JANUARY 23, 2025 | MONTPELIER, VT

ISO New England Overview and Regional Update

Senate Natural Resources and Energy Committee

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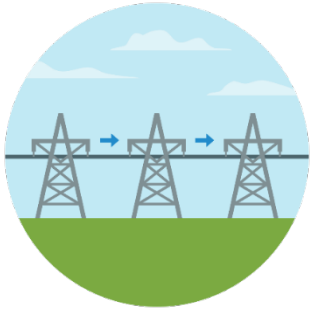
ABOUT ISO NEW ENGLAND

ISO New England Performs Three Critical Roles to Ensure Reliable Electricity at Competitive Prices

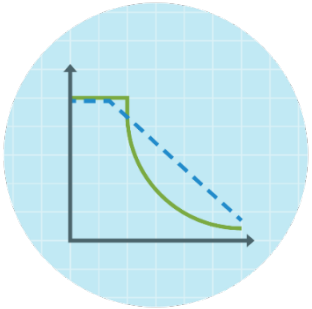
Grid Operation

Coordinate and direct the flow of electricity over the region's high-voltage transmission system



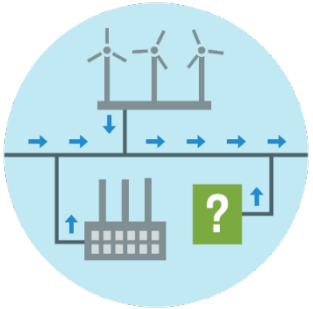
Market Administration

Design, run, and oversee the markets where wholesale electricity is bought and sold



Power System Planning

Study, analyze, and plan to make sure New England's electricity needs will be met over the next 10 years



ISO New England's *Mission and Vision*

Mission: *What we do*

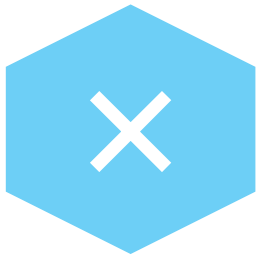
Through collaboration and innovation, ISO New England plans the transmission system, administers the region's wholesale markets, and operates the power system to ensure reliable and competitively priced wholesale electricity

Vision: *Where we're going*

To harness the power of competition and advanced technologies to reliably plan and operate the grid as the region transitions to clean energy

*The ISO's **Vision** for the future represents our long-term intent and guides the formulation of our Strategic Goals*

Things We Don’t Do



Handle retail electricity

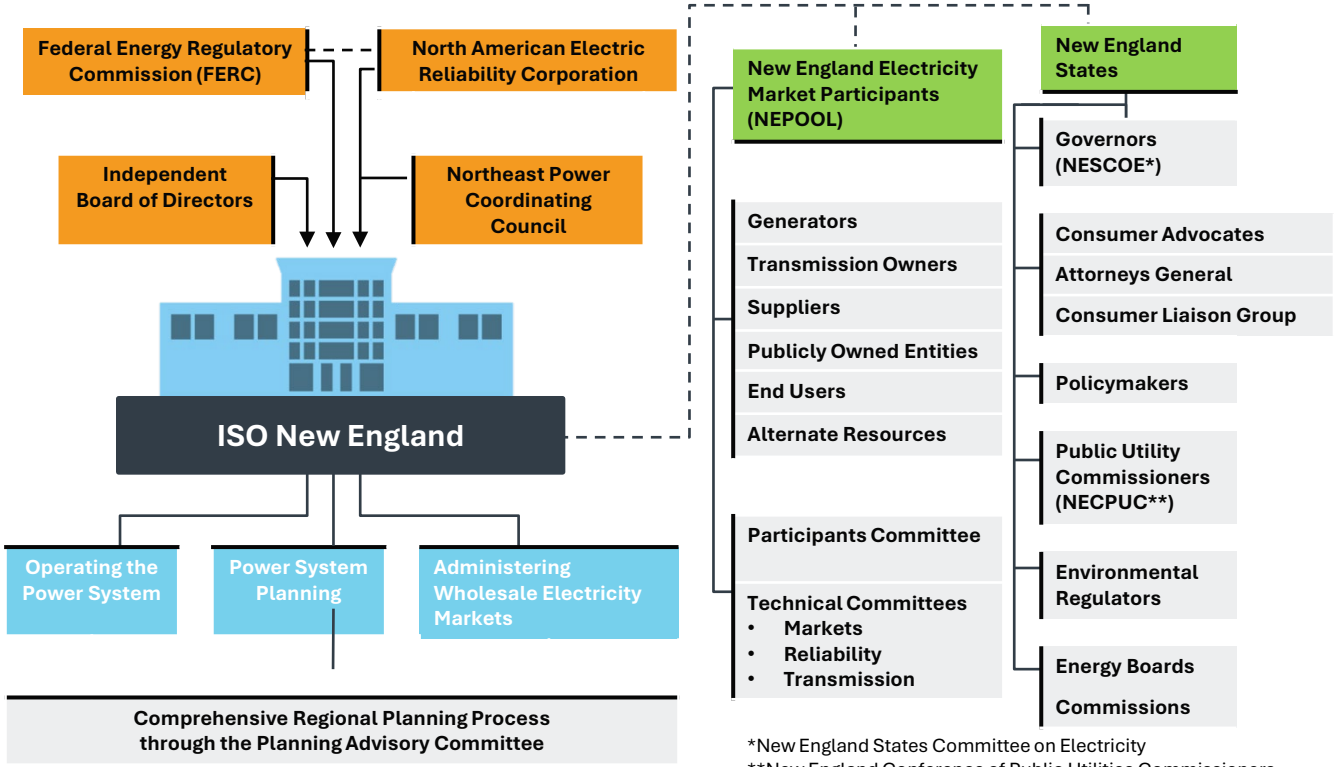
Own power grid infrastructure

Have a stake in companies that own grid infrastructure

Have jurisdiction over fuel infrastructure

Have control over siting decisions

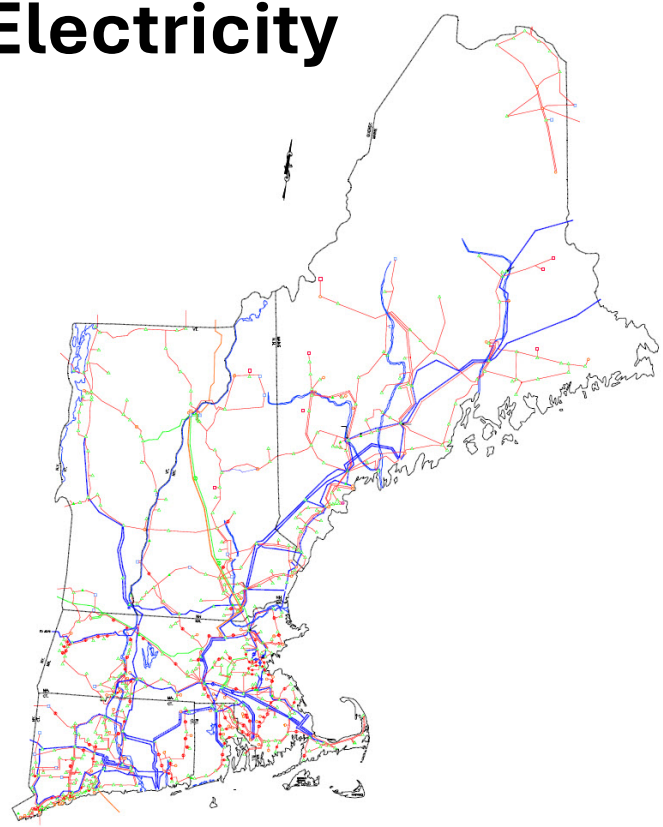
Numerous Entities Including an Independent Board Provide Oversight of and Input on ISO's Responsibilities



*New England States Committee on Electricity
**New England Conference of Public Utilities Commissioners

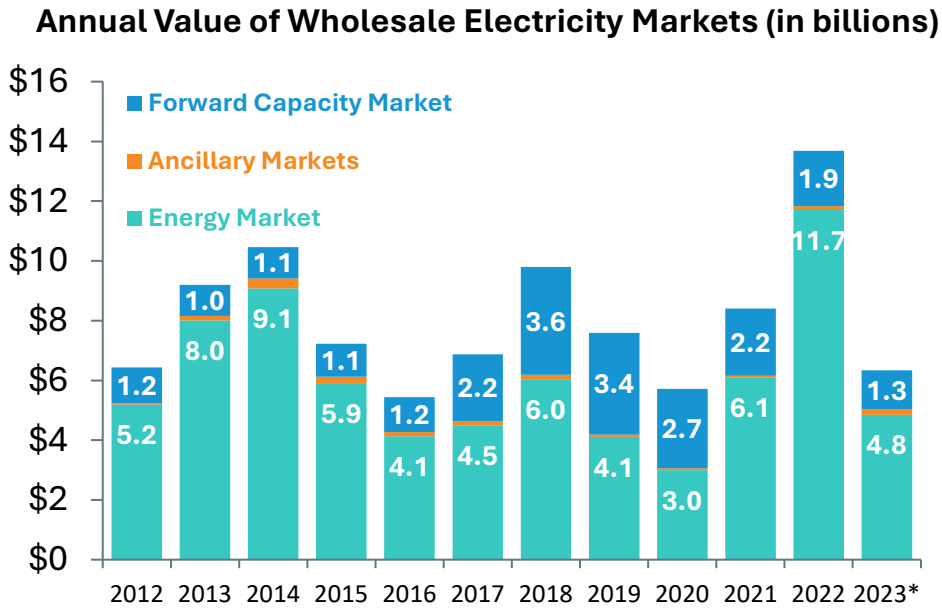
New England's Transmission Grid Is the Interstate Highway System for Electricity

