THANK YOU REV2023 SPONSORS & EXHIBITORS!

Energy Resilience and the Grid

Renewable Energy Vermont

2023 Annual Conference

Sarah Adams

STATE POLICY ADVISOR, EXTERNAL AFFAIRS

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

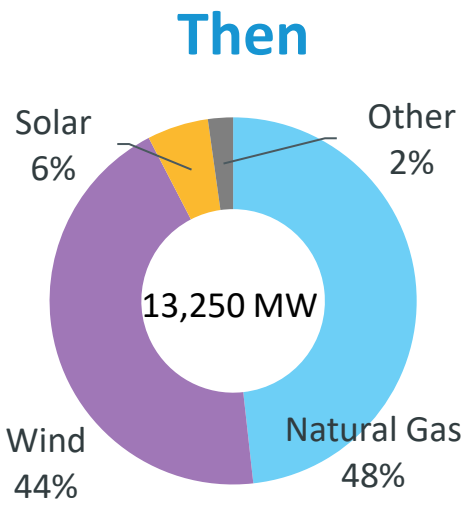
Vision: *Where we're going*

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

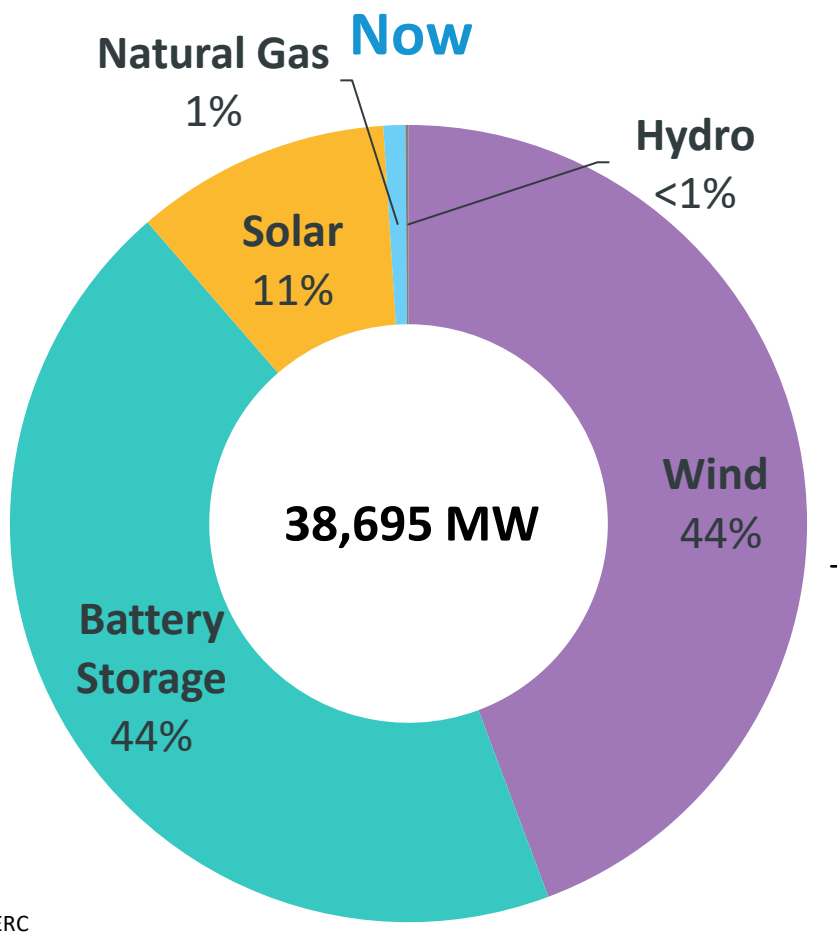
*The ISO's new **Vision** for the future represents our long-term intent and guides the formulation of our Strategic Goals*

The ISO Generator Interconnection Queue Provides a Snapshot of Resource Proposals

