Operational Impact of Extreme Weather Events

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ISO-NE Is a Summer-Peaking System

New England shifted from a winter-peaking system to a **summer-peaking** system in the early 1990s, largely because of the growth of air conditioning and a decline in electric heating

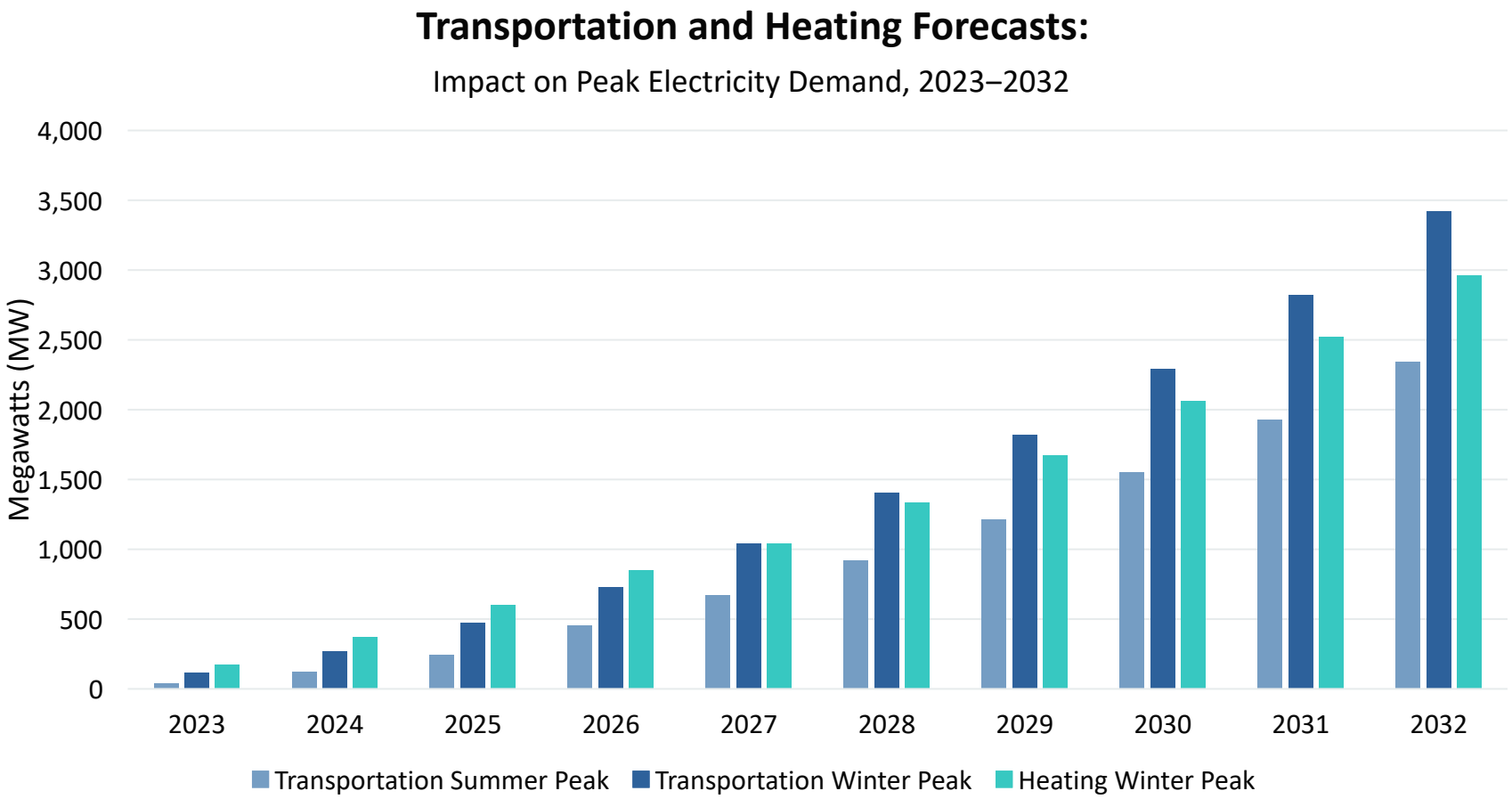
- Peak demand on a normal summer day has typically ranged from 17,500 MW to 22,000 MW
- Summer demand usually peaks on the hottest and **most humid** days and averaged roughly 25,600 MW since 2000

- Region's all-time summer peak demand was **28,130 MW** on **August 2, 2006**

The region is expected to shift back to a **winter-peaking system** with the electrification of heating demand

- Region's all-time **winter** peak demand was **22,818 MW** on **January 15, 2004**

Electricity Demand from Electric Vehicles and Heating Sectors to Grow Over the Next Decade

