

ISO New England Identifies Growing Fuel-Security Risk as the Power System Undergoes Rapid Transformation



*House Members of the Massachusetts Joint Committee
on Telecommunications, Utilities and Energy*

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PRESIDENT & CEO





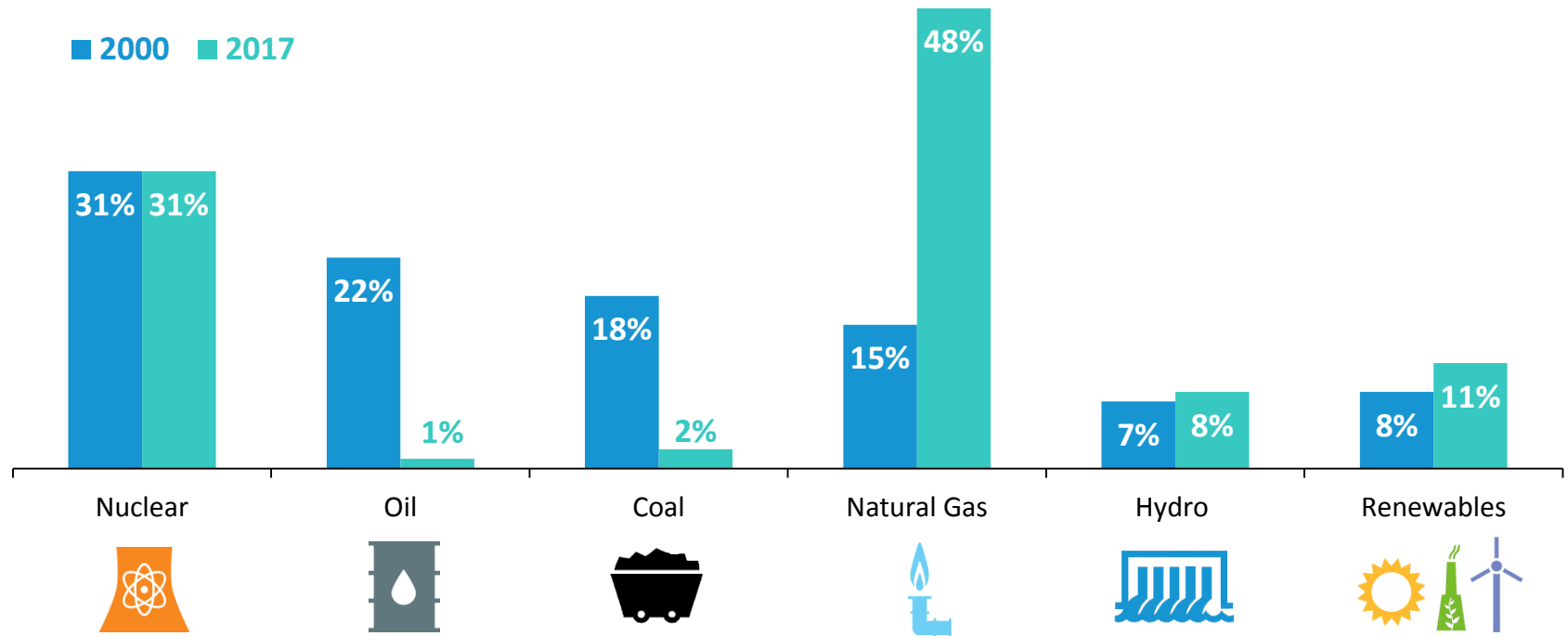
KEY MESSAGES

- The New England power system is changing rapidly
 - Shifting away from resources with stored fuels (coal, oil, nuclear) toward resources with just-in-time fuel (natural gas) and resources that are weather dependent (wind and solar)
- We need to ensure reliability through the transition, and firm up the delivery of energy during the winter
- The ISO's *operational analysis* and *experience* show the region trending in a negative direction with regard to fuel-security risk



New England Has Seen Dramatic Changes in the Energy Mix: *From Coal and Oil to Natural Gas*

Percent of Total **Electric Energy** Production by Fuel Type
(2000 vs. 2017)

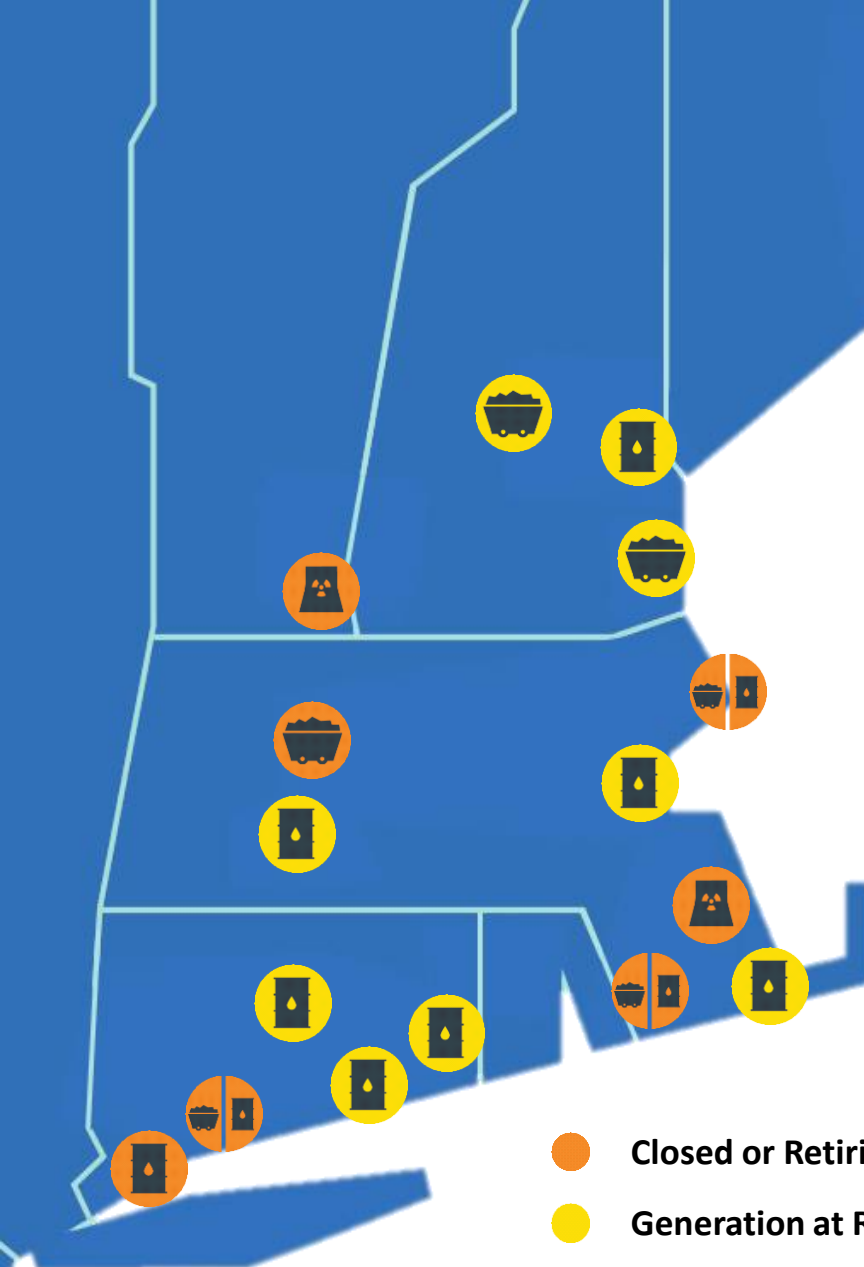


Source: ISO New England [Net Energy and Peak Load by Source](#)

Renewables include landfill gas, biomass, other biomass gas, wind, 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.