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



June 2017



September 2023

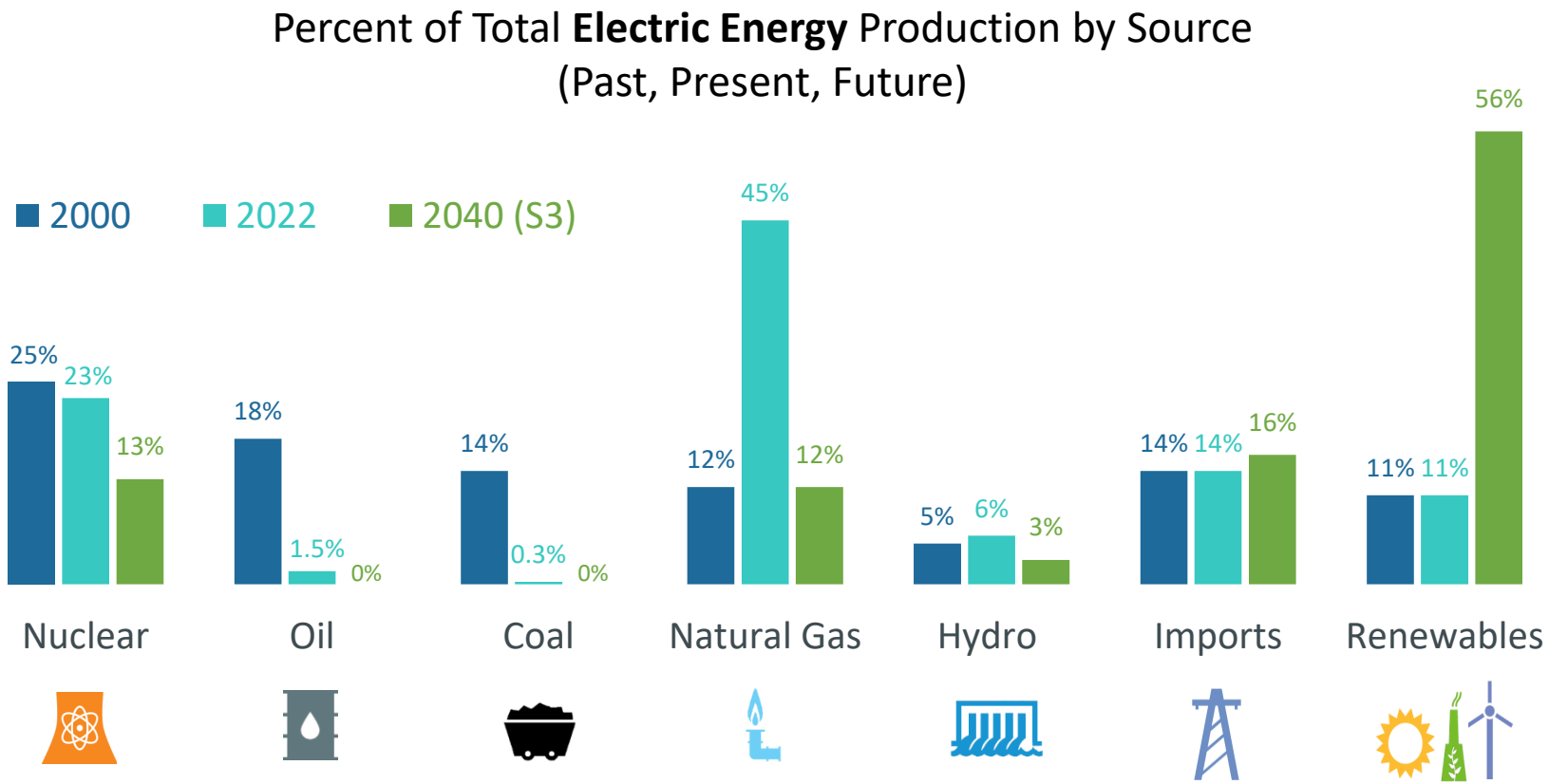
Offshore Wind	
CT	2,400 MW
MA	11,514 MW
RI	704 MW