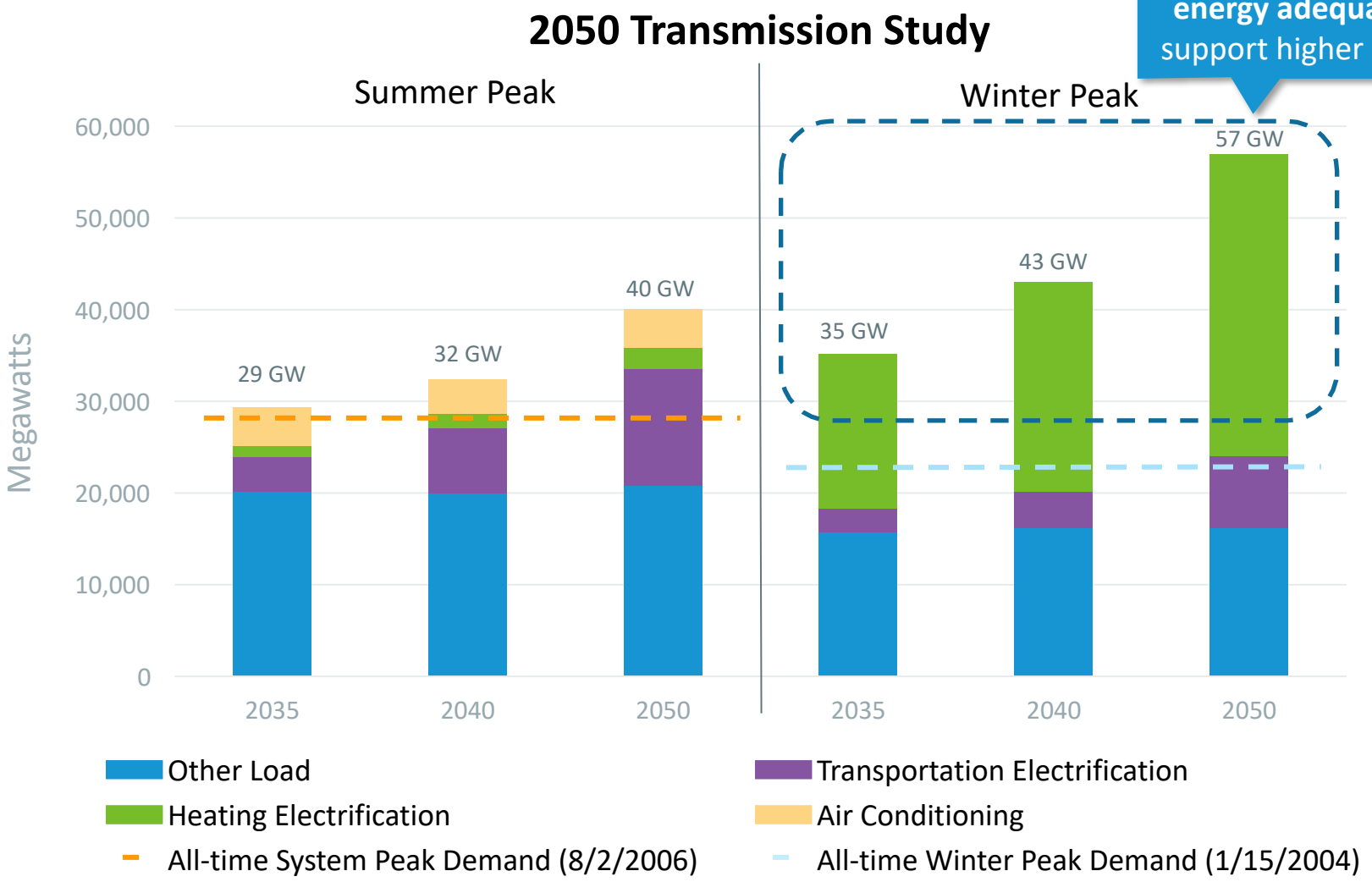


Percentage of Net System Peak in 2032: Transportation – summer: 9%; Transportation – winter: 13%; Heating – winter: 11%

Sources: ISO New England 2023-2032 Forecast Report of Capacity, Energy, Loads, and Transmission (2023 CELT Report) (May 2023), 2023 Forecast Data.