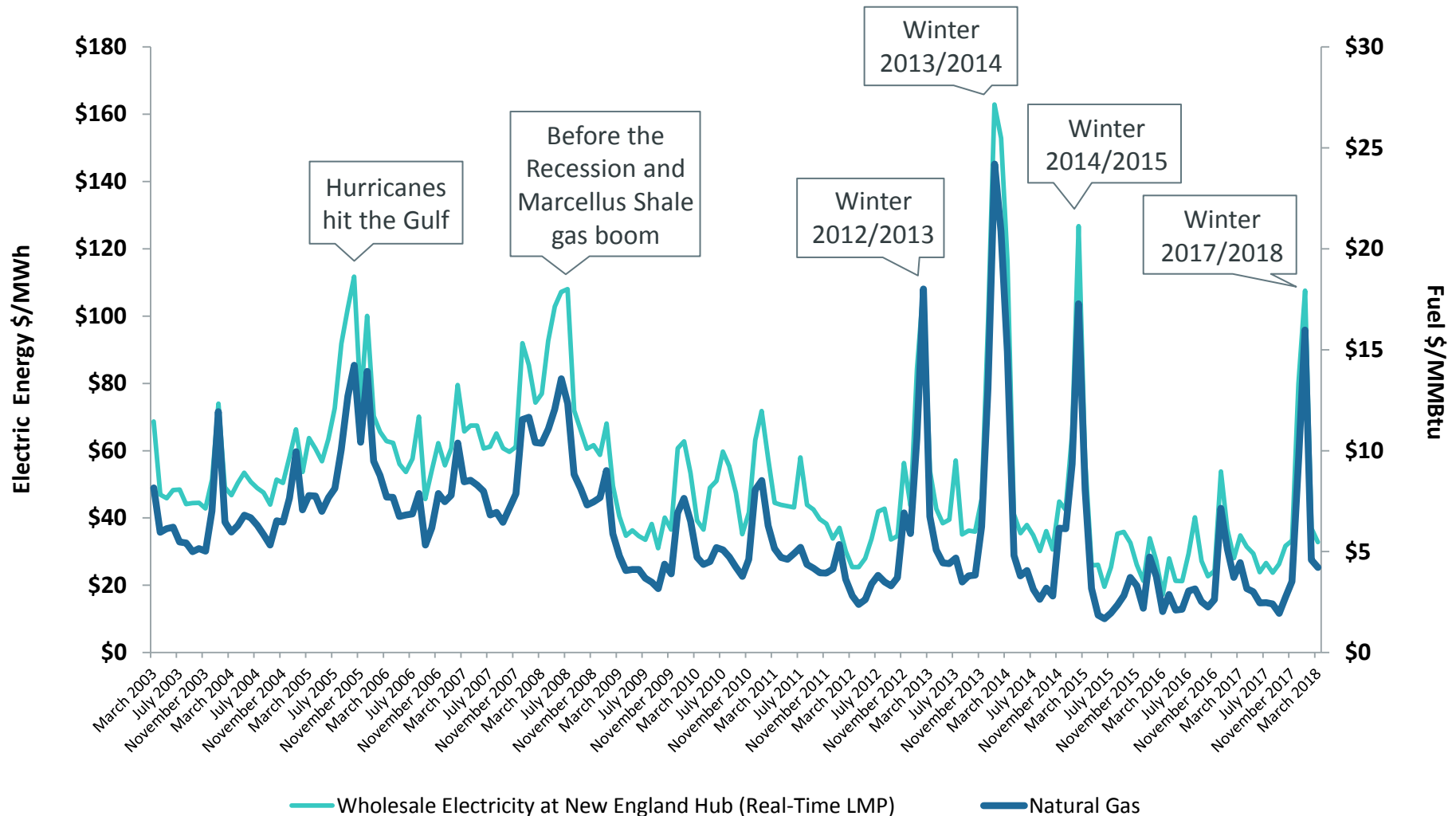
A map of New England (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island) is shown in blue. Various locations are marked with circular icons. Orange icons represent power plants that are closed or retiring, while yellow icons represent power plants that are at risk of retirement. The icons include symbols for coal (a train car), oil (a barrel), and nuclear (a reactor).

Since 2013, More Than 4,600 MW of Generation Have Retired or Announced Plans for Retirement in the Coming Years

- More than **5,000 MW** of remaining coal and oil are at risk of retirement
- These resources have played a **critical** role in recent winters when natural gas supply is constrained in New England

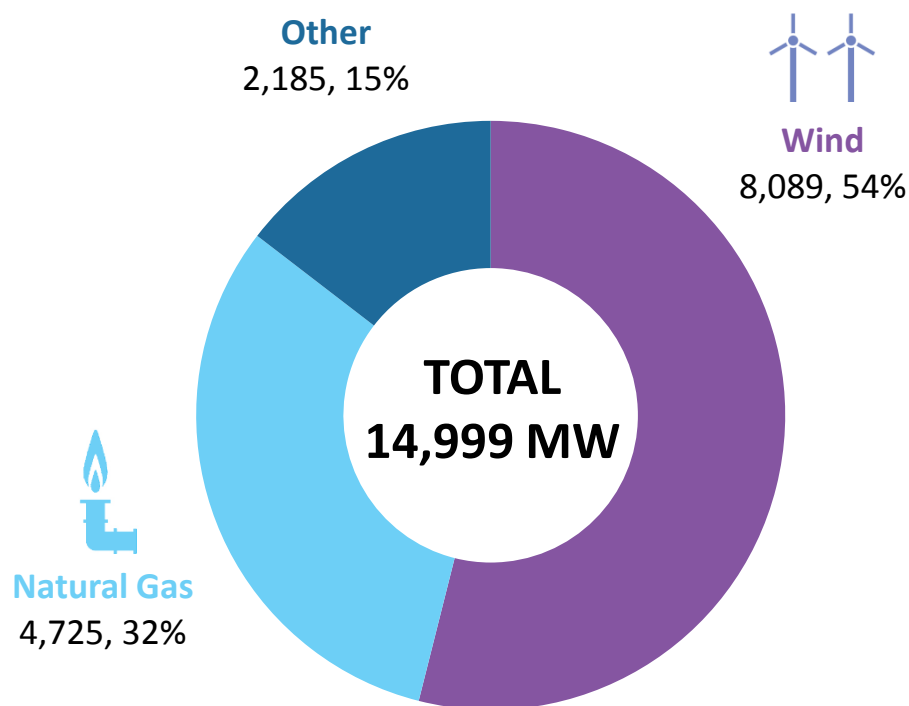
● Closed or Retiring
● Generation at Risk

Price Volatility Becomes More Acute as Infrastructure Constraints Become More Severe



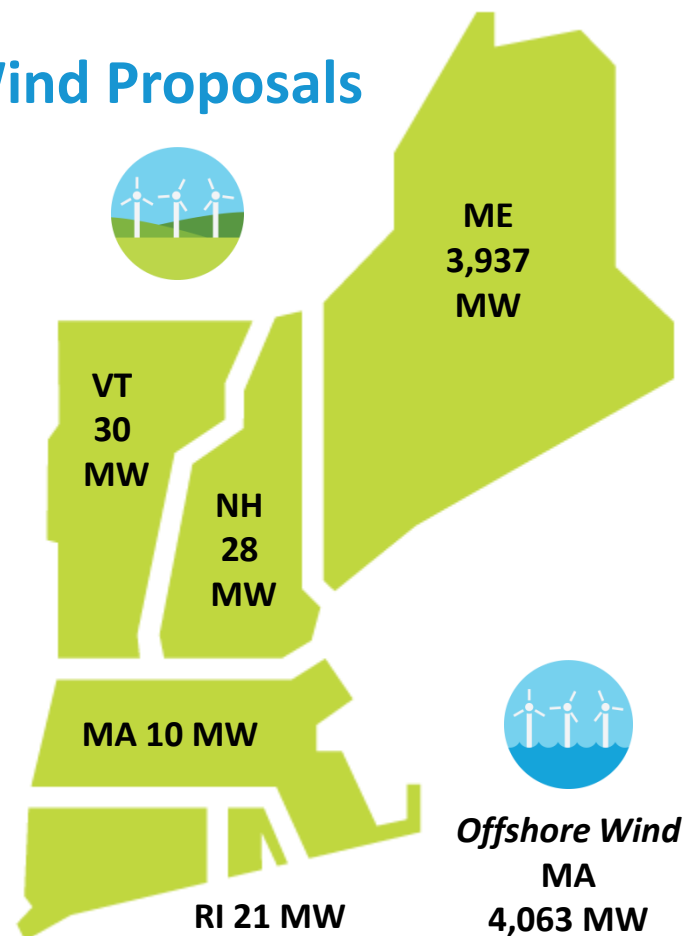
Wind Power Now Comprises More Than Half of New Resource Proposals in the ISO Interconnection Queue

All Proposed Generation



Source: ISO Generator Interconnection Queue (April 2018)
FERC and Non-FERC Jurisdictional Proposals; Nameplate Capacity Ratings
Note: Some natural gas proposals include dual-fuel units (oil). Other includes solar, battery storage, hydro, biomass, and fuel cell proposals.

Wind Proposals



Note: Some wind proposals include battery storage.