Onshore Wind	
ME	2,522 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

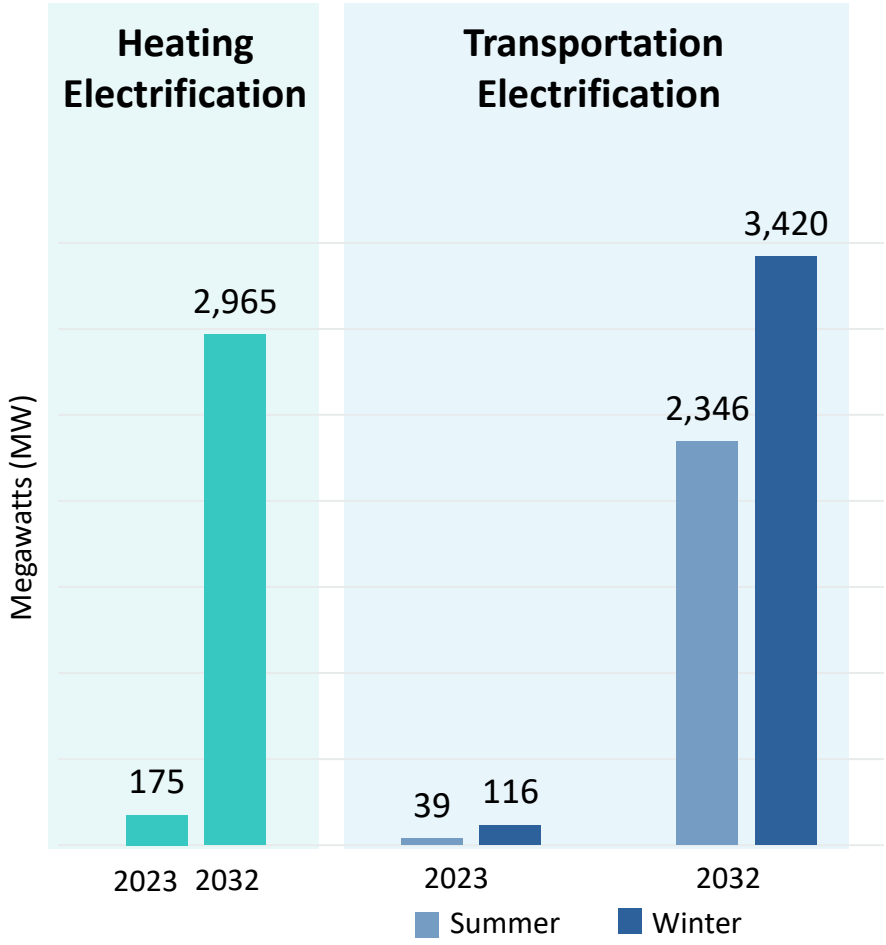


Source: ISO New England Net Energy and Peak Load by Source; data for 2022 is preliminary and subject to resettlement; data for 2040 is based on Scenario 3 of the ISO New England 2021 Economic Study: Future Grid Reliability Study Phase 1.

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

2023 CELT Includes 10-Year Forecasts for Heating and Transportation Electrification

- The ISO began including **forecasted impacts** of heating and transportation electrification on state and regional electric energy and demand in the 2020 CELT report
- In New England by **2032**, the ISO forecasts that there will be:
  - **>1 M households with heat pumps**
  - **> 600 M square feet of commercial space heated with heat pumps**
  - **~ 3M light-duty EVs**
  - **> 10,000 medium and heavy-duty EVs** (includes delivery vehicles, school buses, and transit buses)