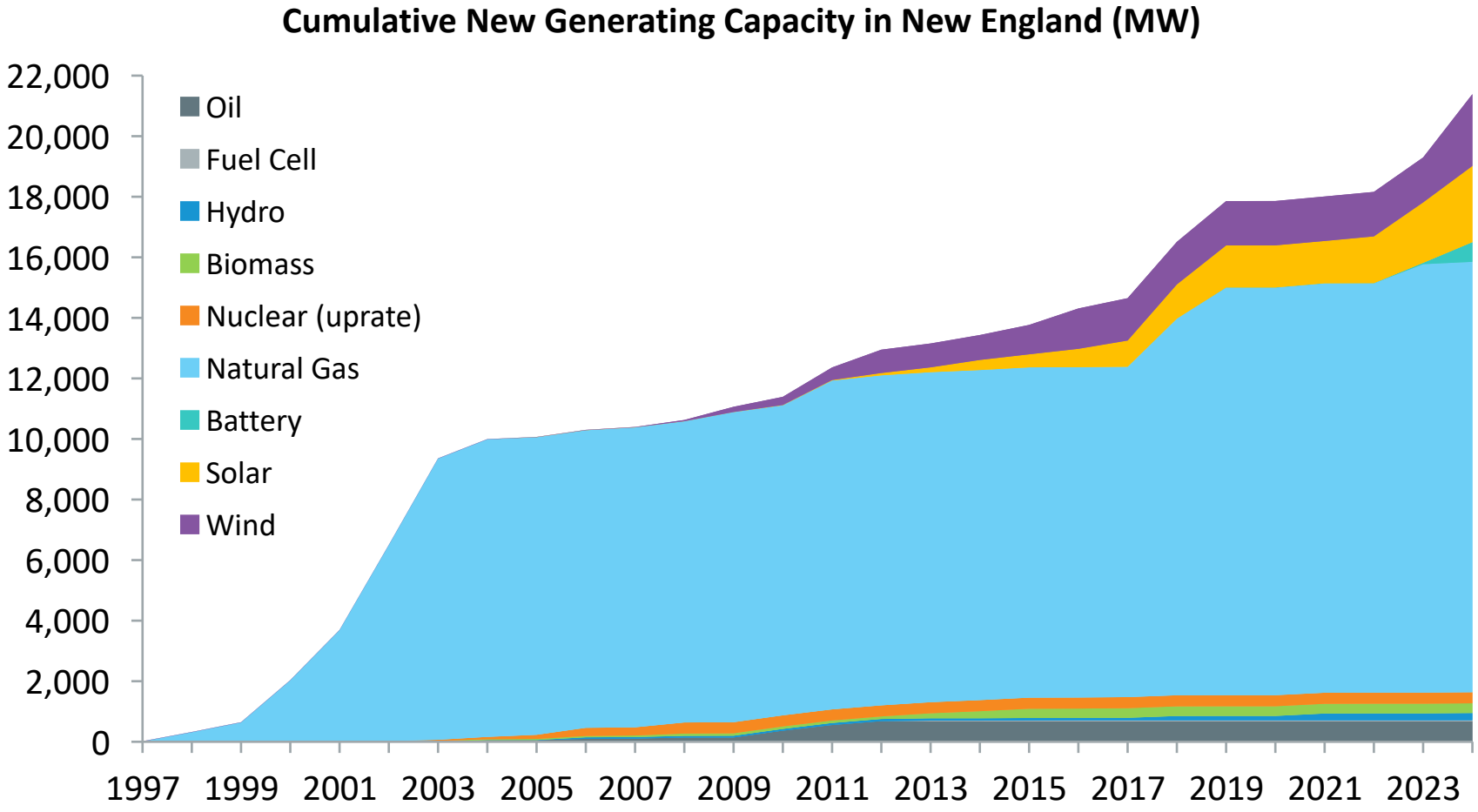
New England System Peak Grows Substantially and Shifts to Winter-Peaking

Region needs to address **energy adequacy** risk to support higher load levels



For the Past Two Decades, Most of the Region's New Generating Capacity Has Been Natural Gas

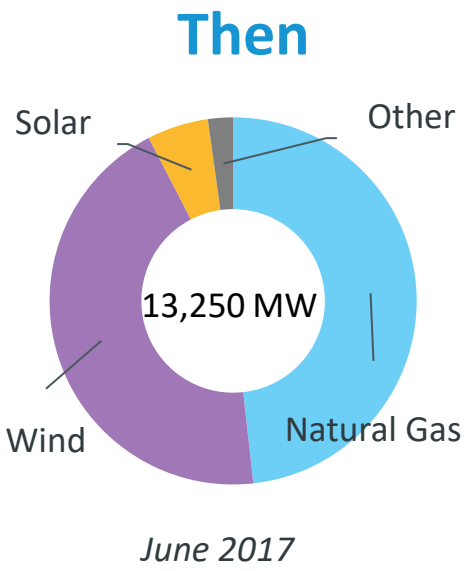
Solar and Wind Have Increased Over the Past Decade