FUEL SECURITY

- Ensuring adequate fuel for generators is the most **pressing** challenge to future grid reliability
- Launched in the fall of 2016, ISO New England's *Operational Fuel-Security Analysis* (OFSA) was released in January 2018



Addressing Fuel-Security Risks Is Vital to Ensuring Reliability through the Grid's Rapid Transformation

- The analysis examines **23** possible fuel-mix combinations during the 2024-2025 winter, and quantifies each case's **fuel-security risk**
 - *i.e.*, the number and duration of energy shortfalls that would require implementation of emergency procedures to maintain reliability
- The study assumed **no** additional natural gas pipeline capacity to serve generators would be added during the study timeframe
- The study seeks to illustrate the **range of potential risks** that could confront the power system if fuel and energy were constrained during the winter



Study Suggests Six Major Conclusions



1. **Outages:** The region is vulnerable to the season-long outage of any of several major energy facilities.
2. **Key Dependencies:** As we retire more resources, reliability becomes heavily dependent on LNG and electricity imports; more dual-fuel capability is also a key reliability factor.
3. **Logistics:** Timely availability of fuel is critical, highlighting the importance of fuel-delivery logistics.
4. **Risk:** All but four of 23 scenarios result in load shedding, indicating a trend towards increased fuel-security risk.
5. **Renewables:** More renewables can help lessen fuel-security risk but are likely to drive oil-and coal-fired generator retirements, requiring high LNG imports to counteract the loss of stored fuels.
6. **Positive Outcomes:** Higher levels of LNG, imports, and renewables can minimize system stress and maintain reliability; delivery assurances for LNG and imports, as well as transmission expansion, will be needed.



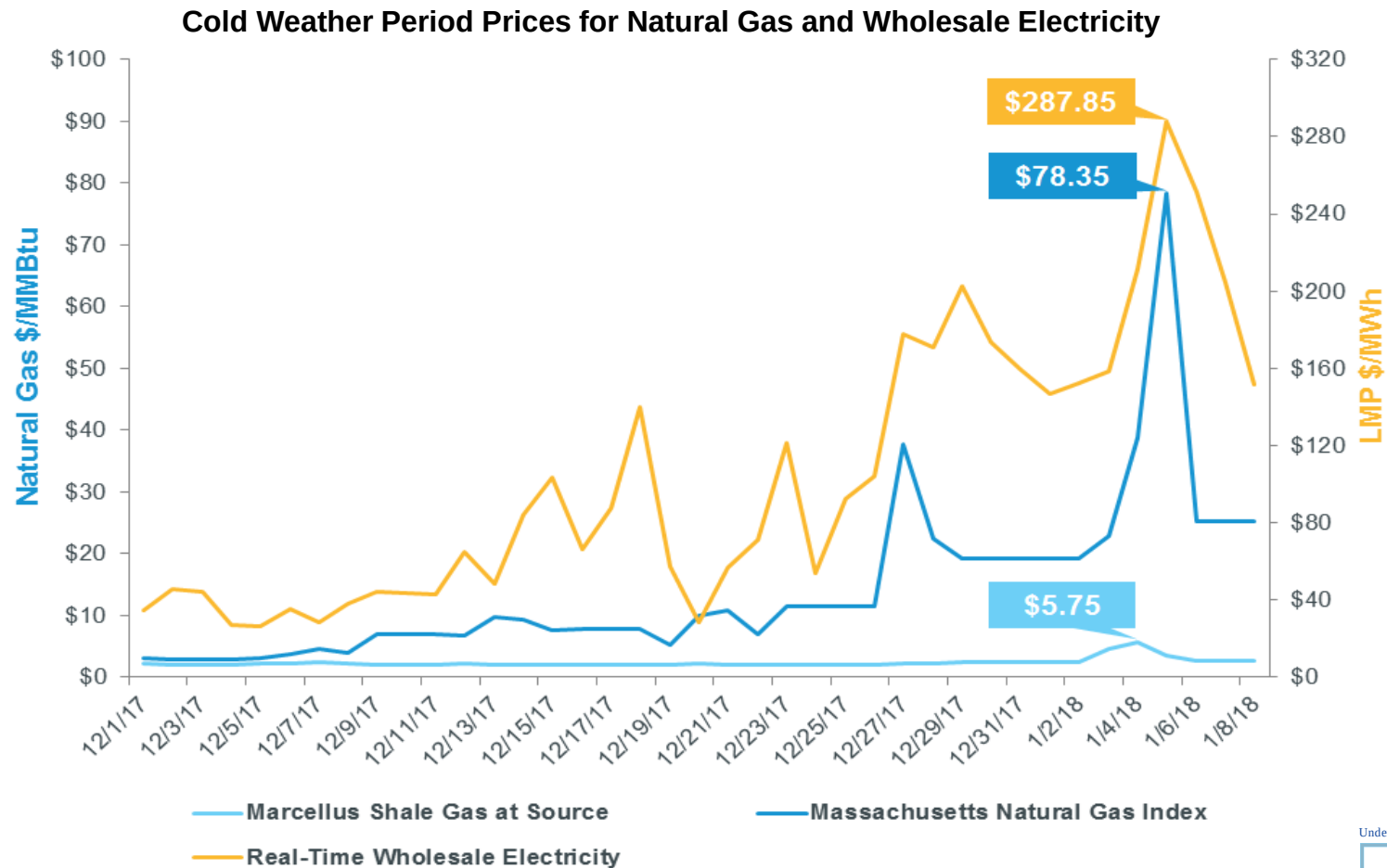
Recent Cold Weather Period Reinforces Findings in *Operational Fuel-Security Analysis*

- During the recent cold weather period (from December 26 to January 8), gas and oil **fuel price inversion** led to oil being in economic merit and base loaded, leading to rapid depletion of the region's oil supply
- Fuel delivery **logistics** became a concern
 - Heating customers get priority for oil and gas
 - Storms can delay trucked oil and LNG tankers
 - Truck drivers face restrictions on driving time
- With oil being base loaded, **emissions** limitations became a concern for several oil-fired generators



Frigid Cold Drove Up Regional Demand for Natural Gas

This led to spikes in natural gas prices, which then led to spikes in wholesale electricity prices; with natural gas at a premium, oil generation became economic



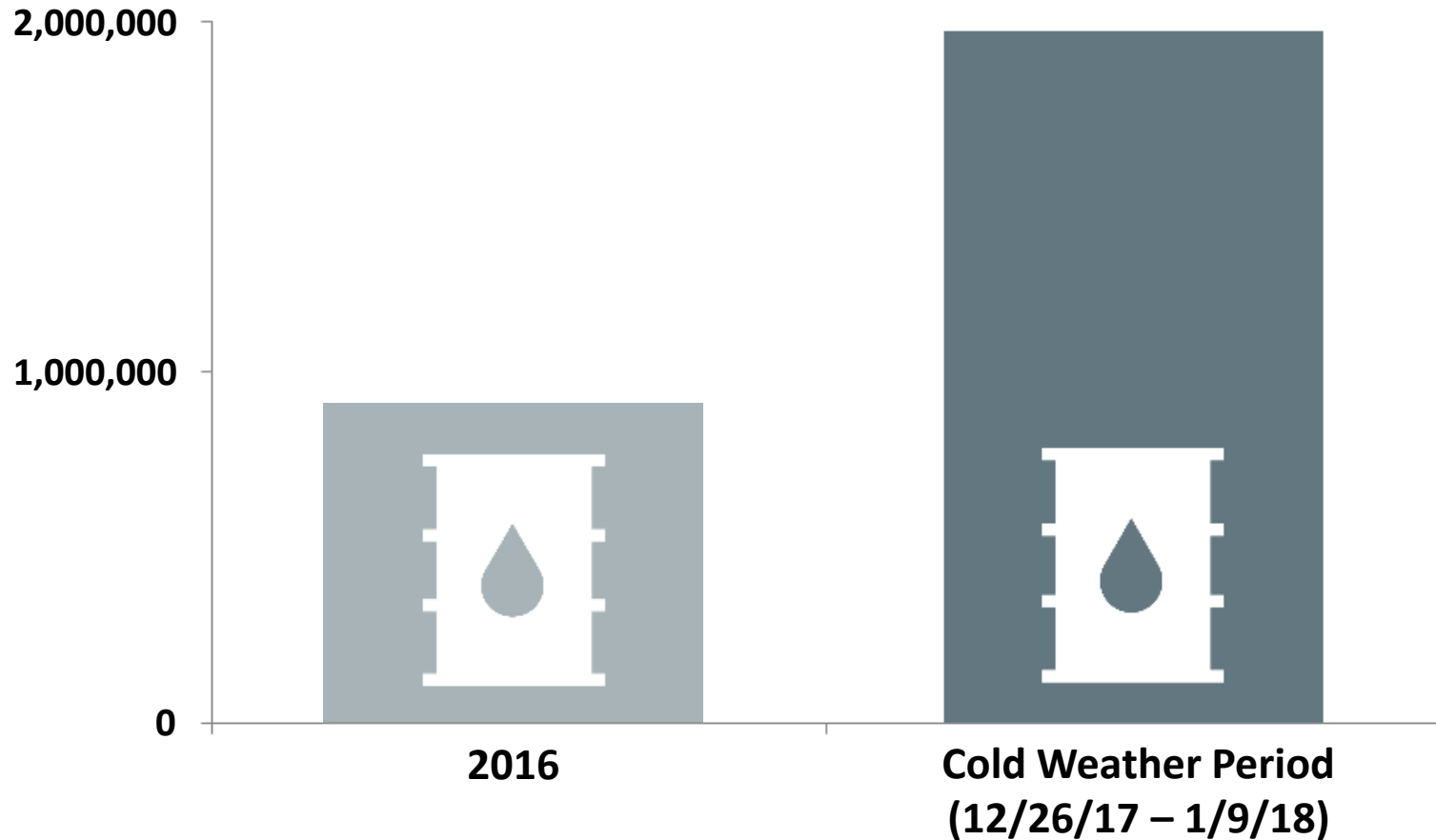
Underlying natural gas data furnished by:



Generators Burned 2 Million Barrels of Oil in 2 Weeks

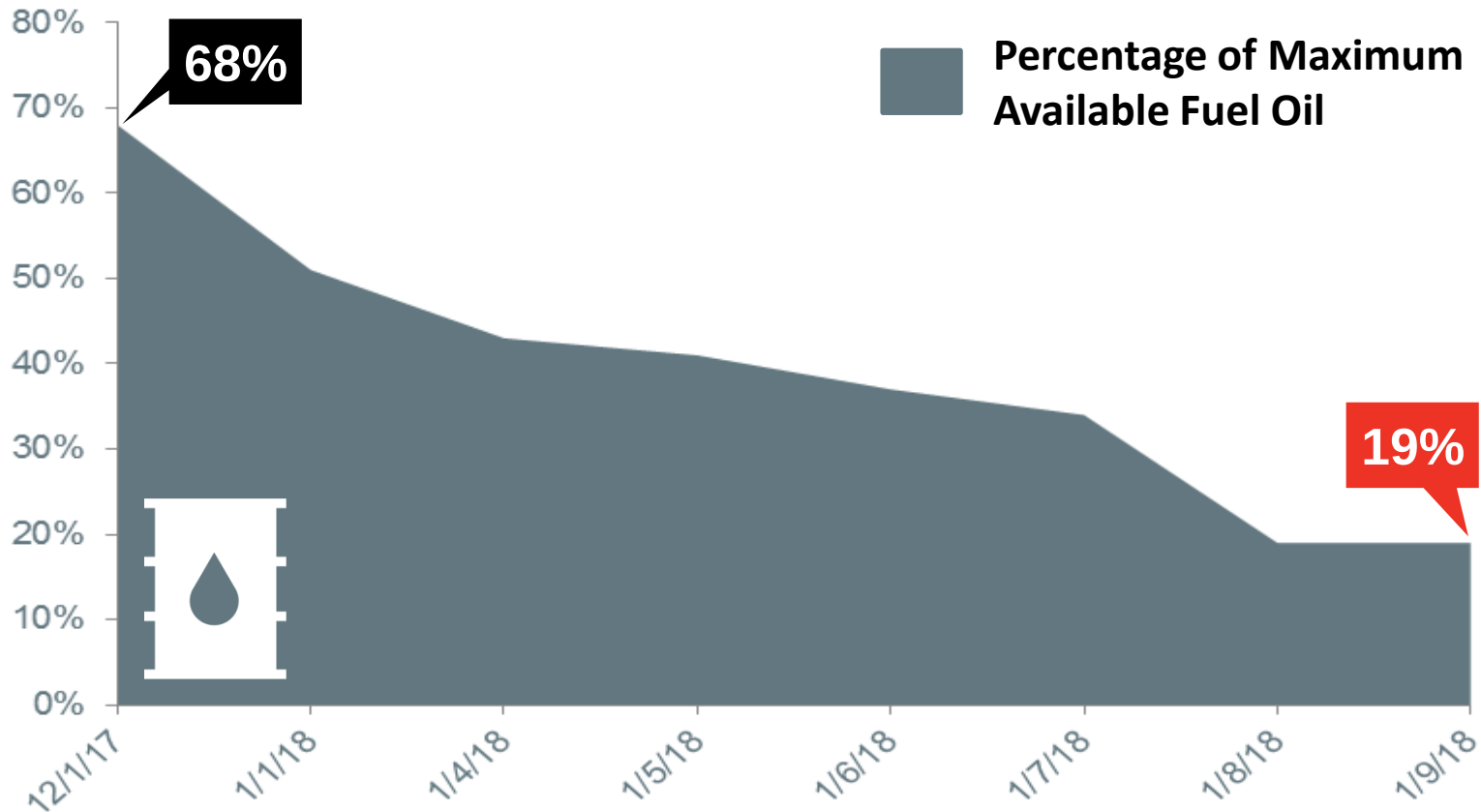
That's more than twice the amount of oil used in all of 2016

Barrels of Oil



Generators' Oil Inventories Declined Rapidly

Several large oil units were left with only enough fuel for a few more days, forcing the ISO to posture (hold back) units to conserve this fuel

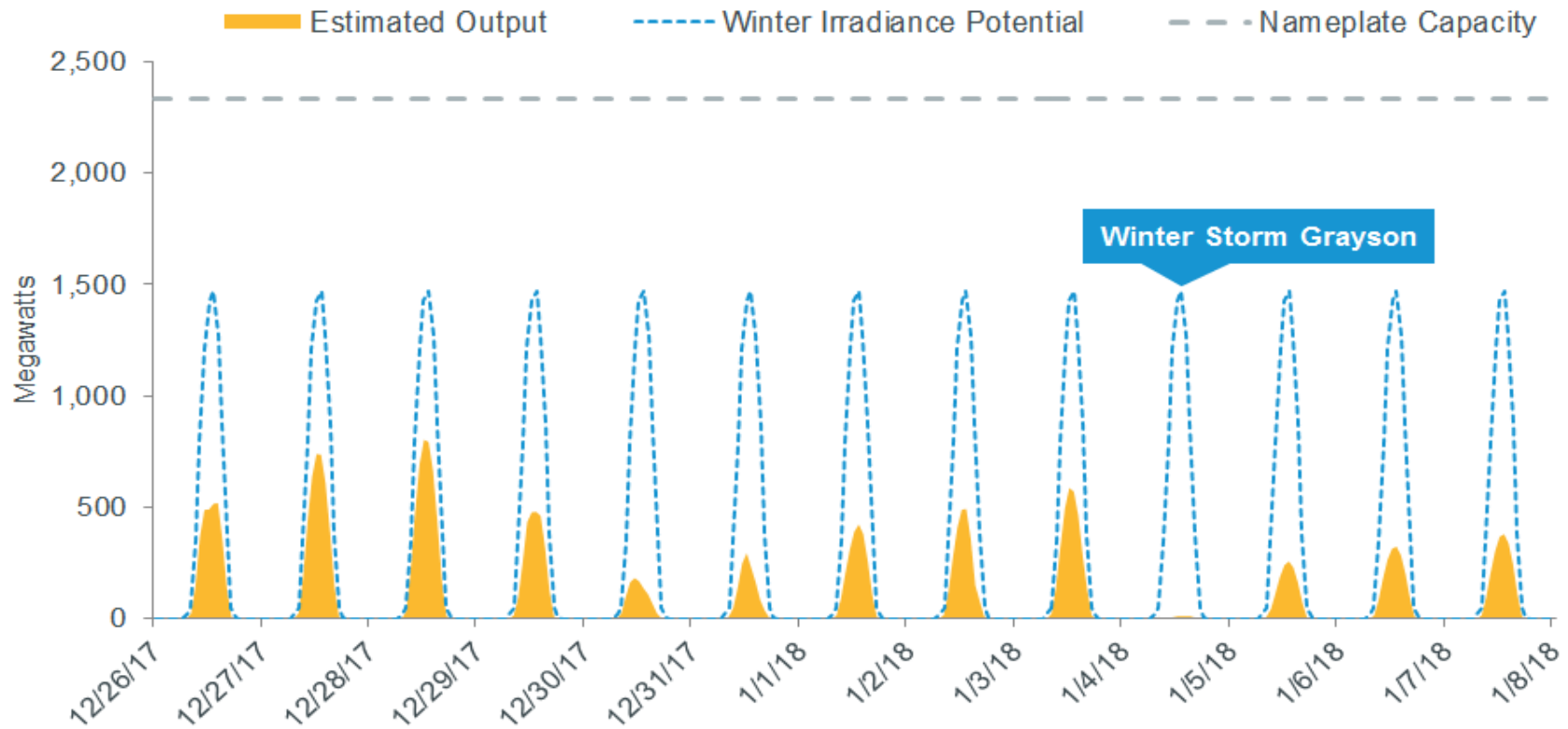


Note: This chart reflects the ISO's best approximation of usable oil, discounting unit outages, reductions, or emissions.

The Variability of Solar PV Was Also On Display

During the cold weather period, clouds and snow cover reduced output from regional solar power, adding to grid demand

Potential vs. Actual Estimated Output from Behind-the-Meter Solar Power



Note: Output derived from statistical sampling of actual meter readings.

Winter irradiance potential reflects the energy that PV capacity could produce at this time of year with clear skies and no snow cover.