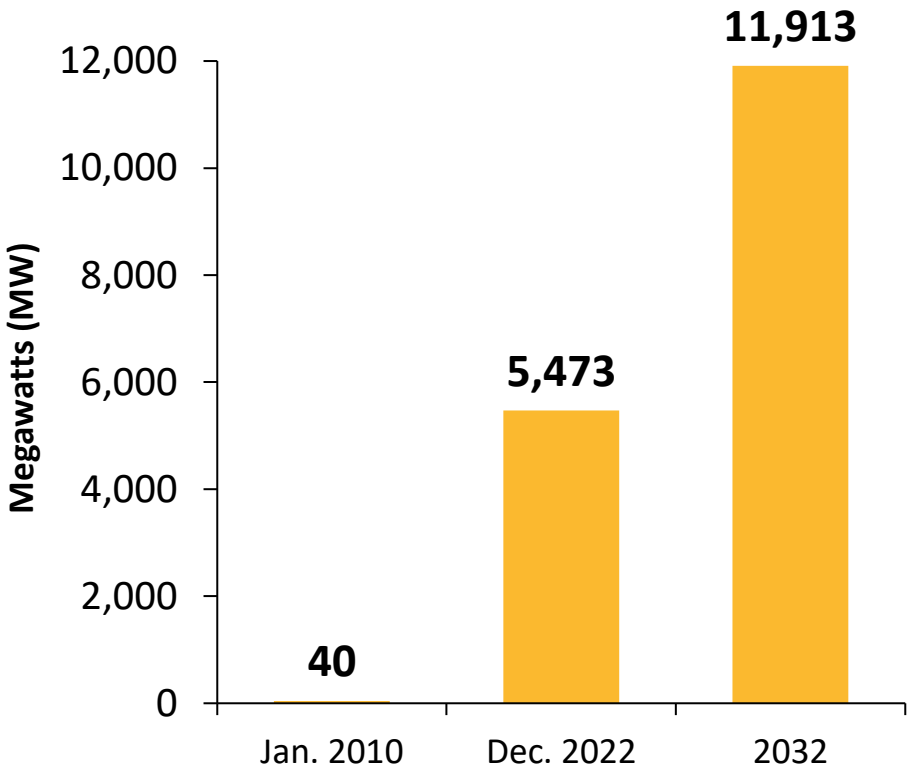
Sources: : ISO New England 2023-2032 Forecast Report of Capacity, Energy, Loads, and Transmission (2023 CELT Report) (May 2023), Final 2022 Transportation Electrification Forecast, and Final 2022 Heating Electrification Forecast

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

December 2022 Solar PV Installed Capacity (MW_{ac})

State	Installed Capacity (MW_{ac})	No. of Installations
Connecticut	912	73,553
Massachusetts	3,289	150,020
Maine	295	8,583
New Hampshire	183	14,427
Rhode Island	326	17,034
Vermont	468	19,348
New England	**5,473**	**282,965**