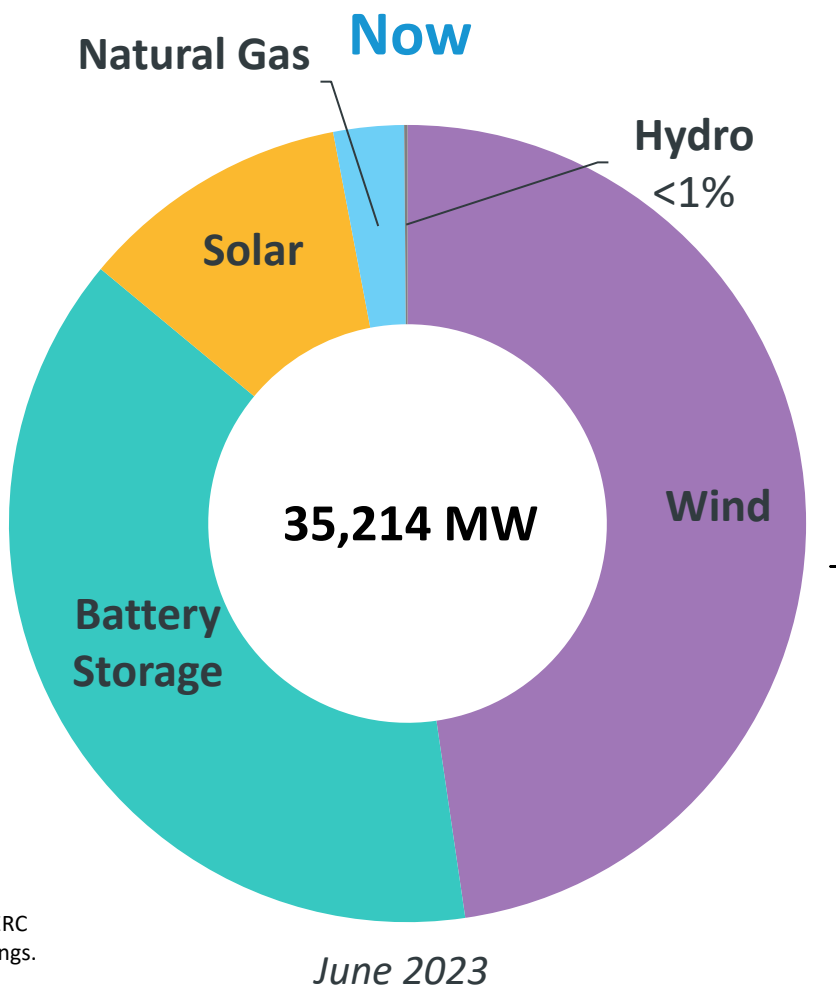


Note: New generating capacity for years 2021 – 2024 includes resources clearing in recent Forward Capacity Auctions.

The ISO Generator Interconnection Queue Provides a Snapshot of Resource Proposals

Dramatic shift in proposed resources from natural gas to battery storage and renewables