Fuel Security Presents Structural, Regulatory, and Market-Design Challenges



- The ISO assumed fuel-security challenges could be addressed by **improving performance incentives** for generators and that additional fuel infrastructure would be built (e.g., dual fueling); however, investment in adequate fuel infrastructure has stalled
- A number of the states are creating **additional emissions restrictions**, further limiting the use of fossil-fired resources
- Fuel infrastructure is shared between heating and electric industries and **reaches capacity during cold weather**
 - Logistics of fuel deliveries become very complex and prone to congestion and delays, significantly increasing operational risk
 - Forward contracting is needed to ensure availability of infrastructure and timely provision of the commodity



Fuel Security Presents Structural, Regulatory, and Market-Design Challenges, *continued*



- Fuel suppliers have **insufficient incentives** to meet demand from *spot* customers (e.g., electric generators) during cold weather conditions
- The ISO has ***no jurisdiction over fuel infrastructure*** and has to seek fuel adequacy through appropriate incentives/obligations for generators, who generally do not have a long-term view on fuel supply
- Non-gas generation (and fuel infrastructure) is retiring in the **absence of sufficient incentives** to provide the reliability services needed during cold weather periods



Recent Retirement Announcements Trigger Immediate Action on Fuel Security

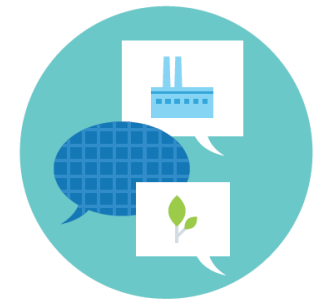


- Retirement de-list bids have been submitted for Units 7, 8, and 9 and the jet at the **Mystic Generating Station**, located in Boston, for the upcoming Forward Capacity Auction (FCA #13)
 - Units 8 and 9 are the primary customer for the DISTRIGAS LNG terminal that supplies both Mystic Station and the New England pipeline system
 - Exelon is in the process of acquiring the DISTRIGAS facility to ensure fuel supply for these units
- An updated fuel-security analysis shows that the loss of Units 8 and 9 and/or DISTRIGAS presents an **unacceptable risk to reliability**
- Exelon has stated that Units 8 and 9 will be retired unless it can recover its costs

Note: FCA #13 will be held in February 2019 for the resources needed during the June 1, 2022 – May 31, 2023 Capacity Commitment Period.



The ISO Is Pursuing Three Tracks to Address Fuel-Security Challenges



- Immediate: Seek a ***waiver from FERC*** to retain Mystic 8 and 9 to ensure fuel security (not currently allowed under the ISO tariff); Exelon will seek cost-of-service compensation through FERC
- Short-term: Working with stakeholders, develop ***criteria*** to retain resources for fuel security under the ISO tariff
 - File tariff changes by end of 2018 so they are in place before the March 2019 retirement de-list bid deadline for FCA #14
- Long-term: Working with stakeholders, develop a ***market-based solution*** that will ensure sufficient firm energy to maintain reliability in the winter
 - Needed resources and infrastructure will be ***compensated through the market***, rather than reliability contracts

Note: FCA #14 will be held in February 2020 for the resources needed during the June 1, 2023 – May 31, 2024 Capacity Commitment Period.



Closing Observations



- New England is trending toward a **riskier fuel-security profile** based on our historical experiences and the forward-looking results from the OFSA
- The **operational risk** manifests itself as a **lack of firm energy** during cold weather
- **The region is likely to remain exposed to winter energy constraints for the foreseeable future** – and the region will become more dependent on large volumes of LNG
- **Coordinating the timing of exit and entry of resources will be very challenging** – state-sponsored renewable resources will reduce energy market revenues over time, causing increases in capacity market revenues and gradual retirements of existing resources
- **Premature loss of existing non-pipeline-gas units will greatly exacerbate operational risks** – Exelon's plans to retire Mystic units in 2022 accelerates discussions on fuel security



Discussion: How Do the States Want to Position the Region in the Long Term?



- How does the region ensure **reliable and firm sources of energy** when the power system is stressed by very cold weather?
- Should policymakers **alleviate the winter energy constraints** that drive reliability risks, price volatility, and higher emissions during very cold weather?
- Can the states shape their **resource procurements** to meet both policy goals and alleviate winter reliability challenges?



Questions



APPENDIX



ISO New England (ISO) Has Two Decades of Experience Overseeing the Region's Restructured Electric Power System

- **Regulated** by the Federal Energy Regulatory Commission
- **Reliability Coordinator** for New England under the North American Electric Reliability Corporation
- **Independent** of companies in the marketplace and **neutral** on technology