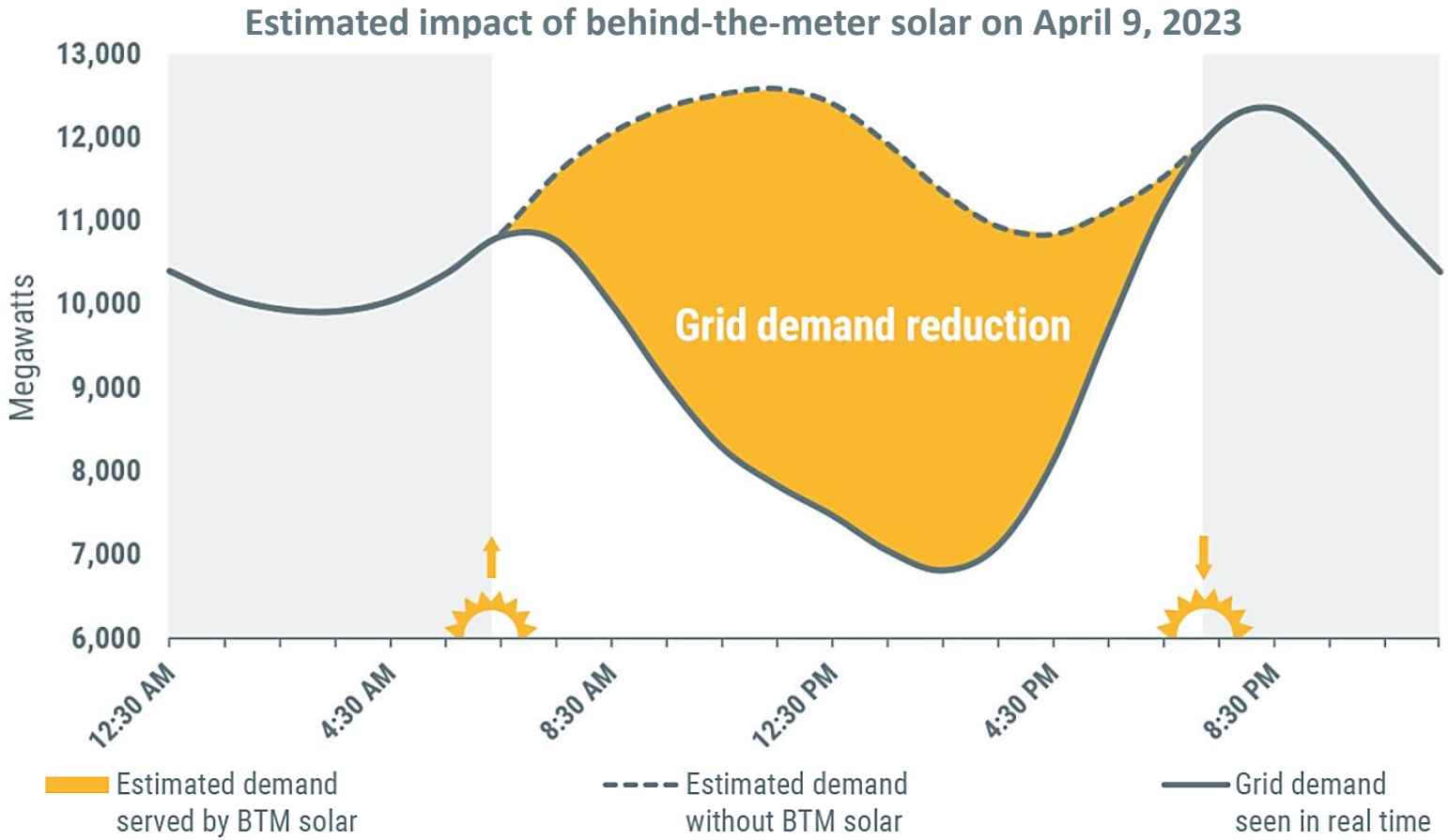
Cumulative Growth in Solar PV through 2032 (MW_{ac})



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

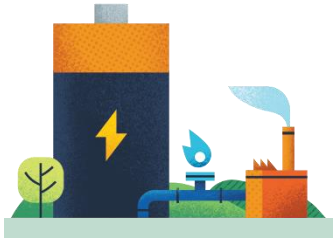
There Are Four Pillars Necessary to Support a Successful Clean Energy Transition