Offshore Wind

CT	2,400 MW
MA	11,514 MW
RI	704 MW

Onshore Wind

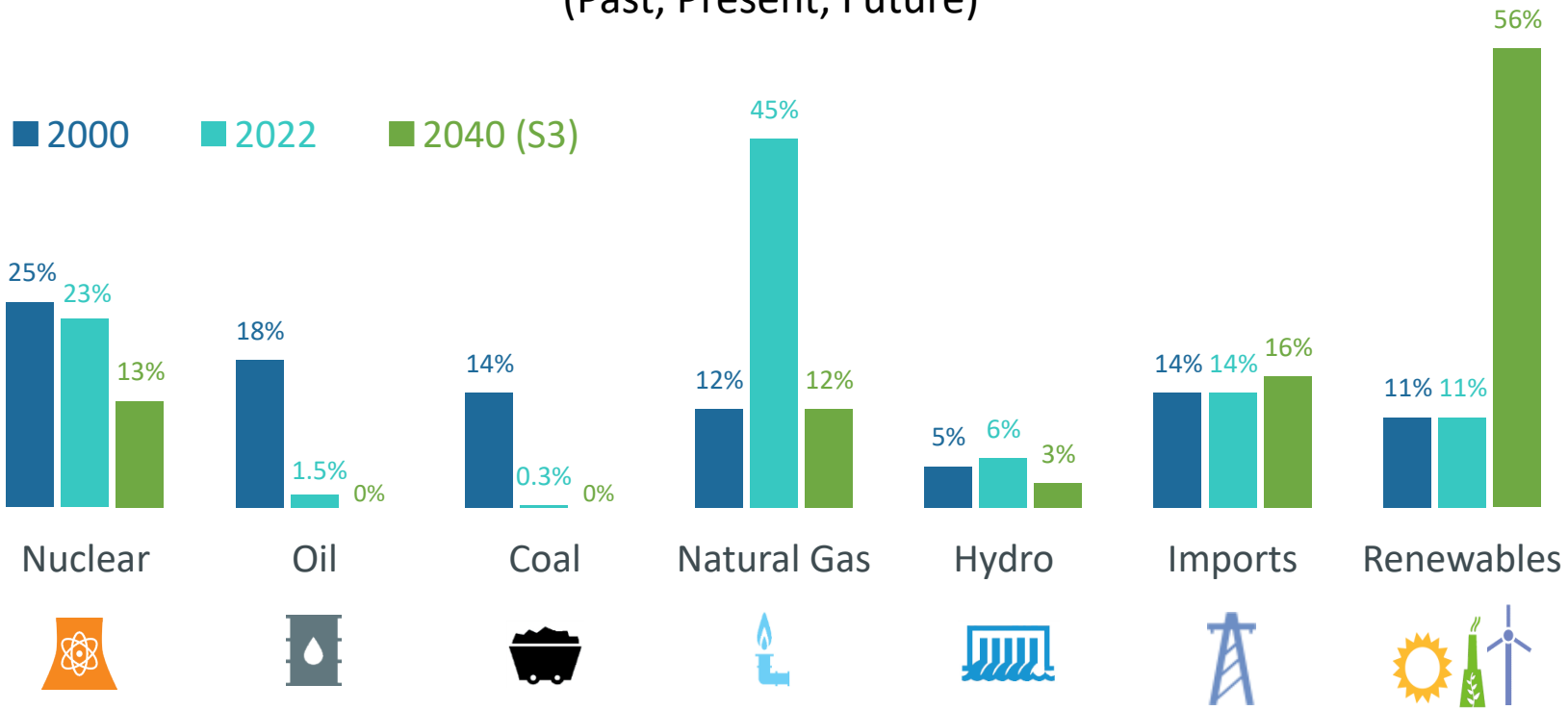
ME	2,325 MW

Source: ISO Generator Interconnection Queue, FERC Jurisdictional Proposals; Nameplate Capacity Ratings.

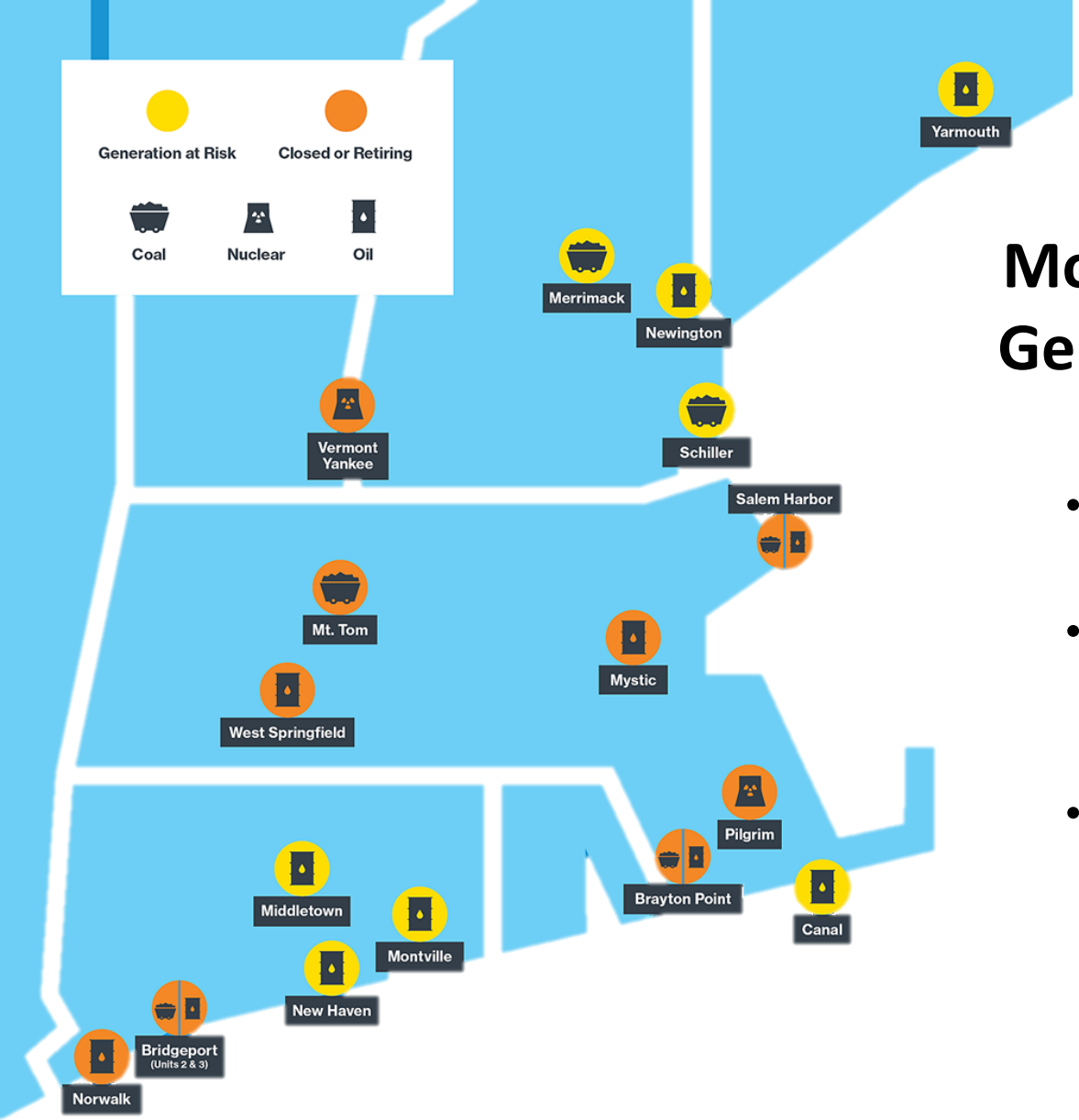
Dramatic Changes in the Energy Mix

New England made a major shift from coal and oil to natural gas over the past two decades, and is shifting to renewable energy in the coming decades