- **9,000 miles** of high-voltage transmission lines (primarily 115 kV and 345 kV)
- **13 transmission interconnections** to power systems in New York and Eastern Canada
- **13%** of region's energy needs met by imports in 2024
- **$12.7 billion** invested to strengthen transmission system reliability since 2002; **$1.4 billion** planned
- Developers have proposed multiple transmission projects to access **non-carbon-emitting resources** inside and outside the region



Many Resources Compete to Supply Electricity in New England's Wholesale Markets

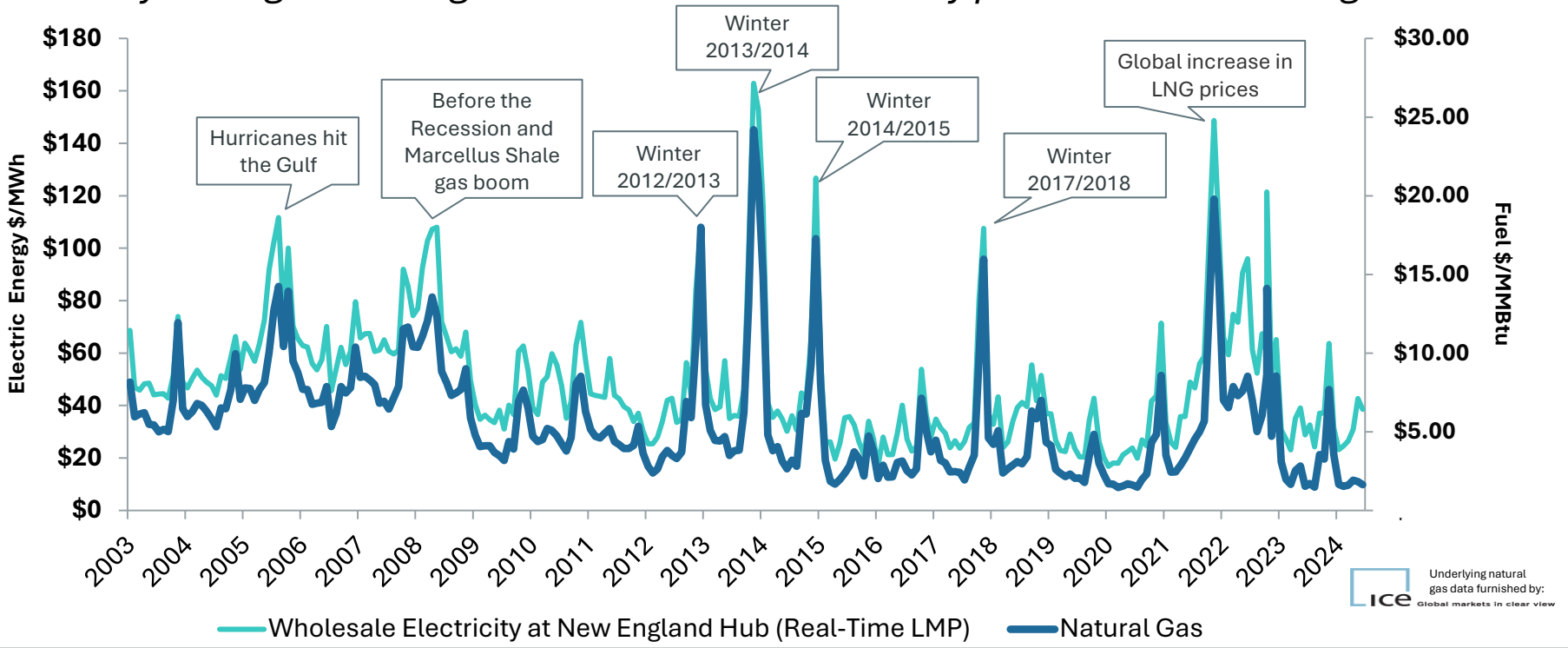
- Approximately 550 buyers and sellers in the markets
- **$6.3 billion** in wholesale electricity market transactions in 2023
  - **$4.8 billion** in the energy market
  - **$182 million** in the ancillary services markets
  - **$1.3 billion** in the capacity market
- Extensive analysis and reporting of market results



Source: ISO-NE Markets and Settlements Data; (March 2024)

Natural Gas and Wholesale Electricity Prices Are Linked

Monthly average natural gas and wholesale electricity prices at the New England hub



GRID TRANSFORMATION

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

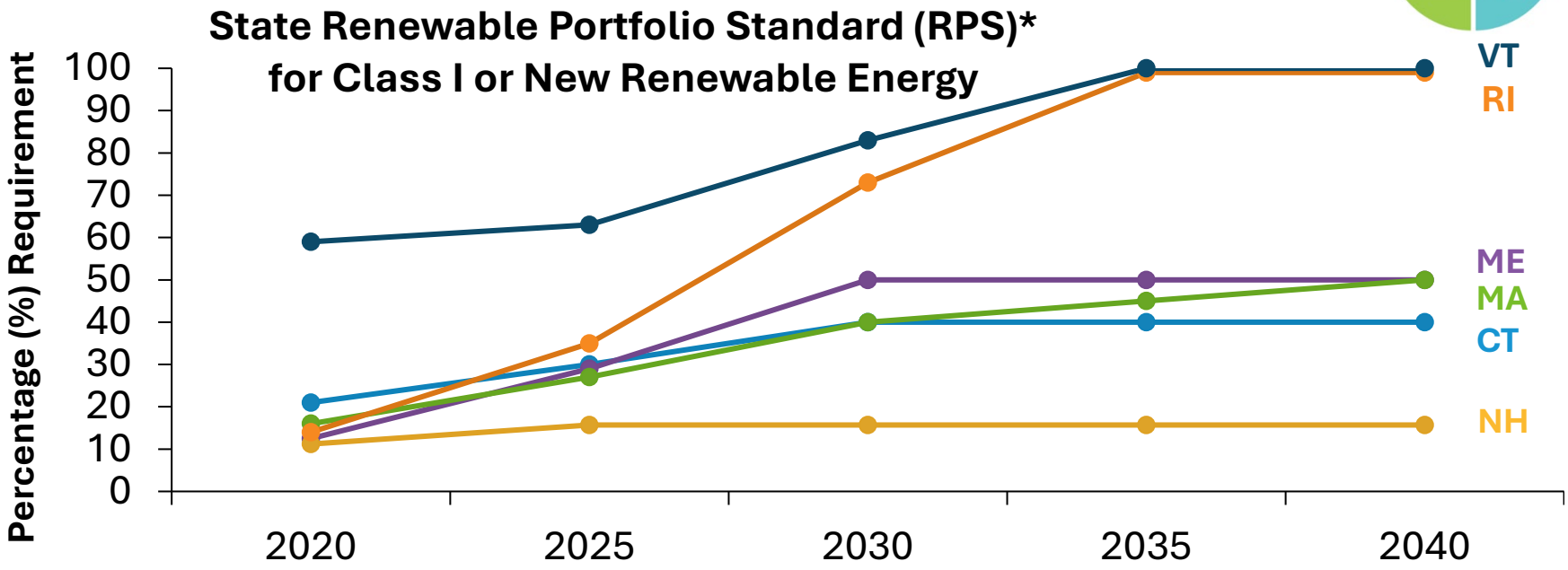
- Region's all-time **winter** peak demand was **22,818 MW** on **January 15, 2004**

State Laws Target Deep Reductions in CO_2 Emissions and Increases in Renewable and Clean Energy

≥80% by 2050	Five states mandate greenhouse gas reductions economy wide: MA, CT, ME, RI, and VT (mostly below 1990 levels)
Net-Zero by 2050 80% by 2050	MA emissions requirement MA clean energy standard
100% by 2035	VT renewable energy requirement
100% by 2050 Carbon-Neutral by 2045	ME renewable energy goal ME emissions requirement
100% by 2040	CT zero-carbon electricity requirement
100% by 2033	RI renewable energy requirement