1

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

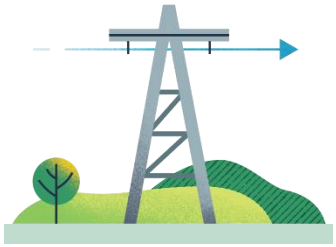
2

Balancing resources that keep electricity supply and demand in equilibrium



3

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

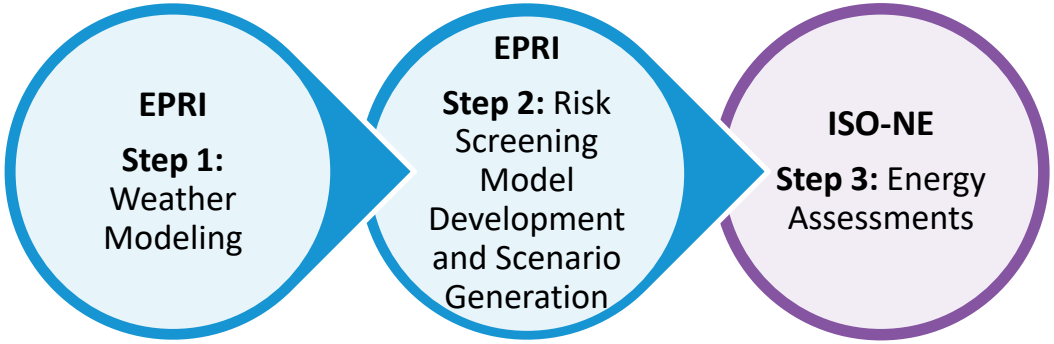


4

Robust transmission to integrate renewable resources and move clean electricity to consumers across New England

Operational Impact of Extreme Weather Events – Energy Adequacy Study

- *Operational Impact of Extreme Weather Events* is a probabilistic energy-security study undertaken jointly by the ISO and the Electric Power Research Institute (EPRI)
- The study seeks to inform the region about future energy adequacy risks and provide context for assessing solutions, is one of several key projects undertaken by the ISO to help New England prepare for tomorrow's greener grid
- The study is being undertaken in three major steps, with EPRI providing weather modeling and risk screening model development, and ISO completing the energy assessments, using the 21-day energy assessment tool



- This energy adequacy study tool provides a much needed foundation for the ISO to monitor risks and study the system as it continues to evolve