Percent of Total **Electric Energy** Production by Source
(Past, Present, Future)



Source: ISO New England Net Energy and Peak Load by Source; data for 2022 is preliminary and subject to resettlement; data for 2040 is based on Scenario 3 of the ISO New England 2021 Economic Study: Future Grid Reliability Study Phase 1.
Renewables include landfill gas, biomass, other biomass gas, wind, grid-scale solar, behind-the-meter solar, municipal solid waste, and miscellaneous fuels.

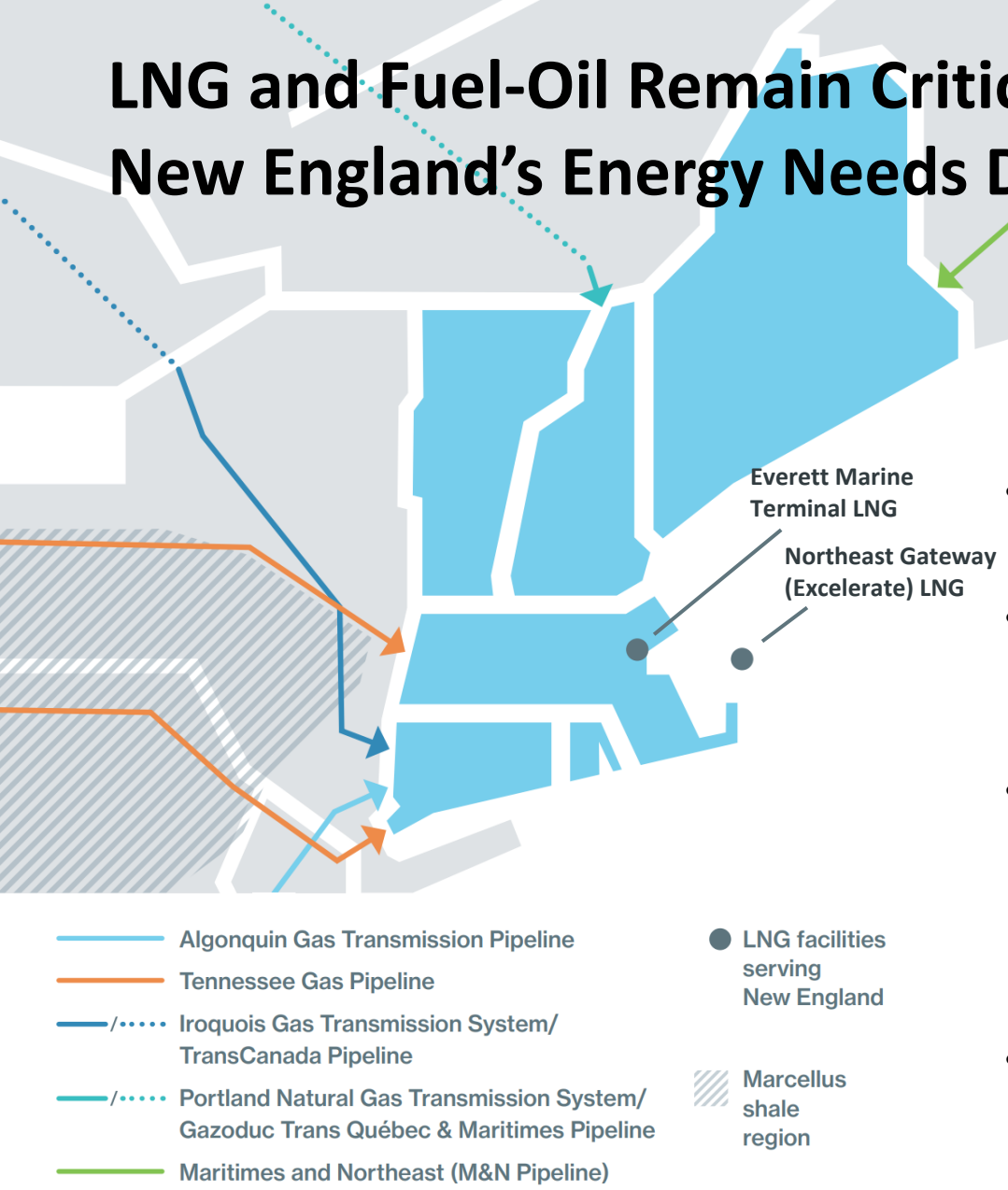


From 2013 to 2022, More Than 5,200 MW of Generation Have Retired

- Include predominantly coal, oil, and nuclear resources
- Another **5,000 MW** of remaining coal and oil are at risk of retirement
- These resources have played an **important** role in recent winters when natural gas supplies are constrained in New England