Renewable Energy Is on the Rise

State policy requirements are a major driver

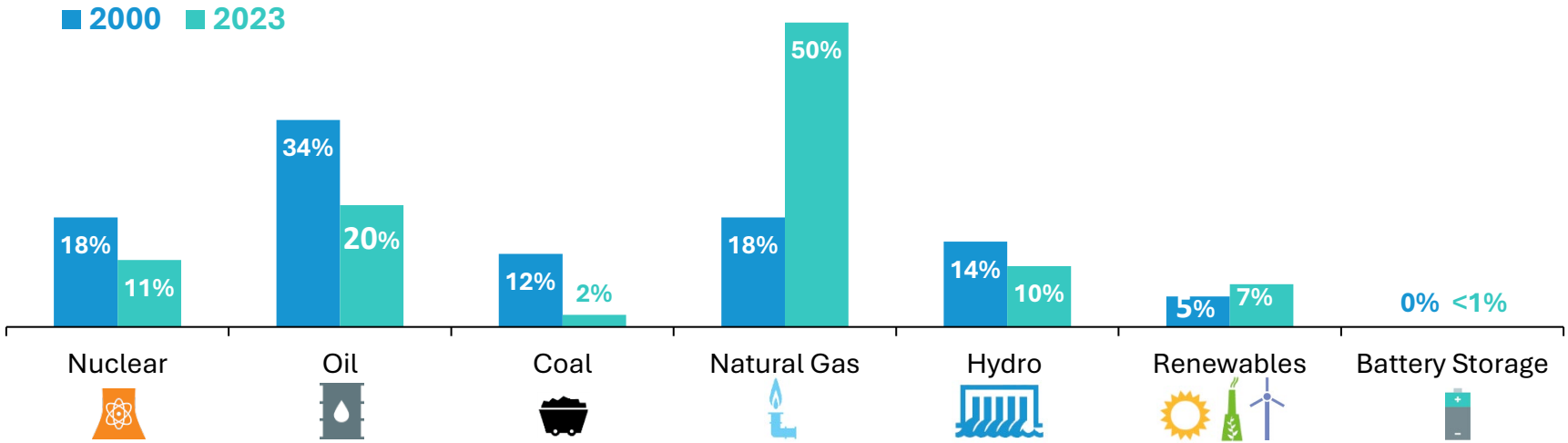


Notes: State RPS requirements promote the development of renewable energy resources by requiring electricity providers (electric distribution companies and competitive suppliers) to serve a minimum percentage of their retail load using renewable energy. Connecticut's Class I RPS requirement plateaus at 40% in 2030. Maine's Class I/IA RPS requirement increases to 50% in 2030 and remains at that level each year thereafter. Massachusetts' Class I RPS requirement increases by 2% each year between 2020 and 2024, 3% each year between 2025 and 2029, reverting back to 1% each year thereafter, with no stated expiration date. New Hampshire's percentages include the requirements for both Class I and Class II resources (Class II resources are new solar technologies beginning operation after January 1, 2006). New Hampshire's Class I and Class II RPS requirements plateau at 15.7% in 2025. Rhode Island's requirement for 'new' renewable energy reaches 100% in 2033. Vermont's 'total renewable energy' requirement reaches 100% for all utilities in 2035; it recognizes several tiers comprised of new and existing renewable energy, located in Vermont or New England, and is unique in classifying large-scale hydropower as renewable.

Dramatic Changes in the Energy Mix

The resources making up the region's installed generating capacity have shifted from nuclear, oil, and coal to natural gas

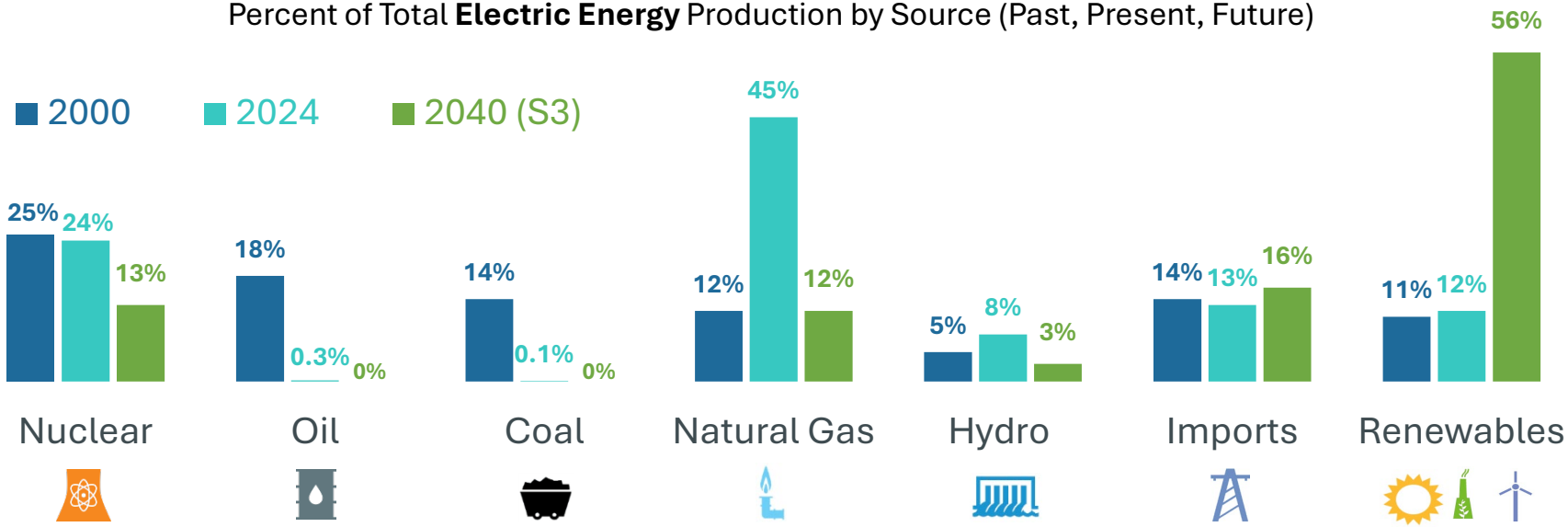
Percent of Total System **Capacity** by Fuel Type
(2000 vs. 2023)



Source: ISO New England 2023-2032 Forecast Report of Capacity, Energy, Loads, and Transmission (2023 CELT Report), Summer Seasonal Claimed Capability (SCC) Capacity. Renewables include landfill gas, biomass, other biomass gas, wind, grid-scale solar, municipal solid waste, and miscellaneous fuels.

Dramatic Changes in the Energy Mix

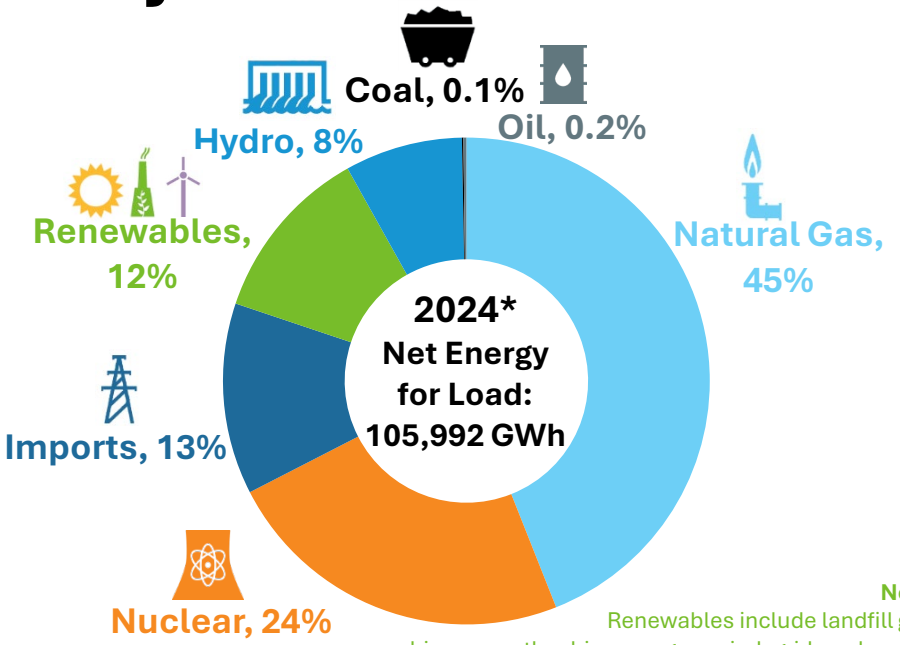
New England made a major shift from coal and oil to natural gas over the past two decades, and is shifting to renewable energy in the coming decades



Source: ISO New England Net Energy and Peak Load by Source; data for 2024 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.

Lower-Emitting Sources of Energy Supply Most of New England's Electricity

- In 2024, most of the region's energy needs were met by natural gas, nuclear, imported electricity (mostly hydropower from Eastern Canada), renewables, and other low- or non-carbon-emitting resources
- Region is transitioning away from older coal and oil resources



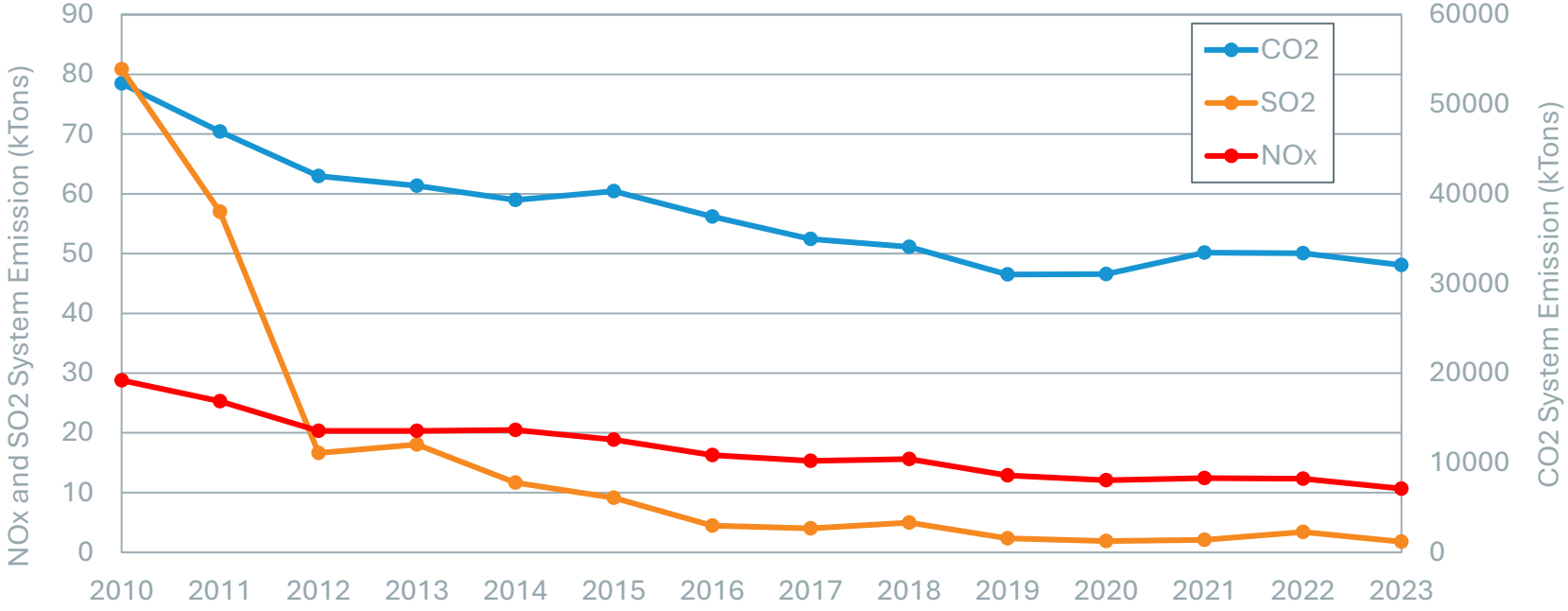
Note: Renewables include landfill gas, biomass, other biomass gas, wind, grid-scale solar, municipal solid waste, and miscellaneous fuels.