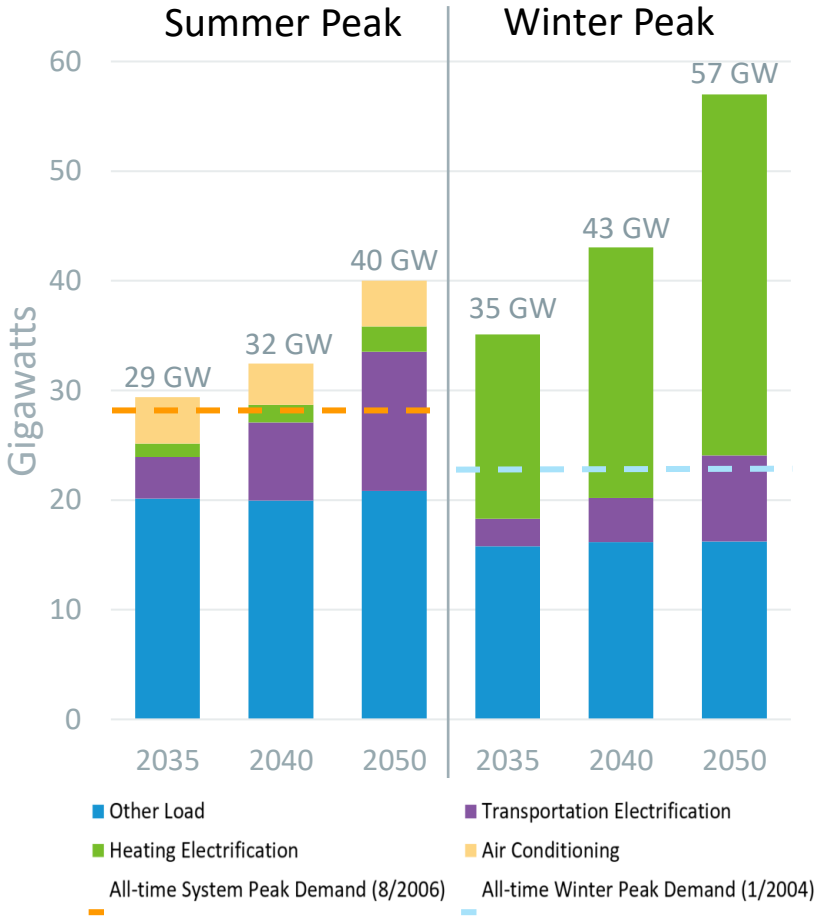
Energy Adequacy Study – Key Takeaways

- Preliminary results of energy assessments for 2027 winter & summer events, and 2032 winter & summer have been presented to the Reliability Committee
- Results reveal a range of energy shortfall risks and associated probabilities, and indicate an increasing energy shortfall risk profile between 2027 and 2032
- Results of preliminary studies reveal similar energy adequacy risk with and without the Everett Marine Terminal in-service
- 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
- Stakeholders were invited to request additional sensitivities to the 2032 case
  - ISO received requests for the performance of ~35 sensitivities from 15 different stakeholders
  - ISO is planning to perform ~28 sensitivity requests

For more information on the on the stakeholder-informed sensitivity analysis, please refer to the September 19 Reliability Committee presentation.

2050 Transmission Study

- Aims to **inform the region** of the amount, type, and high-level cost estimates of **transmission infrastructure** that would be *needed to cost-effectively and reliably serve peak loads*, in a clean-energy future
- Study assumptions represent several **paradigm shifts** for New England
  - Shift from *summer-peaking* to *winter-peaking*
  - Increased development of *renewable* resources
  - Electrification of *heating* and *transportation* more than doubles peak power consumption by 2050
- Significant **new transmission** may be needed to reliably serve load



The most up-to-date information on the 2050 study is available at the Planning Advisory Committee and Longer-Term Transmission Studies webpages.

2050 Transmission Study – Key Takeaways

Reducing Peak Loads Significantly Reduces Transmission Cost

High-Likelihood Concerns Can Be Prioritized

Incremental Upgrades Can Be Made As Opportunities Arise

Generator Location Matters

A Significant Number of Transformers Need to Be Added

* **High-likelihood concerns** are those that would appear under a wide variety of conditions, including conditions that do not exactly match those examined in the 2050 Transmission Study. A detailed explanation may be found in the April 2023 PAC presentation on the 2050 Transmission Study.

Thinking ***bolder*** to address key challenges – utilizing current innovations and existing rights of ways to enable more renewables and make the grid more resilient.

A few technologies we are currently deploying:

Real-Time Intelligence

Digital Substations

Online Monitoring

New Tools

Asset Health Tech (AI/ML/UAS/Robotics)

Intelligent Design

Renewable Integration

Energy Storage

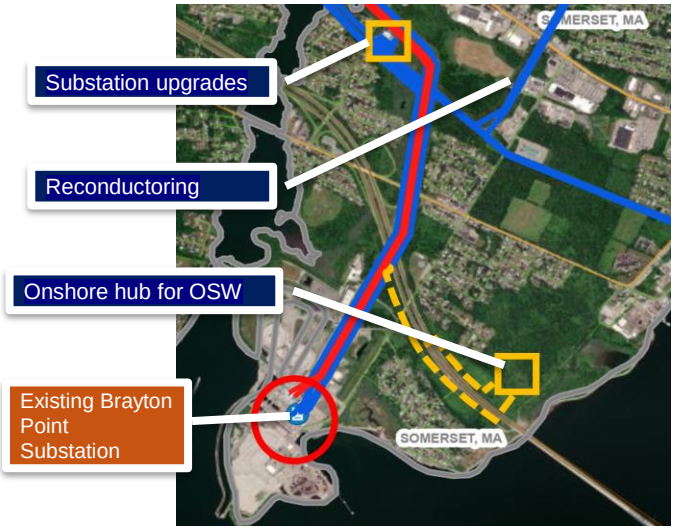
Power Flow Control

- Utilizing technology to optimize capital spend and increase the capacity of the grid.
- Not creating new rights of ways (if possible), but strengthening existing rights of ways
- Building with the future in mind (e.g., electrification of transport and heating)