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

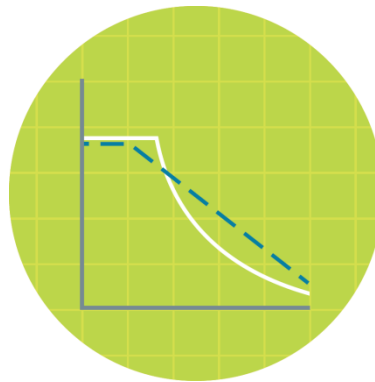
Grid Operation

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



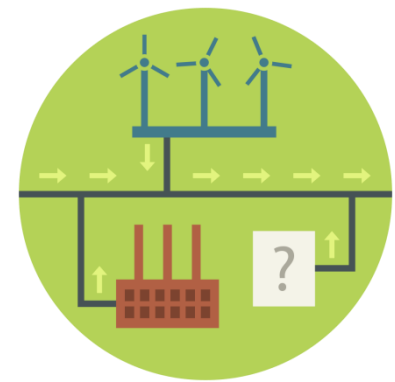
Market Administration

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



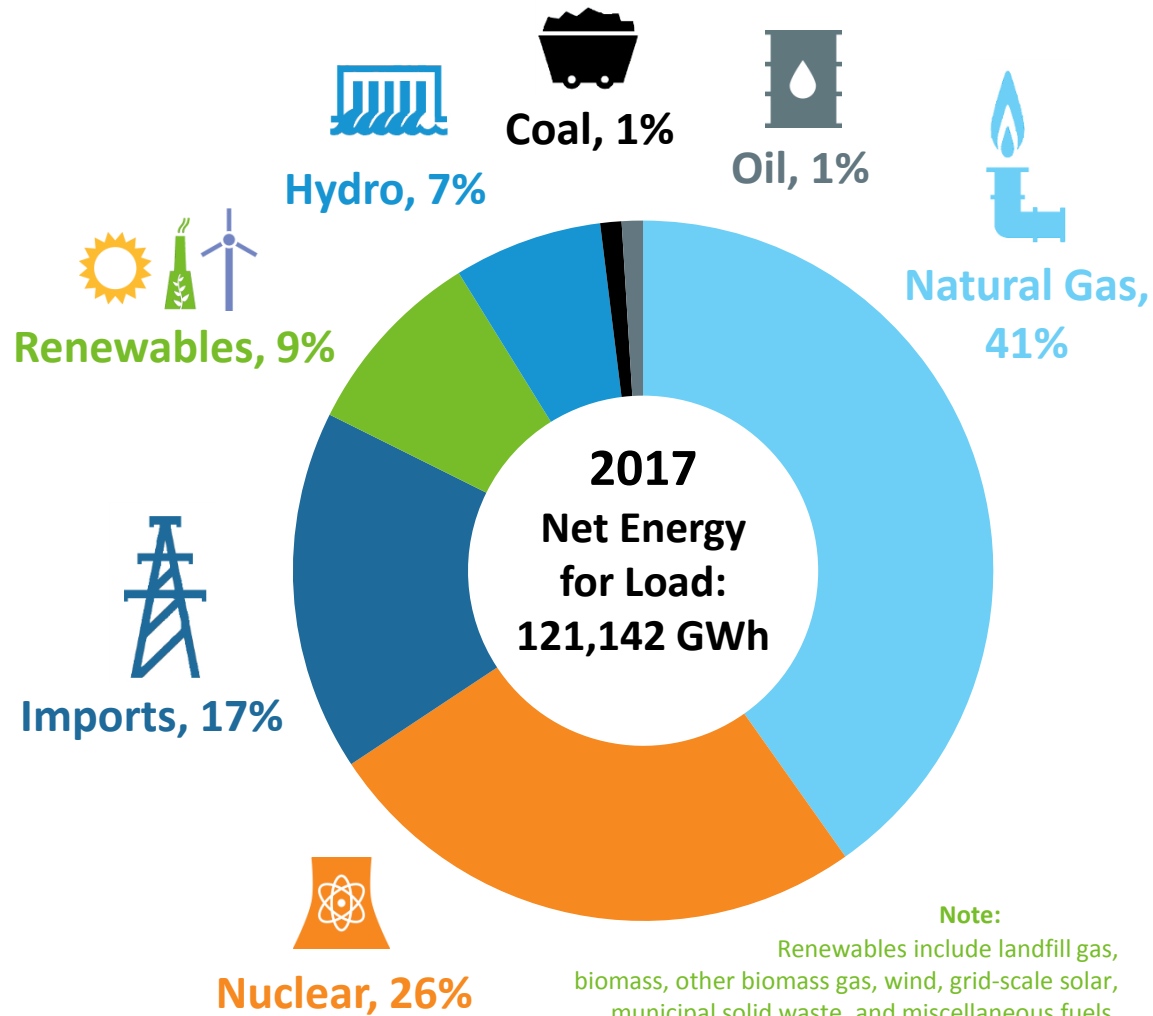
Power System Planning

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



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

- In 2017, 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

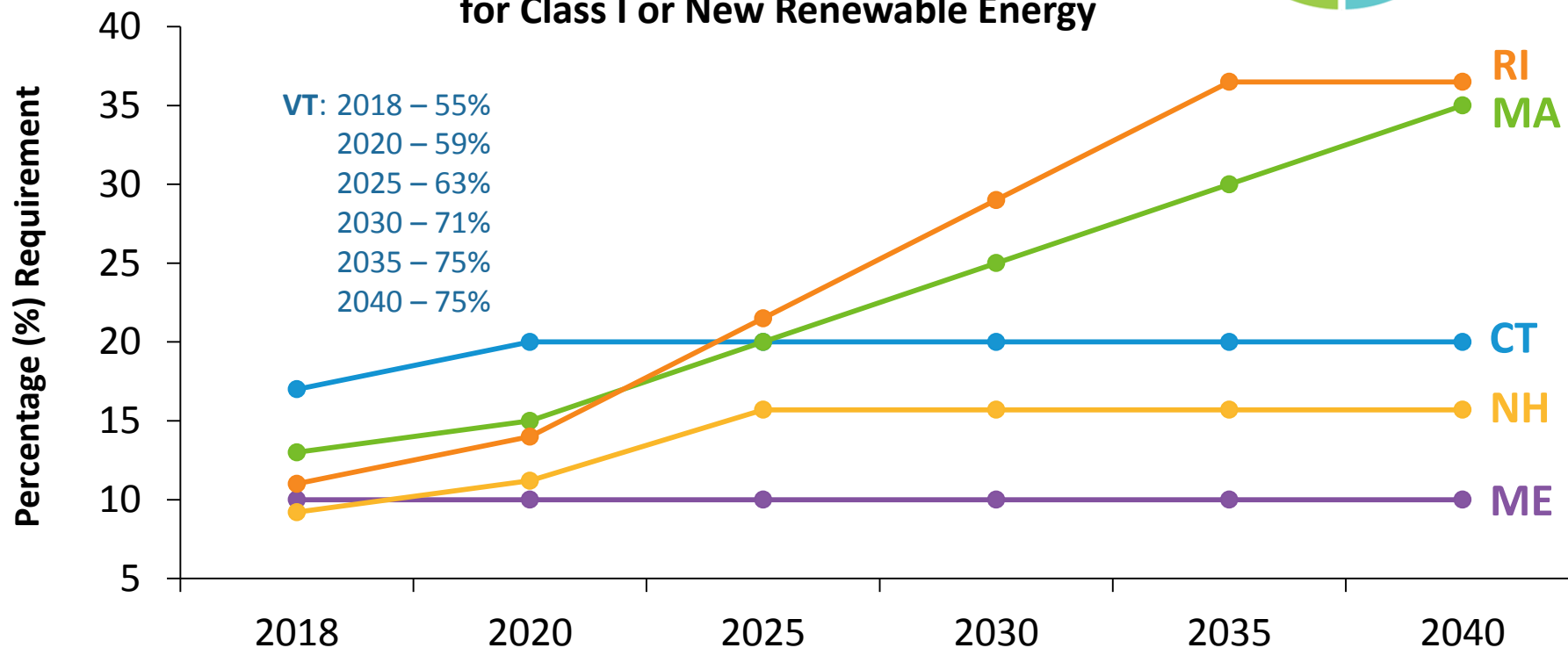


Renewable Energy Is on the Rise

State policy requirements are a major driver



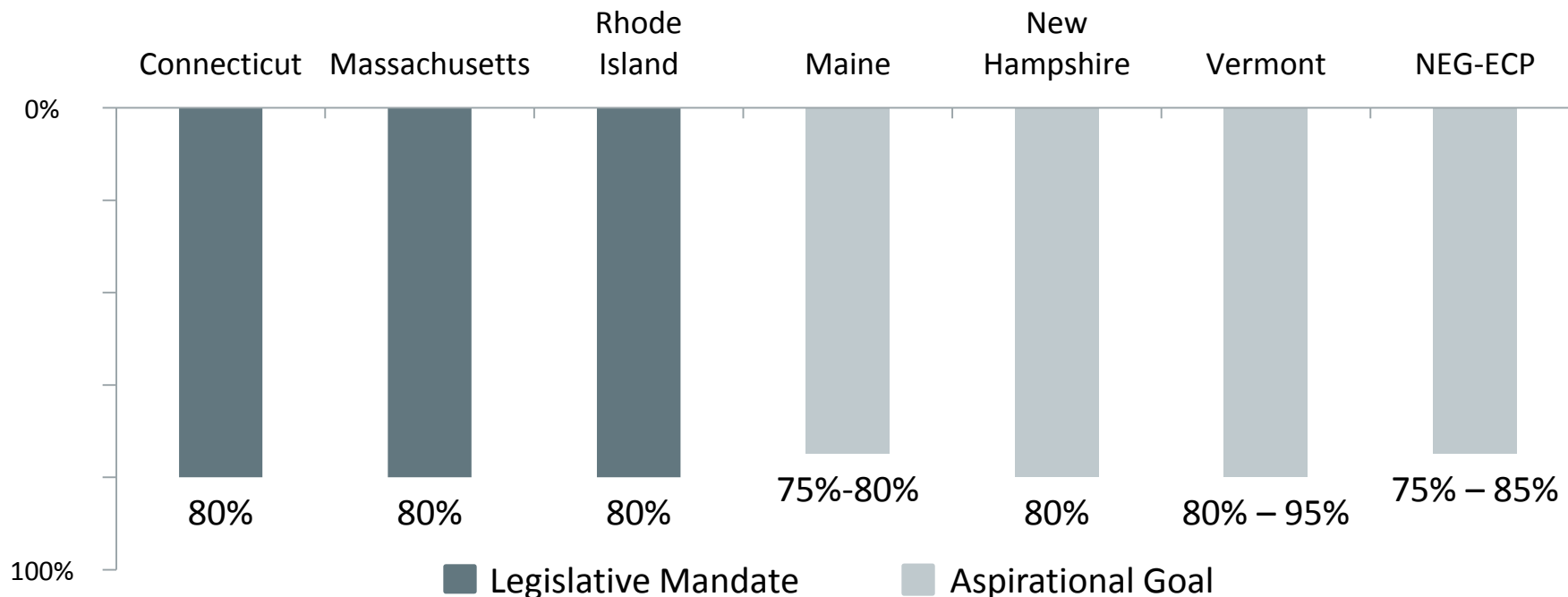
State Renewable Portfolio Standard (RPS)* for Class I or New Renewable Energy



Notes: Connecticut's Class I RPS requirement plateaus at 20% in 2020. Maine's Class I RPS requirement plateaus at 10% in 2017 and expires in 2022 (but has been held constant in this chart for illustrative purposes). Massachusetts' Class I RPS requirement increases by 1% each year after 2020 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 plateaus at 36.5% in 2035. Vermont's 'total renewable energy' requirement plateaus at 75% in 2032; it recognizes all forms of new and existing renewable energy and is unique in classifying large-scale hydropower as renewable.

States Have Set Goals for Reductions in Greenhouse Gas Emissions: *Some Mandated, Some Aspirational*

Percent Reduction in Greenhouse Gas (GHG) Emissions Economy Wide by 2050*



The New England states are promoting GHG reductions on a state-by-state basis, and at the regional level, through a combination of legislative mandates (e.g., CT, MA, RI) and aspirational, non-binding goals (e.g., ME, NH, VT and the New England Governors and Eastern Canadian Premiers).