*Data is subject to adjustment. Source: 2024 Net Energy and Peak Load by Source https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load

Major Emissions Reductions

Emissions from regional generators have fallen significantly since 2001

Annual New England System Generator Emissions, 2010-2023 (Thousand Short Tons)

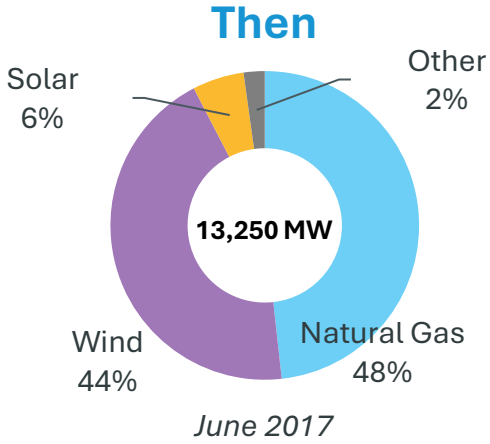


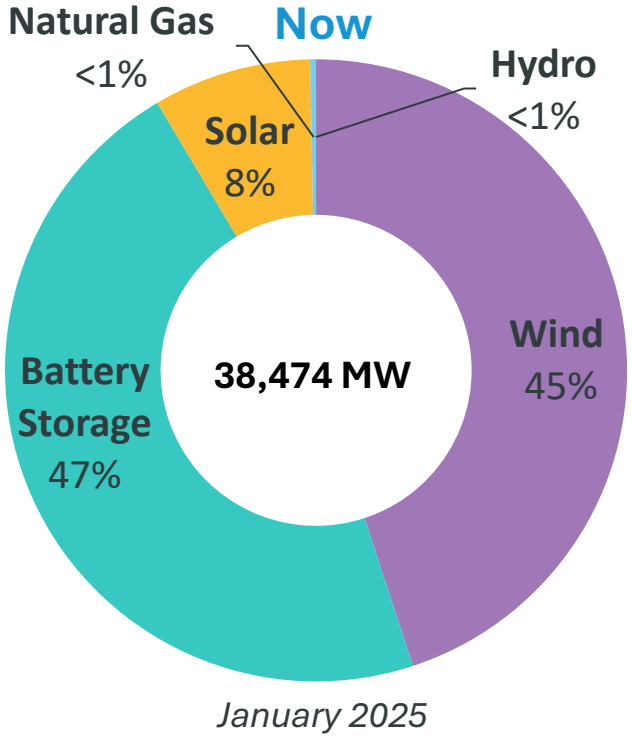
Carbon Dioxide (CO_2) ↓39% **Nitrogen Oxide (NOx) ↓63%** **Sulfur Dioxide (SO_2) ↓98%**

Source: ISO New England, *New England Electric Generators Air Emissions Report*

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	3,750 MW
MA	8,923 MW
RI	1,904 MW

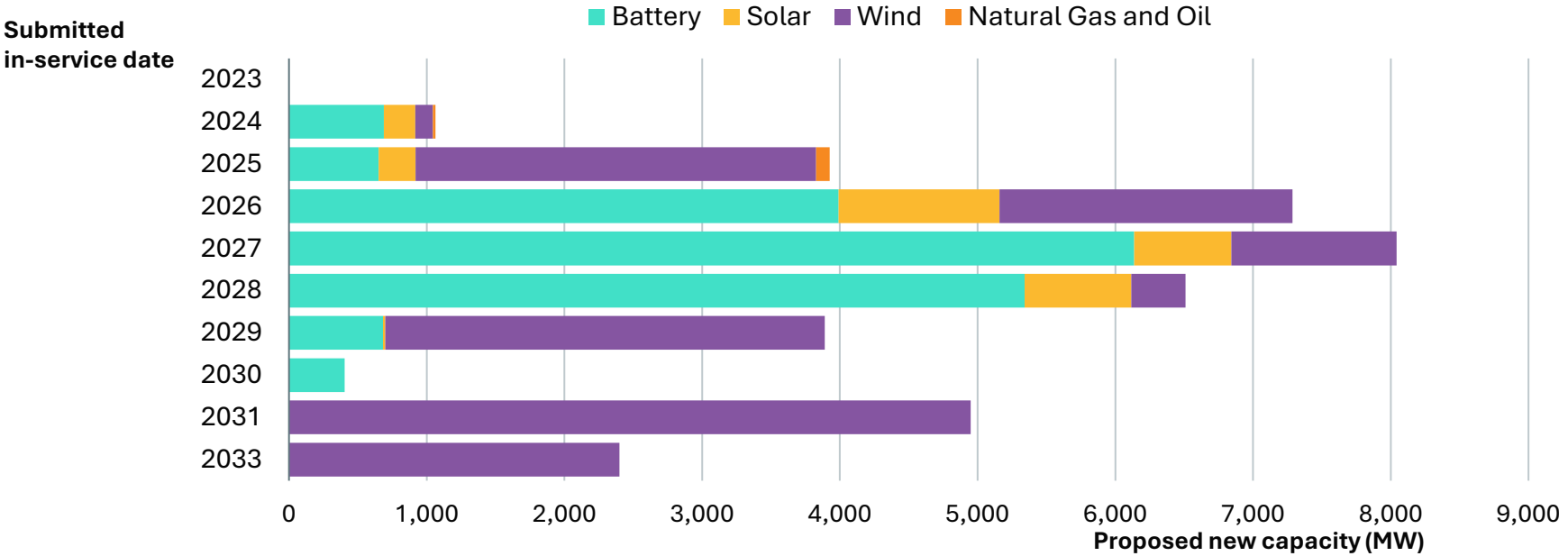
Onshore Wind

ME	2,720 MW

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

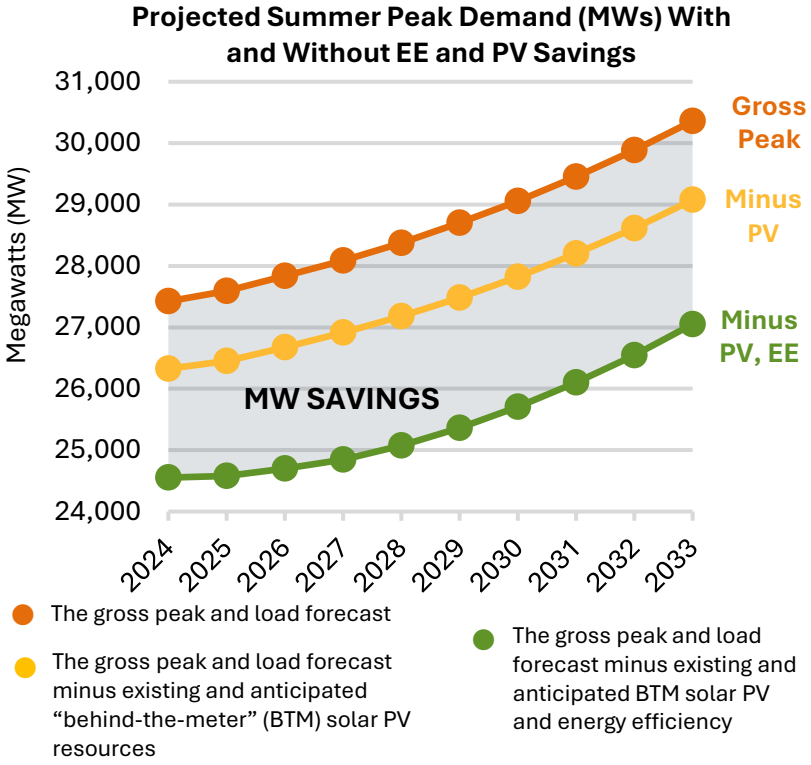
Resources Active in the Interconnection Request Queue

The ISO's Queue reflects more than 200 proposed projects of which over 10,860 MWs have signed interconnection agreements but are not yet commercially operational



Source: ISO Generator Interconnection Queue, FERC Jurisdictional Proposals (updated January 2025)

Energy Efficiency and Behind-the-Meter Solar Resources Are Reducing Peak Demand



- **28,130 MW:** all-time summer peak demand, set on August 2, 2006
- Energy efficiency (EE) and behind-the-meter (BTM) solar are **reducing peak demand**
- Peak demand reductions:

  2024: EE and BTM solar **reduce peak demand by 10.5%**

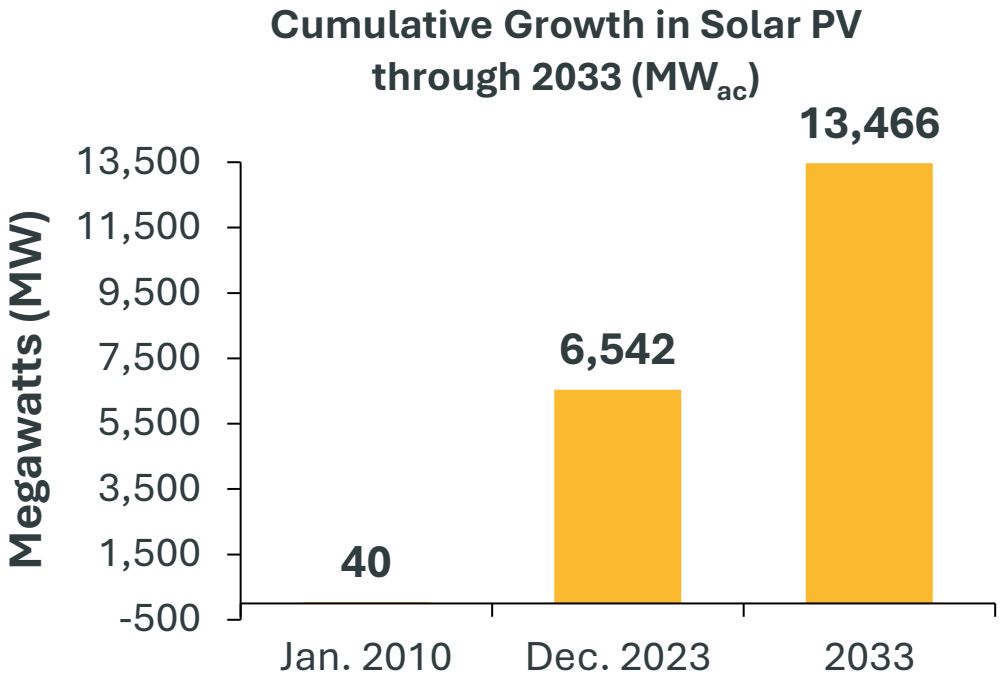
  2033: EE and BTM solar **reduce peak demand by 10.9%**

Source: ISO New England 2024-2033 Forecast Report of Capacity, Energy, Loads, and Transmission (2024 CELT Report) (May 2024)
Summer peak demand is based on the "50/50" forecast.

ISO New England Forecasts Strong Growth in Solar Photovoltaic (PV) Resources

December 2023 Solar PV Installed Capacity (MW_{ac})

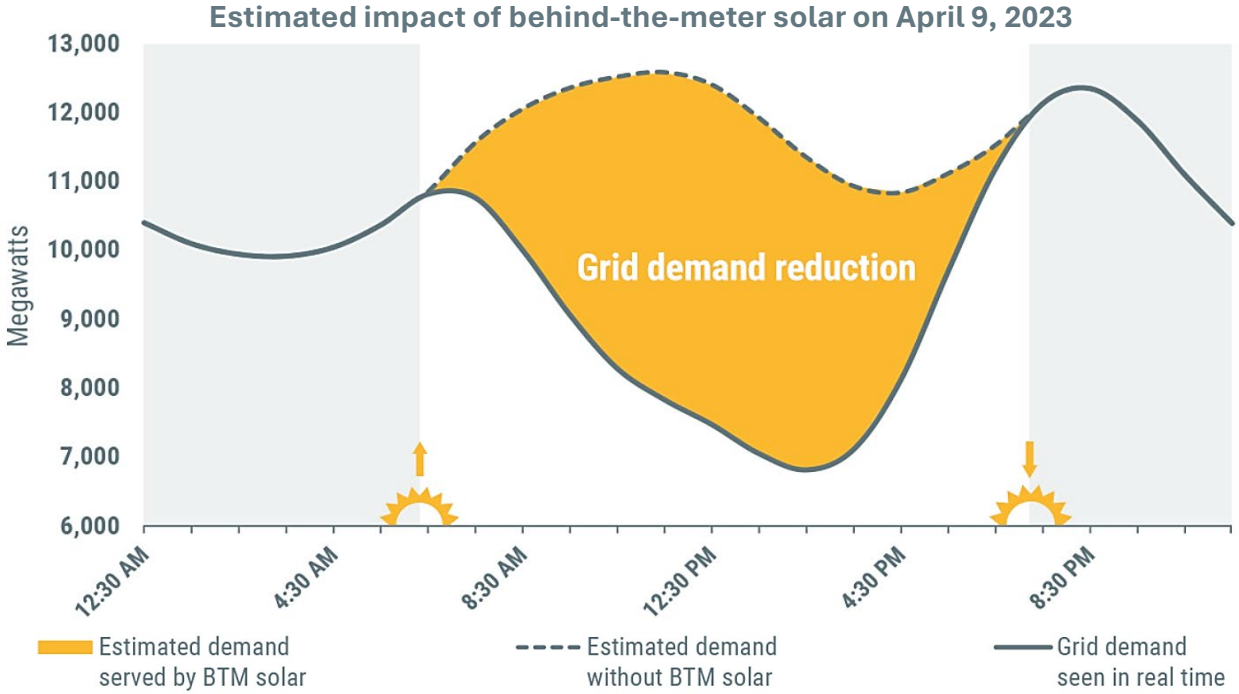
State	Installed Capacity (MW_{ac})	No. of Installations
Connecticut	1,091	91,290
Massachusetts	3,712	179,362
Maine	588	11,506
New Hampshire	244	21,234
Rhode Island	400	22,769
Vermont	507	21,179
New England	**6,542**	**347,341**



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: ISO New England 2024-2033 Forecast Report of Capacity, Energy, Loads, and Transmission (2024 CELT Report) (May 2024), and 2024 Photovoltaic (PV) Forecast; MW values are AC nameplate.

Nighttime Electricity Load on the Region's Electric Grid is Exceeding Daytime Consumption On Sunny Days

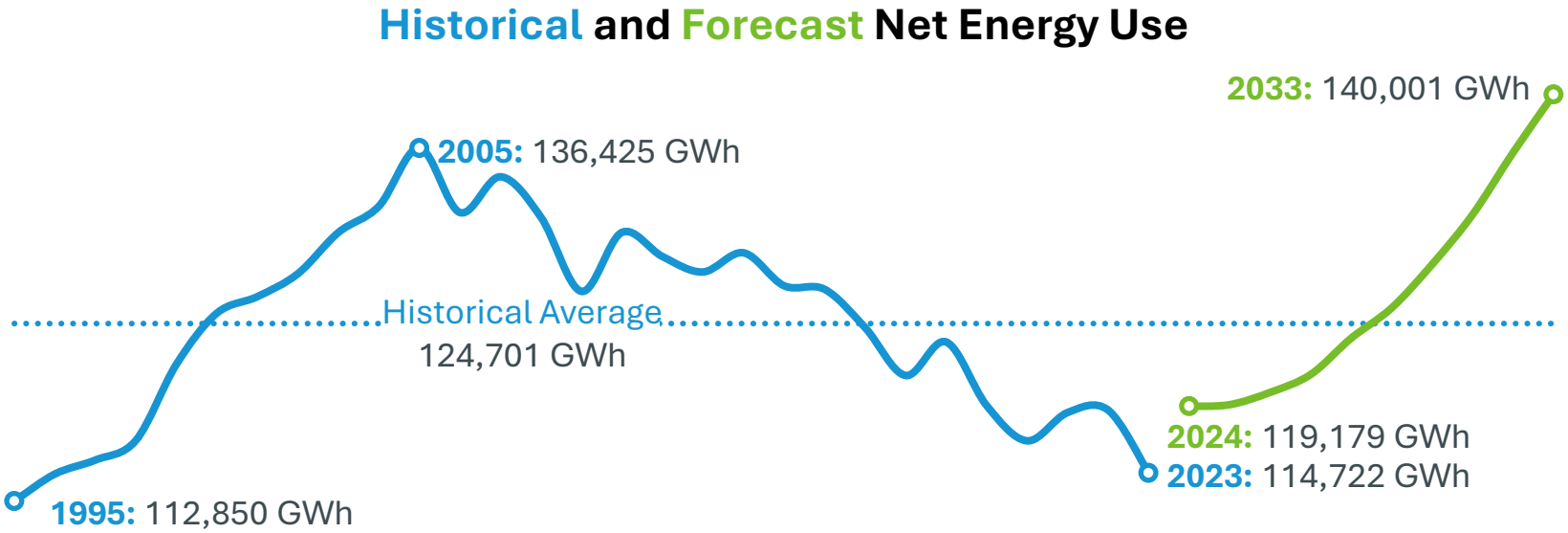
Continued development of solar deployment drives down afternoon load, especially in spring when demand is lower



Source: ISO Newswire Article from April 11, 2023, New England again sets record for low demand on regional power system - ISO Newswire

Increased Electrification is Expected to Drive Steady Growth in Net Annual Energy Use