Advancing Forward a Clean Energy Transmission Network

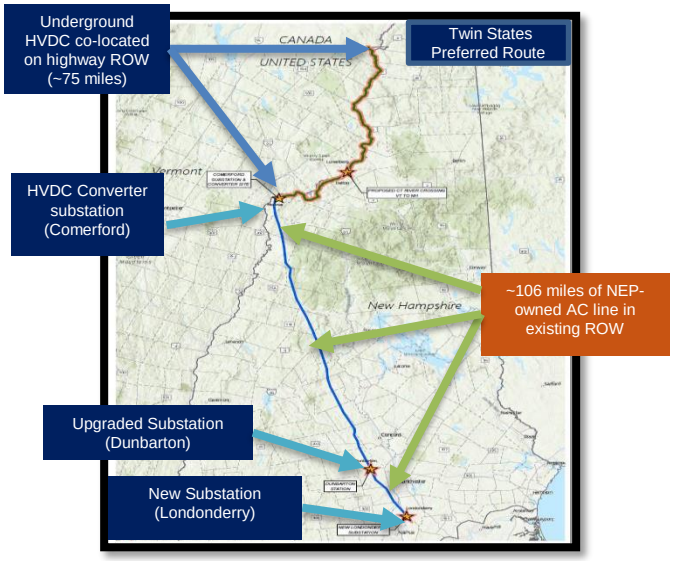
Cleaner Grid New England – Brayton Point

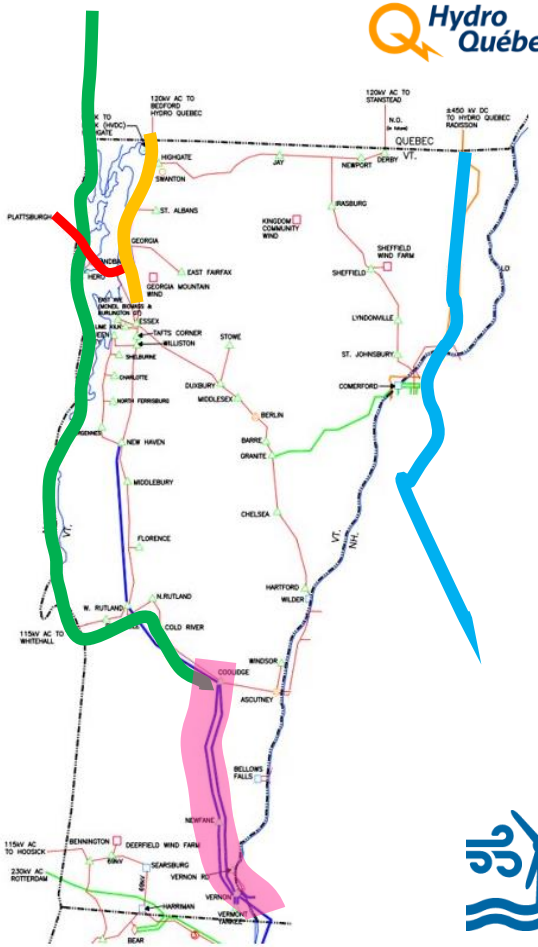
- Onshore hub for OSW and substation upgrades to support increase of up to **2,400 MW** of OSW / Energy Storage.
- **Reduced congestion:** Expected economic benefit of **$479M** over a 10-year period based on production cost.



Twin States Clean Energy Link

- **1,200 MW** bi-directional transmission capacity project between Quebec and New England.
- New England region will benefit from the increased balancing renewables, two way flows, and reliability.





VELCO transmission system

VELCO 345 kV peninsula

Increase New York Imports, NYPA
- Study of PV20 upgrade

New England Clean Power Link
- Transmission Facilitation Program
- Topic Area 3: Grid Innovation Program

Emerging Initiative, Grid United, HQ
- K42 corridor
- Bidirectional value study

Twin States Clean Energy Link, Nat. Grid
- Transmission Facilitation Program

THANK YOU REV2023 SPONSORS & EXHIBITORS!