Source: ISO New England Status of Non-Price Retirement Requests and Retirement De-list Bids (April 2023)

LNG and Fuel-Oil Remain Critical to Meeting New England's Energy Needs During Cold Weather

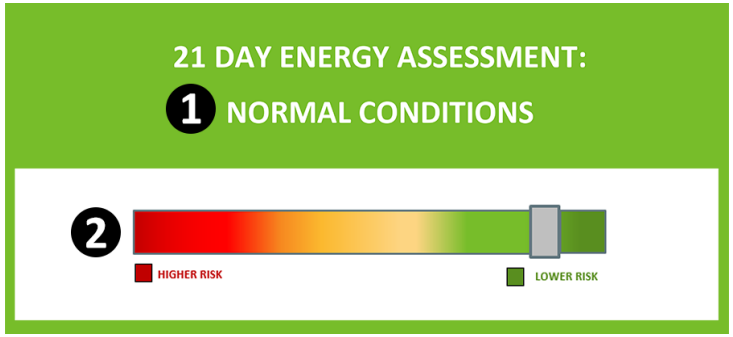


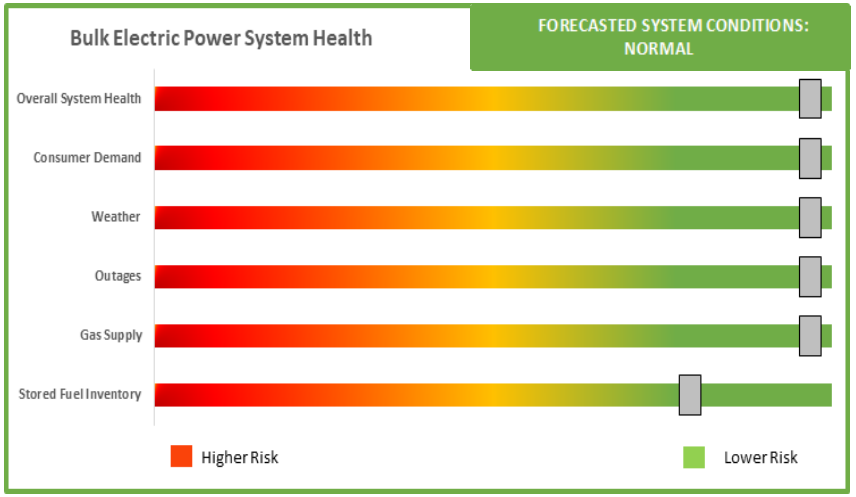
- LNG injections from facilities in the east help counter pipeline constraints
- ISO's industry leading gas-electric coordination enhances situational awareness of potential issues
- The region has significant fuel-oil fired generating capability (~12,500 MW) with vast amounts of storage capacity (~240M gallons), but most storage is at older, infrequently operated units
- Timely replenishment of LNG and fuel-oil supplies is critical in advance of and during cold weather

ISO's Energy Security Assessment Practices

21-Day Energy Assessment

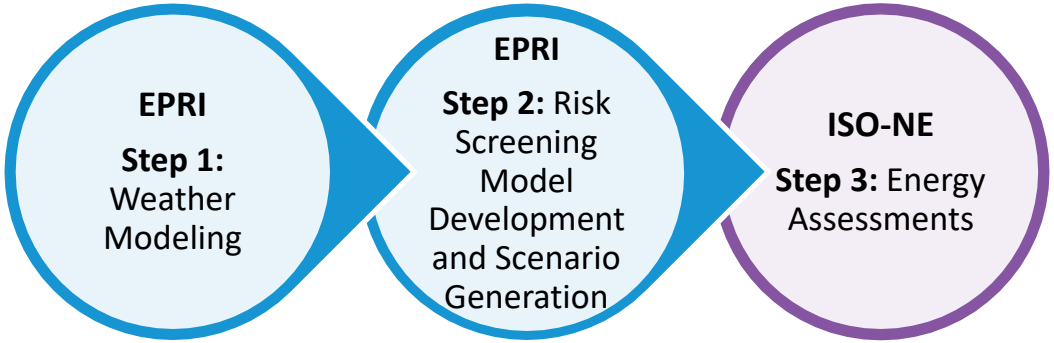
- Since 2018, ISO has published a 21-Day Energy Assessment Forecast to provide early warning of potential energy shortfalls
- The rolling three-week forecast:
  - Considers anticipated power system conditions, forecasted weather and consumer demand, and expected fuel inventories, and
  - Compares hourly energy forecasts against thresholds established in OP-21
- Results of the assessment give ISO New England, public officials, and stakeholders time to take action to prevent shortfalls from materializing