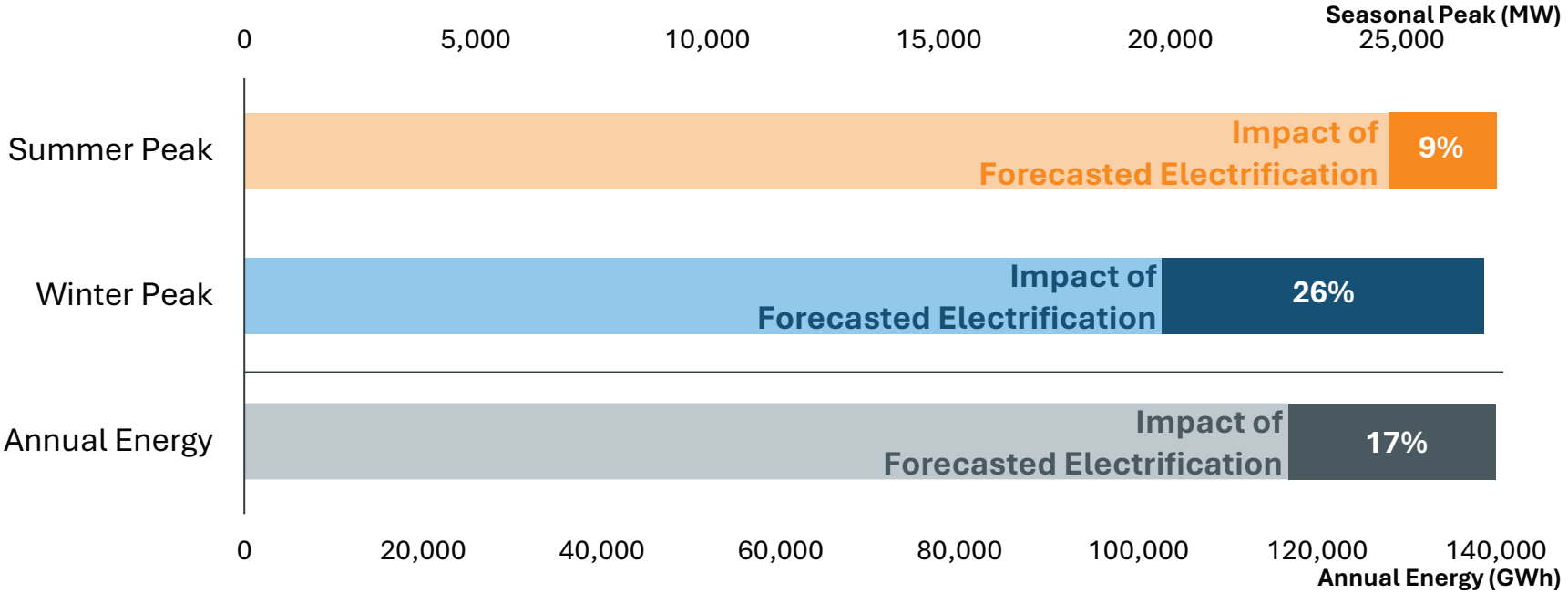
Following two decades of decreased net energy use as a result of state policies incentivizing solar PV and energy efficiency



Source: ISO New England 2024-2033 Forecast Report of Capacity, Energy, Loads, and Transmission (2024 CELT Report) (May 2024)

Impact of Electrification on 2033 Annual Energy Use and Seasonal Demand in New England

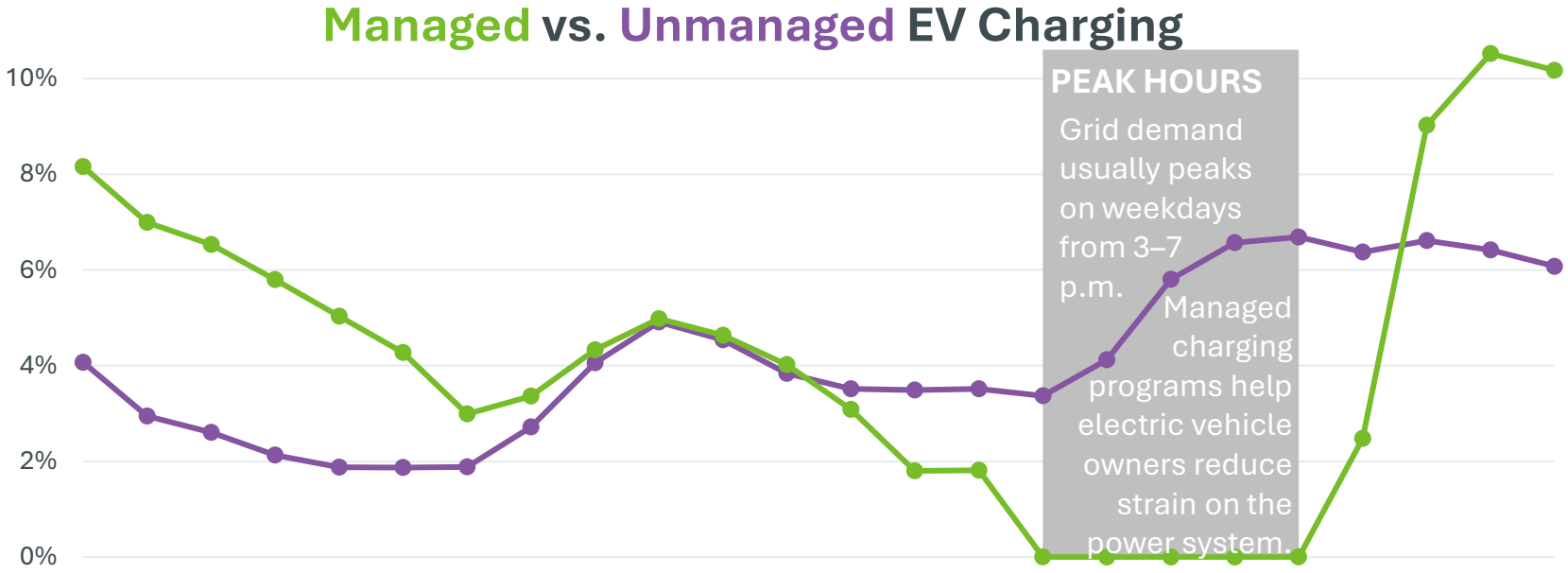
In 2033, impacts of electrification are expected to account for more than 23,000 GWh of annual energy consumption, roughly 2,500 MW of summer demand and 7,000 MW of winter demand



Source: ISO New England 2024-2033 Forecast Report of Capacity, Energy, Loads, and Transmission (2024 CELT Report) (May 2024)

Managed Charging Profiles Added to Transportation Electrification Forecast

Managed charging programs offer incentives for EV owners to avoid charging during peak hours, shifting charging to times when demand and wholesale prices tend to be lower



Source: ISO New England 2024-2033 Forecast Report of Capacity, Energy, Loads, and Transmission (2024 CELT Report) (May 2024)

There Are Four Pillars Necessary to Support a Successful Clean Energy Transition

PILLAR ONE

Clean Energy

Significant amounts of clean energy to power the economy with a greener grid

PILLAR TWO

Balancing Resources

Resources that can supply electricity, reduce demand, or provide other services to maintain power system equilibrium

PILLAR THREE

Energy Adequacy

A dependable energy supply chain and/or a robust energy reserve to manage through extended periods of severe weather or energy supply constraints

PILLAR FOUR

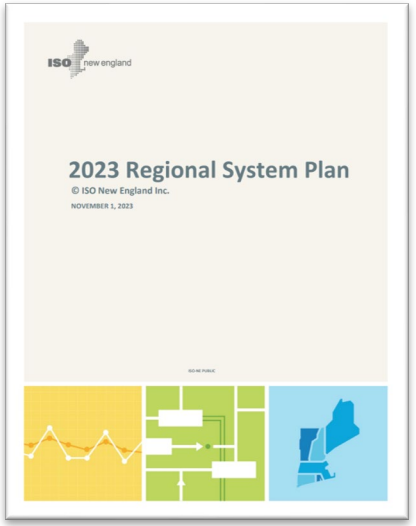
Robust Transmission

To integrate renewable resources and move clean energy to consumers across New England

TRANSMISSION DEVELOPMENTS

Overview of Transmission Planning

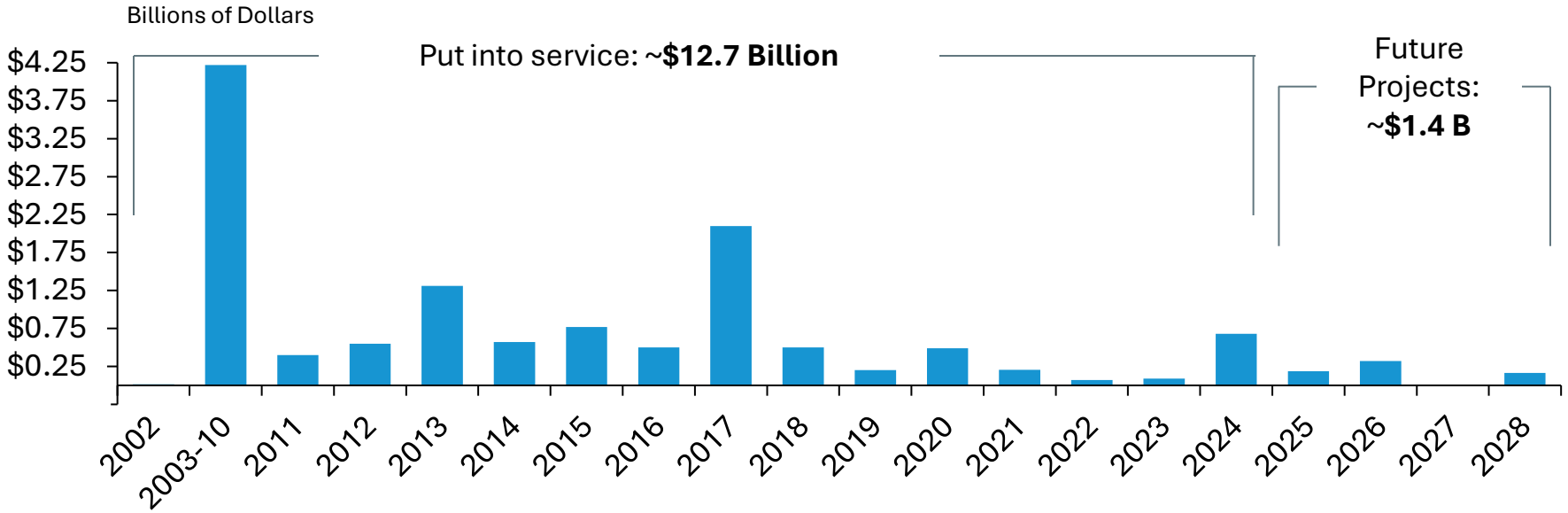
- As the **Regional Transmission Organization**, the ISO is required to identify transmission infrastructure solutions that are essential for maintaining power system reliability in New England
- Through an **open stakeholder process**, the ISO is responsible for the development of long-range plans to address future system needs over the ten-year planning horizon
  - Summarized in a **Regional System Plan (RSP)**
- The transmission planning process is governed by a **FERC-approved tariff**
- ISO-NE continuously revises the transmission planning process to comply with applicable FERC orders