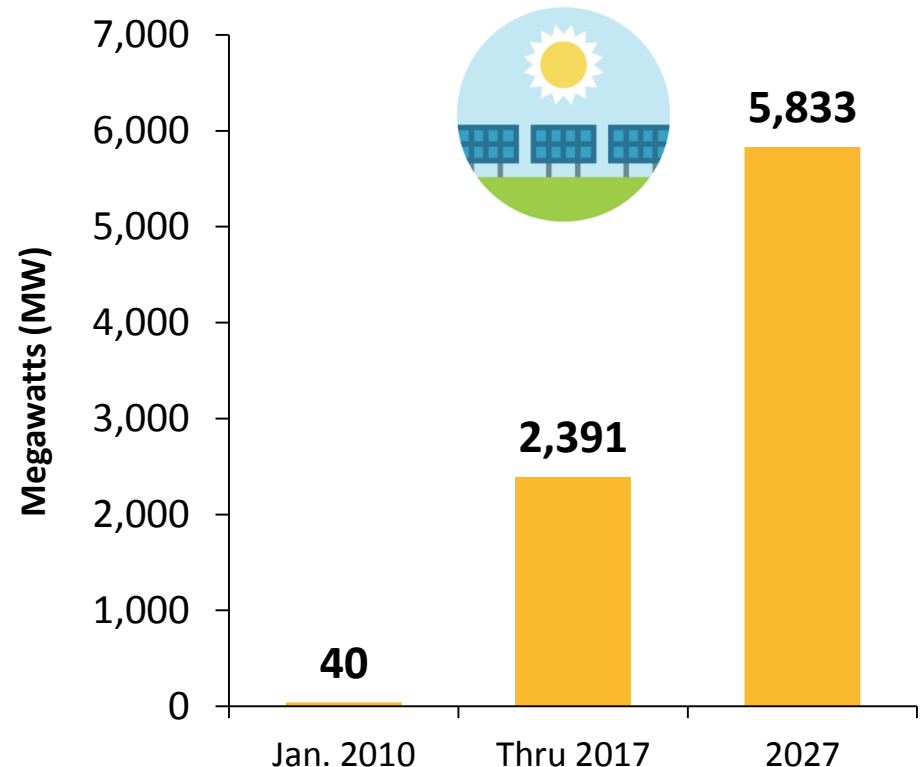
* MA, RI, NH, and VT use a 1990 baseline year for emissions reductions. CT and the NEG-ECP use a 2001 baseline. ME specifies reductions below 2003 levels that *may* be required “in the long term.” For more information, see the following ISO Newswire article: <http://isonewswire.com/updates/2017/3/1/the-new-england-states-have-an-ongoing-framework-for-reducin.html>.

New England Has Seen Significant Growth in Solar PV, and More Is on the Way

December 2017 Solar PV
Installed Capacity (MW_{ac})

State	Installed Capacity (MW _{ac})	No. of Installations
Connecticut	365.6	29,512
Massachusetts	1,602.3	78,047
Maine	33.5	3,598
New Hampshire	69.7	7,330
Rhode Island	62.2	4,148
Vermont	257.2	9,773
New England	2,390.5	132,408

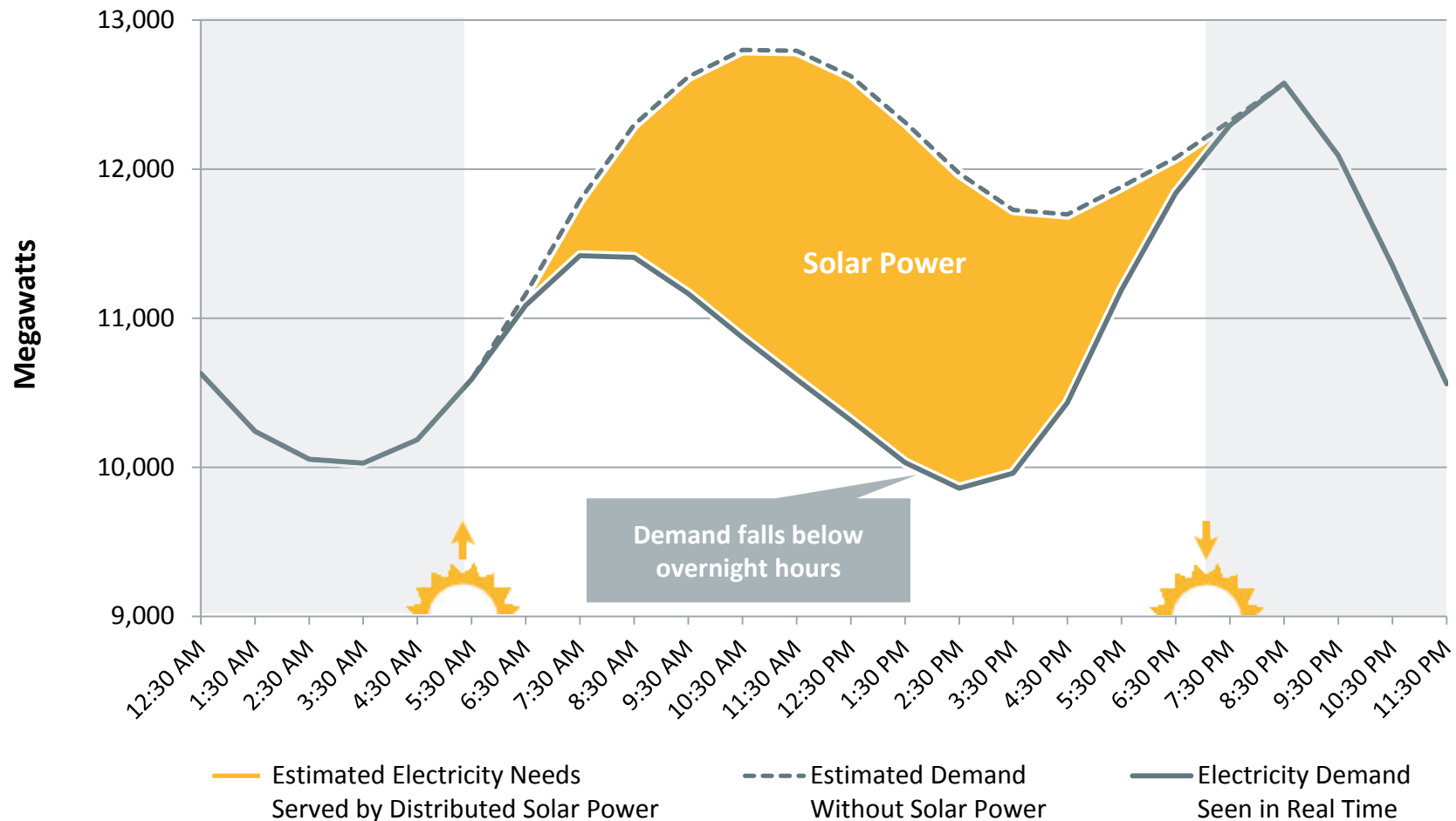
Cumulative Growth in Solar PV
through 2027 (MW_{ac})



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." Source: [Final 2018 PV Forecast](#) (March 2018); MW values are AC nameplate.

Historic Dip in Midday Demand with Record-High Solar Power Output on April 21, 2018

At 1:30 p.m., behind-the-meter solar reduced grid demand by more than 2,300 MW



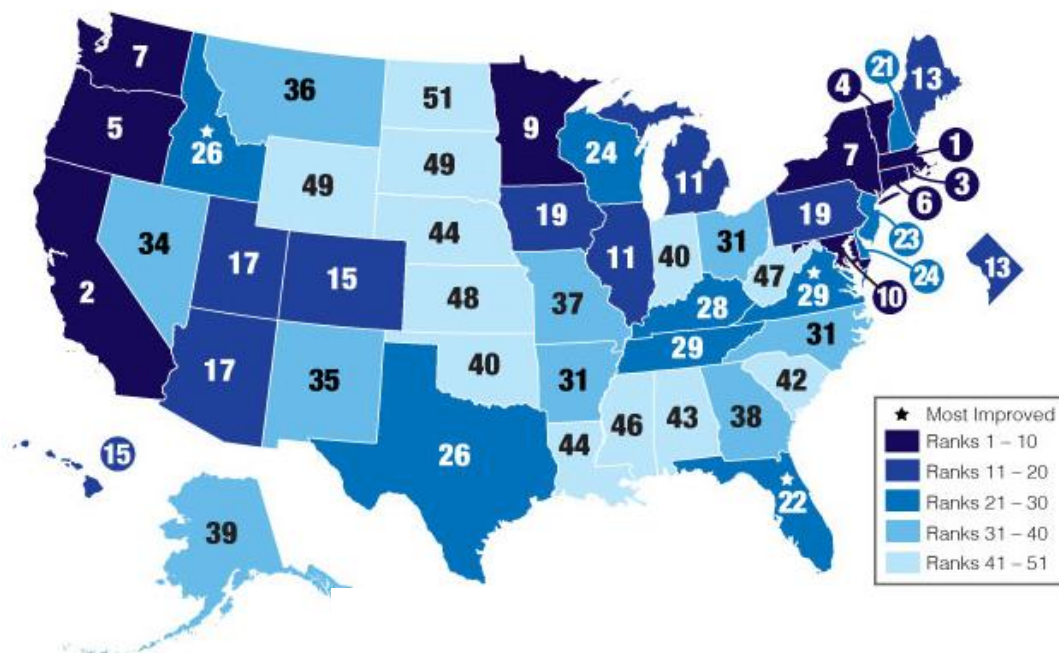
New Energy Storage Technologies Add to Region's Existing Pumped-Storage Facilities

