discussion to Begin Regarding Extreme Weather and Contingency Events

- ISO is working with EPRI to build a model to analyze the reliability impact of extreme weather events
- The ISO will utilize this model to produce high-level, scenario-based, energy-adequacy risk assessments that will inform mitigation actions (e.g., market design)
- Modeling would support analysis of events in all seasons, even though winter is our current concern



# The ISO Is Also Engaged in Multiple Analysis/Design Efforts to Address Policy and Reliability Objectives

- Elimination of the Minimum Offer Price Rule (“MOPR”) and Assessing Impacts on Resource Adequacy
- Net Carbon Pricing/Forward Clean Energy Market
- Enhanced Resource Capacity Accreditation Methodology (e.g., Effective Load Carrying Capability, or “ELCC”)
- Enhanced Ancillary Services (e.g., including reconsideration of ISO’s earlier Energy Security Improvements, or “ESI” proposal)
- Distributed Energy Resource Aggregations (FERC Order 2222)
- 2050 Transmission Study (requested by NESCOE)
- Future Grid Reliability Analysis (requested by NEPOOL)





# Key Takeaways

- New England is transitioning to a power system dominated by energy-limited resources, and the energy limitations could be highly correlated during severe weather events, particularly during the winter
  - We could become a winter peaking system around 2030 and the winter peak is projected to double by around 2050
  - Massive renewable deployments will enable decarbonization, however, there are issues to be resolved:
    - The provision of sufficient **clean, firm, long-duration, balancing-energy supplies is a critical “gap”** in the regional strategy to decarbonize reliably
    - Until the region addresses this gap, we will continue to rely on imported LNG and oil during cold weather, which is likely unsustainable over time
    - How will the gap be closed without a significant price on carbon?



# Key Takeaways, cont.

- Reliability Standards and Market Design will have to evolve
  - New England, as a region, needs to **evaluate the amount of risk** we can live with for extreme weather events, whether to mitigate those risks, by how much, and by whom
  - The market design needs to ensure we can **attract and retain** adequate resources to balance the variability of renewable energy throughout the clean energy transition
  - **Some risks are so remote** that the market design and participants cannot (or will not) price the risk, and policymakers will have to decide whether to socialize the mitigating action or consequences in some way, such as:
    - Through socialized infrastructure investments (to avoid controlled outages),
    - Setting more stringent reliability standards that will drive investment in mitigation, or
    - Improvements in the ability of distribution companies to manage the effects of controlled outages (e.g., efficient outage rotations, or deployment of distributed energy resources)