ISO New England 2023 Regional System Plan

New England Has Made Major Investments in Transmission to Ensure a Reliable Electric Grid

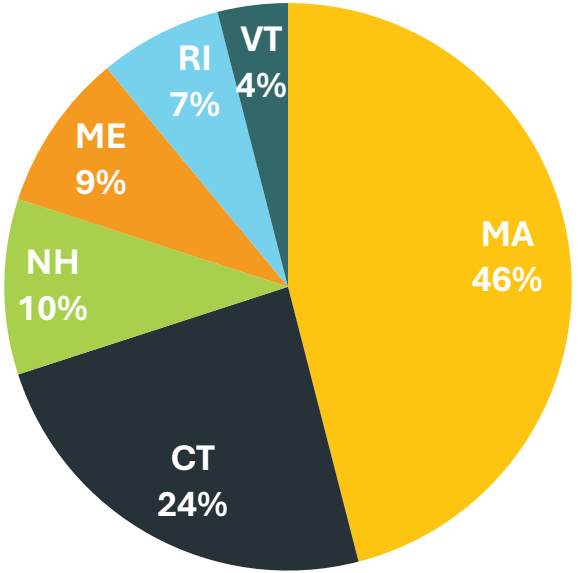
Transmission investment by year that projects are put into service (capital costs)



Source: ISO New England RSP Transmission Project Listing, October 2024
Estimated future investment includes projects under construction, planned and proposed

How Are Transmission Costs Allocated?

- The New England electric grid is a **tightly interconnected** system; each state shares in the benefits of reliability and market efficiency upgrades
- The amount of electricity demand in an area determines its **share** of the cost of new or upgraded transmission facilities needed for reliability or market efficiency



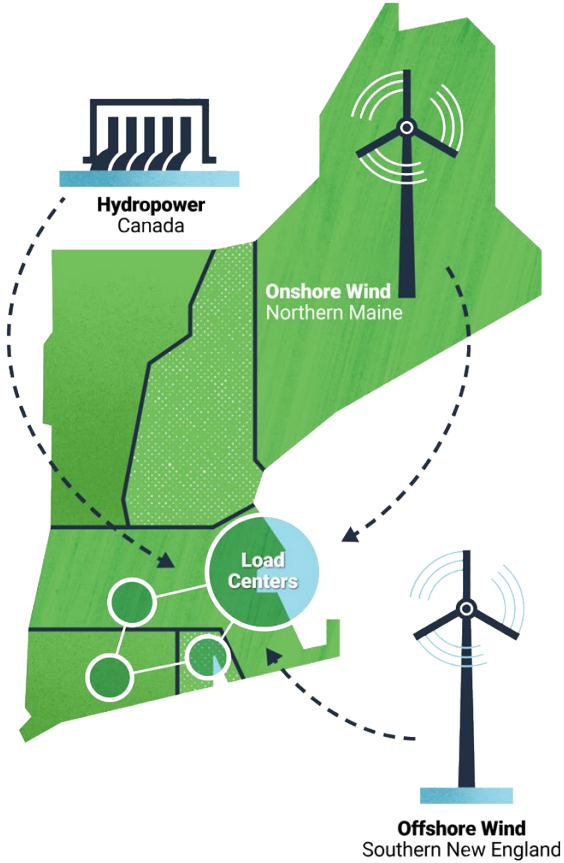
2023 Network Load by State

Transmission Provides Benefits Beyond Reliability

- **Transmission has reduced or eliminated out-of-market costs:**
  - Reliability agreements with certain generators that were needed to provide transmission support in weak areas of the electric grid
    - These often were older, less-efficient generating resources
  - Uplift charges to run specific generators to meet local reliability needs
- **The markets are increasingly competitive:** Easing transmission constraints into import-constrained areas has enabled the ISO to dispatch the most economic resources throughout the region to meet customer demands for electricity
- **Transmission congestion has been nearly eliminated**
- **Transmission facilitates resource transformation:** Transmission upgrades have allowed older, less efficient resources to retire, which helps the states achieve their environmental objectives

Substantial Investment in New and Existing Infrastructure will be Critical to Enabling the Clean Energy Transition

- **$620 million** to **$1 billion** in transmission reliability investment will be needed **each year through 2050** to support the clean energy transition
- Developers are proposing eight elective transmission upgrades (ETUs) to help deliver over **10,000 MW** of clean energy to New England load centers
  (ISO Interconnection Queue January 2025)

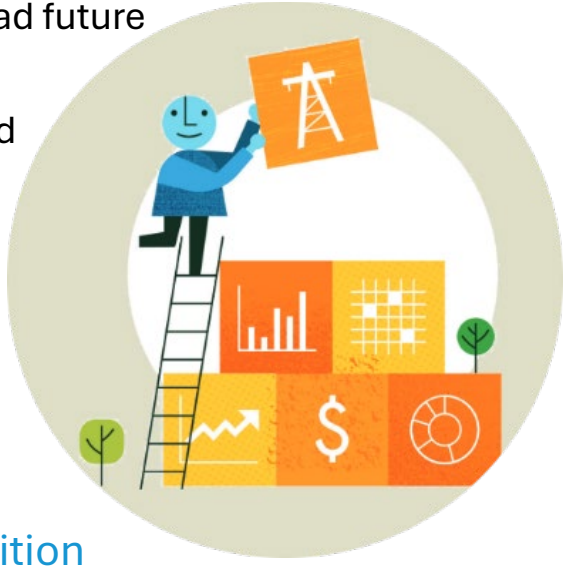


Source: Massachusetts Energy Pathways to Deep Decarbonization study and ISO New England 2050 Transmission Study

RECENT ISO PLANNING STUDIES

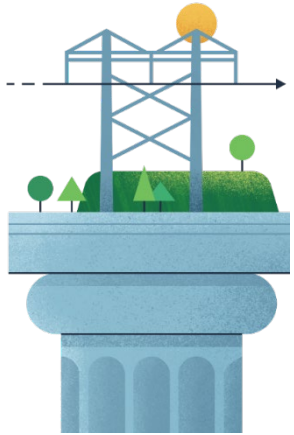
Overview of Studies Supporting the Future Grid

- **Weather:** Operational Impacts of Extreme Weather Events
  - Rigorously model likelihood and impact of extreme weather events
- **Transmission:** 2050 Transmission Study
  - Determine transmission needs to support renewable/high load future
- **Operations:** Future Grid Reliability Study
  - Phase 1- Examine operational effects of renewable-heavy grid
- **Markets:** Pathways to the Future Grid
  - Evaluate different market options to support a renewable-heavy grid
- **Reliability:** Transmission Planning for the Clean Energy Transition
  - Explore how near-term needs assessments should evolve with renewables
- **Economic:** Economic Planning for the Clean Energy Transition
  - Understand the effect of on-going industry trends on economic planning analyses



Longer-Term Transmission Planning (LTTP)

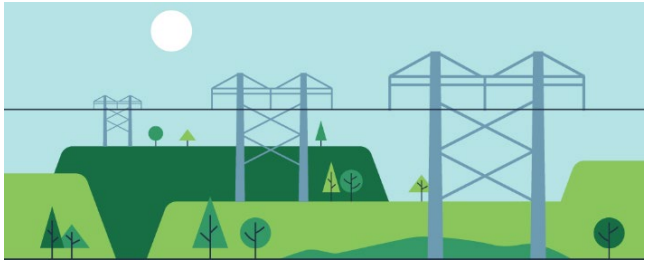
- In 2020, the New England States Committee on Electricity (NESCOE) vision statement recommended that the ISO work with stakeholders to conduct a **comprehensive long-term regional transmission study**
- In response, the ISO began the study and received **FERC approval** to revise the ISO Tariff to establish a repeatable longer-term study process
- The resulting 2050 Transmission Study was the **first longer-term transmission study** conducted for New England



- The study informs stakeholders of the **amount and type** of **transmission infrastructure** necessary to provide reliable, cost-effective energy to the region through the **clean energy transition**, driven by state policy
- The **region's aging transmission system** has the potential to become **a significant bottleneck** to progress if it does not keep pace with changes to other elements of the power system

Looking to the Future: LTTP Phase II

- Accepted by FERC in July 2024, Phase II created a **new process to implement transmission system upgrades** based on longer-term transmission studies
- Provides an avenue for the **states**, through NESCOE, to evaluate and determine cost allocation for **transmission upgrades** needed to ensure a reliable grid throughout the clean energy transition
  - Upon request by the states, ISO will issue and evaluate requests for proposals (RFPs) to **address needs identified by the states** and provide **technical assistance** to the states in support of their procurements and efforts to secure federal funding for transmission investments