- **20 MW** of grid-scale battery storage projects have come on line since late 2015
- More than **500 MW** of grid-scale energy storage are requesting interconnection
- New England has a successful history of operating the region's two large pumped-storage facilities, which can supply **1,800 MW** of power within 10 minutes for up to 7 hours



Energy Efficiency Is a Priority for State Policymakers

2017 State Energy-Efficiency (EE) Scorecard



Source: American Council for an Energy-Efficient Economy

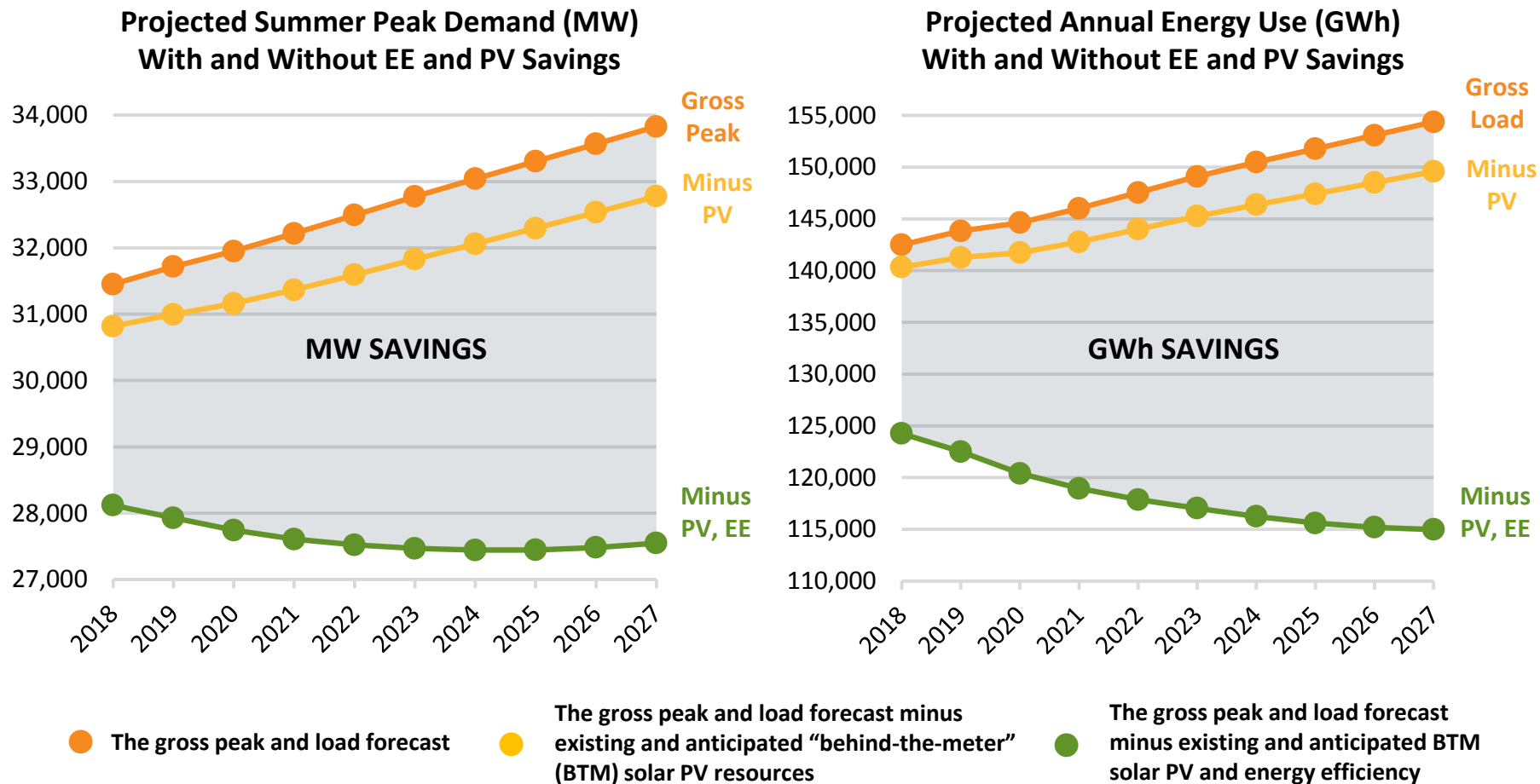
Ranking of state EE efforts by the *American Council for an Energy-Efficient Economy*:

- Massachusetts 1
- Rhode Island 3
- Vermont 4
- Connecticut 6
- Maine 13
- New Hampshire 21

- Billions spent over the past few years and more on the horizon
 - Nearly \$4.9 billion invested in EE from 2011 to 2016
 - ISO estimates \$7.1 billion to be invested in EE from 2022 to 2027



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



Note: Summer peak demand is based on the “90/10” forecast, which accounts for the possibility of extreme summer weather (temperatures of about 94° F).

Source: [ISO New England 2018-2027 Forecast Report of Capacity, Energy, Loads, and Transmission](#) (2018 CELT Report) (April 2018)

Economy-Wide Decarbonization Could Increase Grid Demand

- Increased adoption of electric vehicles (EVs) and greater use of electric heating could drive more demand for electricity
- The ISO plans to work with regional stakeholders this year to quantify the impact of the states' decarbonization policies on long-term demand for power



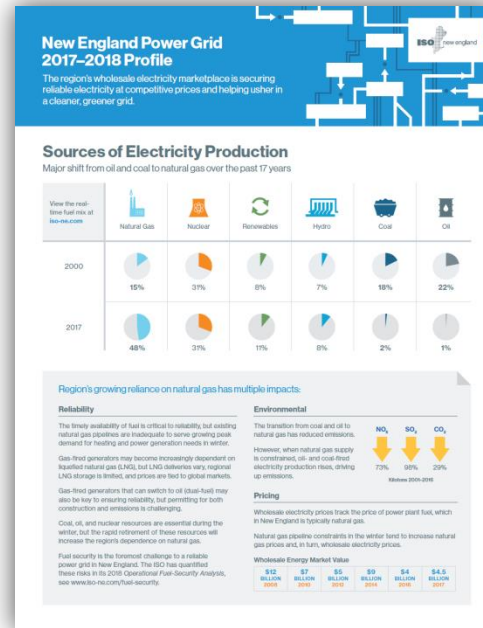
A “Hybrid Grid” Is Emerging

The region is changing how it generates, delivers, and uses electricity

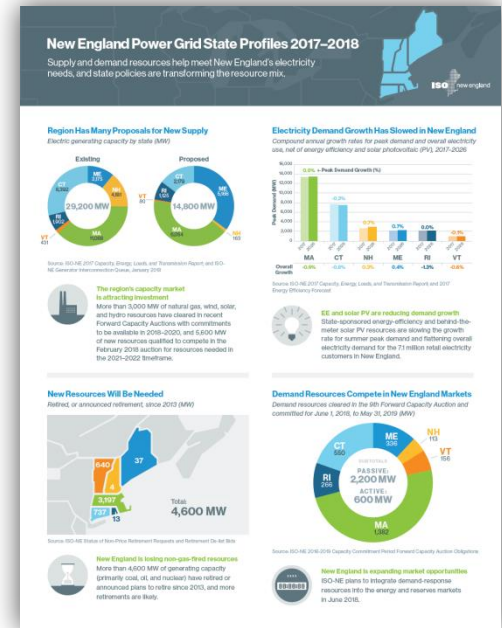
- Large grid-connected power resources + thousands of small “behind-the-meter” resources
- Changes in how much grid energy people use and when they use it
- Significant amounts of variable generation and some battery storage
- Two-way grid communications



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



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



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

You Are Invited to the June 14 CLG Meeting!

Transitioning from Energy Efficiency to the Efficient Use of Energy – What Does it Mean for Consumers?

- Consumer Liaison Group (CLG) meetings are:
 - A **forum** for sharing information between ISO New England and electricity consumers in New England
 - **Developed** by the CLG Coordinating Committee and **facilitated** by ISO New England
 - **Free** and **open** to the public
- Registration for the June 14 meeting is available now

Save the Date!

New England Consumer Liaison Group (CLG)

June 14, 2018
Noon — 3:30 p.m.

[DoubleTree Westborough Hotel](#)
5400 Computer Drive – Westborough, MA
P | 508.366.5511

Keynote Speaker: TBD

Panel Discussion

Transitioning from Energy Efficiency to the Efficient Use of Energy – What Does it Mean for Consumers?

And a presentation from ISO New England

The CLG is the consumers' voice in the electric industry.
Meetings are free and open to the public.
For more information on the CLG, please visit the [CLG webpage](#).

 Questions? Contact Mary Louise "Weezie" Nuara:
413.540.4481 or mnuara@iso-ne.com

Register at: <https://www.iso-ne.com/event-details?eventId=135359>

For More Information...

- Subscribe to the **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**
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