Operational Impact of Extreme Weather Events – Energy Adequacy Study

- ISO is working with the Electric Power Research Institute (EPRI) to conduct a probabilistic energy adequacy study for New England under extreme weather events
- Study results are intended to inform the region on energy adequacy risks
  - These results may help in 'quantifying' a problem statement on energy adequacy, against which possible solutions can be assessed
- Study establishes a framework for risk analysis that can be updated as climate projections are refined and the resource mix evolves
- Framework contains three major steps:



Energy Adequacy Study Key Takeaways

- This energy adequacy study tool developed in partnership with EPRI provides a much needed foundation for the ISO to monitor risks and study the system as it continues to evolve
- Preliminary results of energy assessments for 2027 winter events, 2027 summer events, 2032 winter events, and 2032 summer events have been presented to stakeholders
- Results reveal a range of energy shortfall risks and associated probabilities
- In terms of magnitude and probability, baseline studies (using the 2022 CELT forecast) of 2032 winter events indicate an energy shortfall risk similar to that of the 2027 winter event studies
- Sensitivity analysis of 2032 worst-case scenarios indicate an increasing energy shortfall risk profile between 2027 and 2032

Energy Adequacy Study Key Takeaways, *cont.*

- Results of preliminary studies reveal similar energy adequacy risk with and without the Everett Marine Terminal in-service
  - Assumes that the market will respond with new resources to meet increased electrification load and replace retiring resources, a reliable gas system and responsive oil supply chain, that transmission will be built to interconnect wind and import Canadian hydropower, and no electricity production limitations due to emissions restrictions
  - If key assumptions don't hold, the region may see an increasingly risky profile that the ISO will capture with this assessment tool as we move forward
- Timely additions of BTM and Utility Scale PV, offshore wind, and incremental imports from NECEC are critical to mitigate energy shortfall risks that result from significant peak winter load growth and retirements

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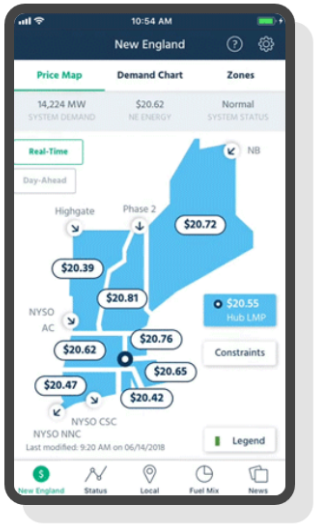

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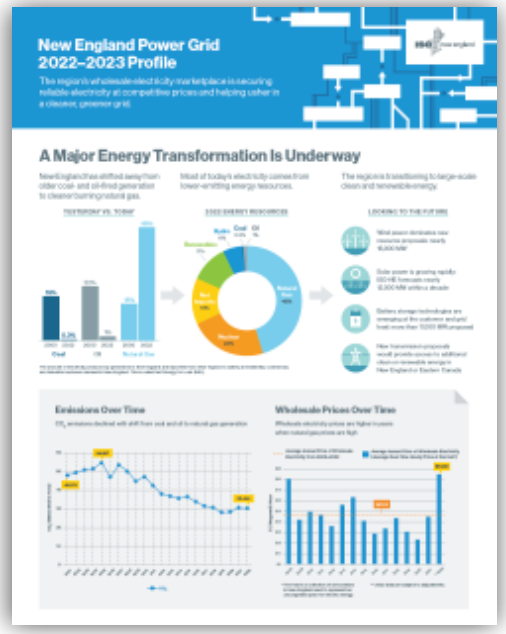
ISO New England Releases Several Publications

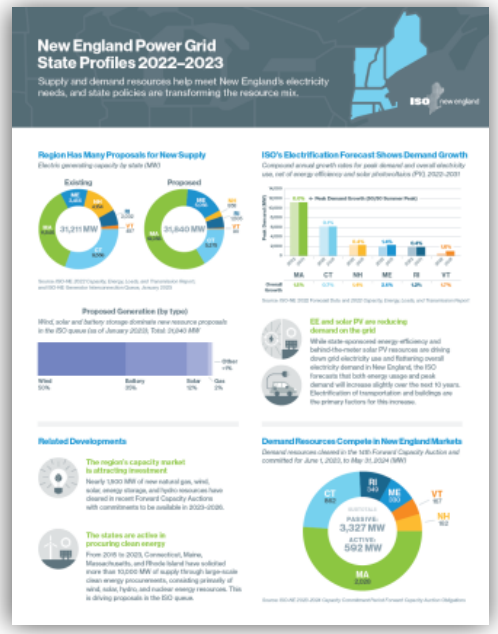
[2022 Regional Electricity Outlook]

Provides an in-depth look at New England's biggest challenges to power system reliability, the solutions the region is pursuing, and other ISO New England efforts to improve services and performance



[New England Power Grid Profile]

Provides key grid and market stats on how New England's wholesale electricity markets are securing reliable electricity at competitive prices and helping usher in a cleaner, greener grid



[New England State Profiles]

Provides state-specific facts and figures relating to supply and demand resources tied into the New England electric grid and state policies transforming the resource mix in the region

Questions