LTTP Key Elements

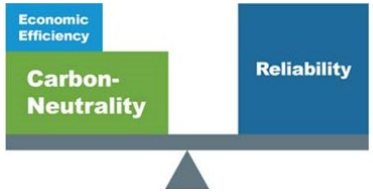
- Framework mirrors the existing competitive solicitation process for public policy, **except in the LTTP process:**
  - NESCOE identifies needs and whether to pursue a solicitation
  - ISO administers single-phase competitive RFP
  - ISO evaluates proposals for viability and financial benefits
  - ISO selects preferred solution if at least one proposal meets the benefit-to-cost ratio threshold
  - NESCOE has the right to terminate the process
- The changes also establish a **cost allocation** method for selected transmission facilities that meet the **benefits criteria**:
  - Costs of selected transmission facilities are allocated across all six states based on their respective load ratio share, similar to Regional Benefit Upgrades
  - NESCOE may propose an alternative cost allocation method to be filed with FERC
- If there is a solution desirable to one or more states, but the benefit-to-cost threshold is not met, the **supplemental process** allows NESCOE to advance the solution, in which case:
  - Costs up to the transmission facility's benefits are allocated across all six states based on its benefit-to-cost ratio, and
  - Costs in excess of those benefits are allocated to the state(s) that voluntarily agree to assume them

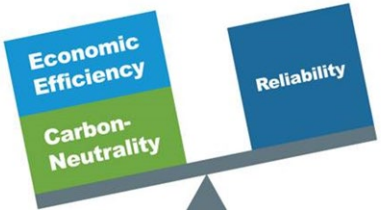
Next Steps: Solving Transmission Needs through a Potential LTTP RFP

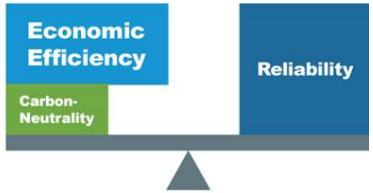
- On October 16, the states sent a letter expressing an **interest in pursuing a solicitation** for transmission solutions under this new LTTP RFP process
- The letter proposed, for stakeholder feedback, that the initial RFP **address the north-to-south interface** issues identified in the 2050 Transmission Study, and potentially facilitate the integration of renewable resources in northern Maine
  - Feedback will be provided to NESCOE through the **Planning Advisory Committee (PAC)**
- On December 13 NESCOE sent a letter to **formally request** that the ISO begin the solicitation process
- The RFP process, from initiation through final recommendation, is expected to take approximately 18 months

Economic Planning for the Clean Energy Transition (EPCET) Overview

- EPCET explores the operational, engineering, and economic challenges the region must address in order to support the New England States' commitment to reduce carbon emissions over the next several decades
- Work performed over two years; final report published in October 2024
- In addition to the final report, a fact sheet, presentation and recording of a recent public webinar on the study, and other related study materials are available on the ISO website







EPCET's key findings converge on a common theme: ***designing the power system of the future requires balancing reliability, economic efficiency, and carbon-neutrality***

EPCET: Key Findings for the New England Grid

- **Increased variability will require vastly different supply levels from year to year**
  - Peak demand could vary by up to 50% between mild and severe winters by 2050
- **Emissions reductions will be seasonal**
  - Spring will be mostly decarbonized by 2040, but a small portion of winter days will still produce significant emissions in 2050
- **Renewable-only build-outs may be vast**
  - If the 2050 resource build-out is almost entirely wind, solar, and batteries, the region will need a power system that is roughly four times its current capacity to achieve state emissions goals and maintain reliability
- **Firm, dispatchable, zero-carbon generation could help address challenges**
  - These resources may support reliability and reduce build-out costs

Average Annual Buildout Necessary to Achieve State Goals by 2050

1,293 MW
per year
of offshore wind (OSW)

955 MW
per year
of solar

268 MW
per year
of land-based wind (LBW)

952 MW
per year
of batteries

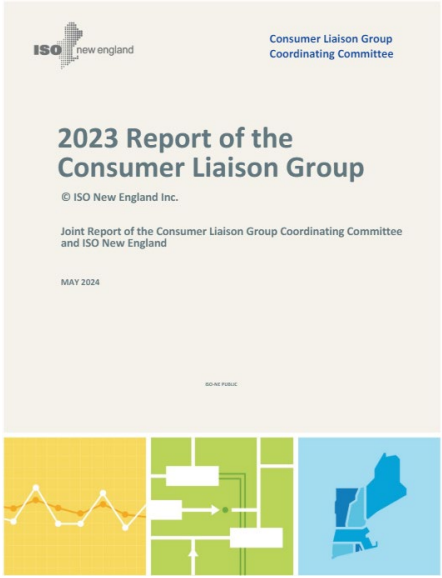
RESOURCES

Consumer Liaison Group Provides a Forum for Consumers to Learn about Regional Electricity Issues

- A forum for sharing information between the ISO and electricity consumers in New England
- The CLG Coordinating Committee consists of 14 members who represent various stakeholder groups
- Quarterly meetings are free and open to the public, with in-person and virtual options to participate

Anticipated 2025 CLG Meeting Dates and Locations:

- Thursday, March 27 – Rhode Island
- Wednesday, June 4 – Massachusetts
- Wednesday, September 24 – New Hampshire
- Wednesday, December 3 – Boston, MA



2023 CLG Annual Report

More information on the CLG is available at: https://www.iso-ne.com/committees/industry-collaborations/consumer-liaison/

ISO Glossary and Acronyms

- ISO maintains a glossary with short definitions of industry terms appearing in ISO materials
- The glossary is available at the ISO's website under the **Participate** then **Support** menus
  - The feature is presented on the ISO website for use by anyone needing to get a handle on a term
  - As terms morph or emerge over time, the glossary is regularly updated
  - The page also includes links to official documents that include full-length legal definitions for many terms

Participate > Support

Glossary and Acronyms

IN THIS SECTION

- Support
- Participant Readiness Project Outlook
- Request Data and Information
- Request CEII Access
- Request Software
- Mailing Lists
- Web Feeds
- Web Conferencing Support
- User Guides
- Glossary and Acronyms
- Web Browser Support
- Web Services Data
- Library of Participant Support Forms
- Upload and Download File Format Protocols
- FAQs
- Website Help

Here, you'll find general definitions of frequently used terms related to New England's wholesale electricity markets and power system.

Precise legal definitions can be found in the following documents:

- Section I: General Terms and Conditions PDF of the Tariff
- ISO New England Manual for Definitions and Abbreviations (Manual M-35)
- Participants Agreement
- Second Restated NEPOOL Agreement PDF

0-9 | A-C | D-F | G-I | J-M | N-Q | R-U | V-Z

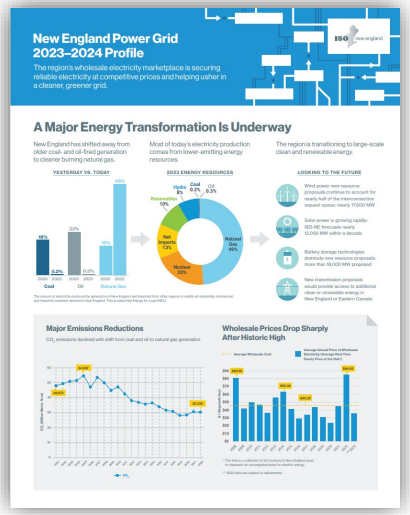
0 - 9

(2.5-; 10-) micron particulate matter	PM (2.5); PM(10)	Two sizes—2.5 microns ($PM_{2.5}$) and 10 microns (PM_{10})—of particulate matter identified in the US Clean Air Act as considered harmful to human health, property, and ecosystems.
10-minute nonspinning reserve	TMNSR	Operating reserve provided by off-line generation that can be electrically synchronized to the bulk electric power system and increase output within 10 minutes in response to a contingency; also called 10-minute nonsynchronized reserve. (Also see 10-minute spinning reserve.)
10-minute nonsynchronized reserve	TMNSR	(See 10-minute nonspinning reserve, the more common term.)
10-minute spinning reserve	TMSR	Operating reserve provided by on-line operating generation that can increase output within 10 minutes in response to a contingency; also called 10-minute synchronized reserve. (Also see 10-minute nonspinning reserve.)
2 x 16; 2/16		2 days per week, 16 hours per day—typically the weekend peak hours of 6:01 a.m. to 10:00 p.m. (aka, hour ending 7 to hour ending 22).

ISO New England Publications

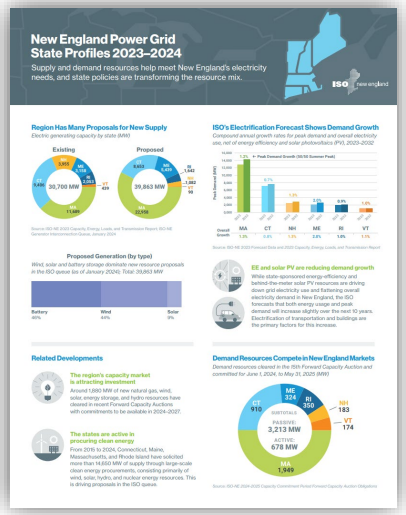
2024 Regional Electricity Outlook

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

For More Information

Subscribe to *ISO Newswire*

ISO Newswire is your source for regular news about ISO New England and the wholesale electricity industry within the six-state region

Log on to ISO Express

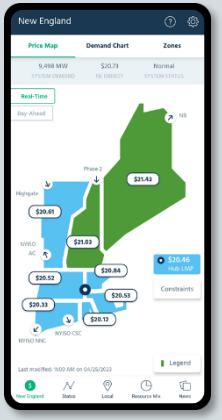
ISO Express provides real-time data on New England's wholesale electricity markets and power system operations

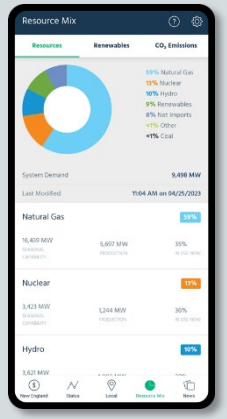
Follow the ISO on Social Media

www.iso-ne.com/social

Download the ISO to Go App

ISO to Go is a free mobile application that puts real-time wholesale electricity pricing and power grid information in the palm of your hand





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Questions

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