

DECEMBER 12, 2017 | HARTFORD, CT



Resource Developments and Transformation of the New England Electric Grid

Connecticut Power and Energy Society

Stephen Rourke

VICE PRESIDENT, SYSTEM PLANNING



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

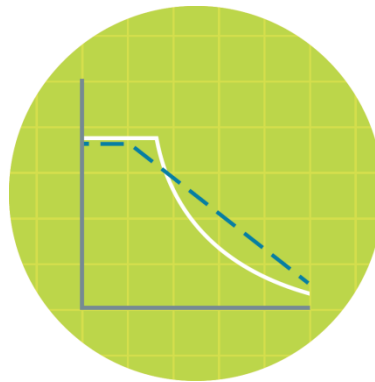
Grid Operation

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



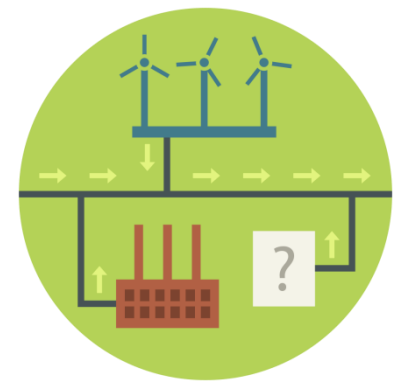
Market Administration

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



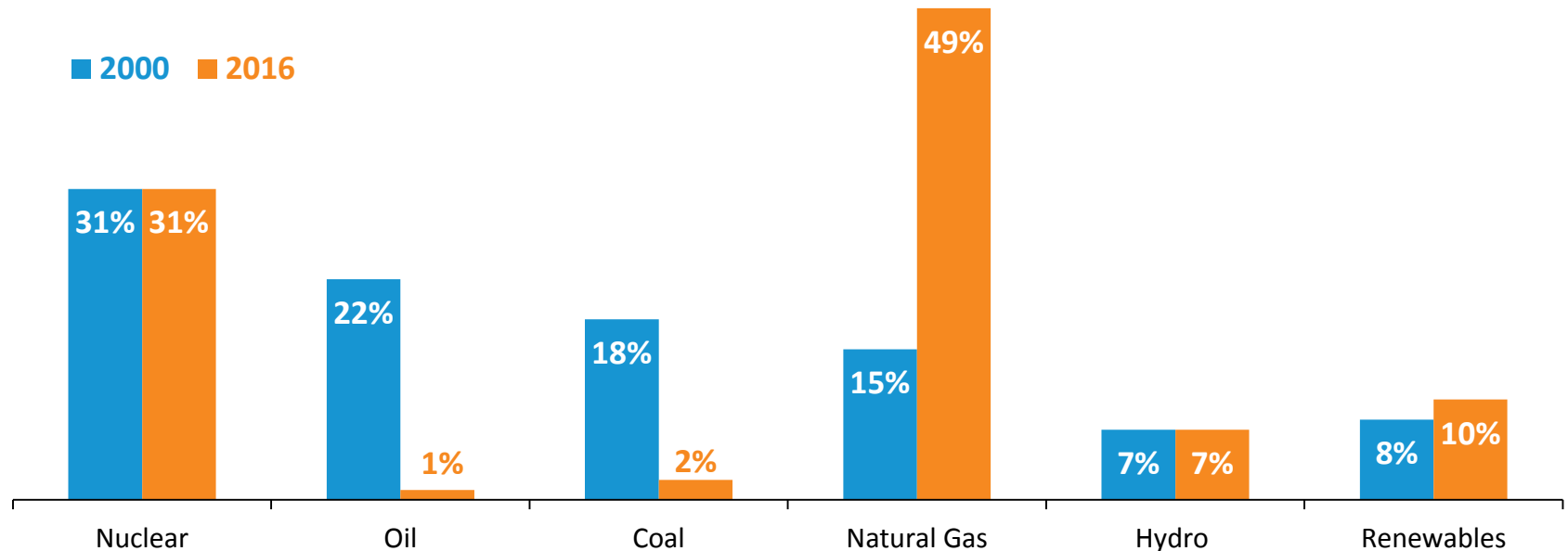
Power System Planning

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



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. 2016)



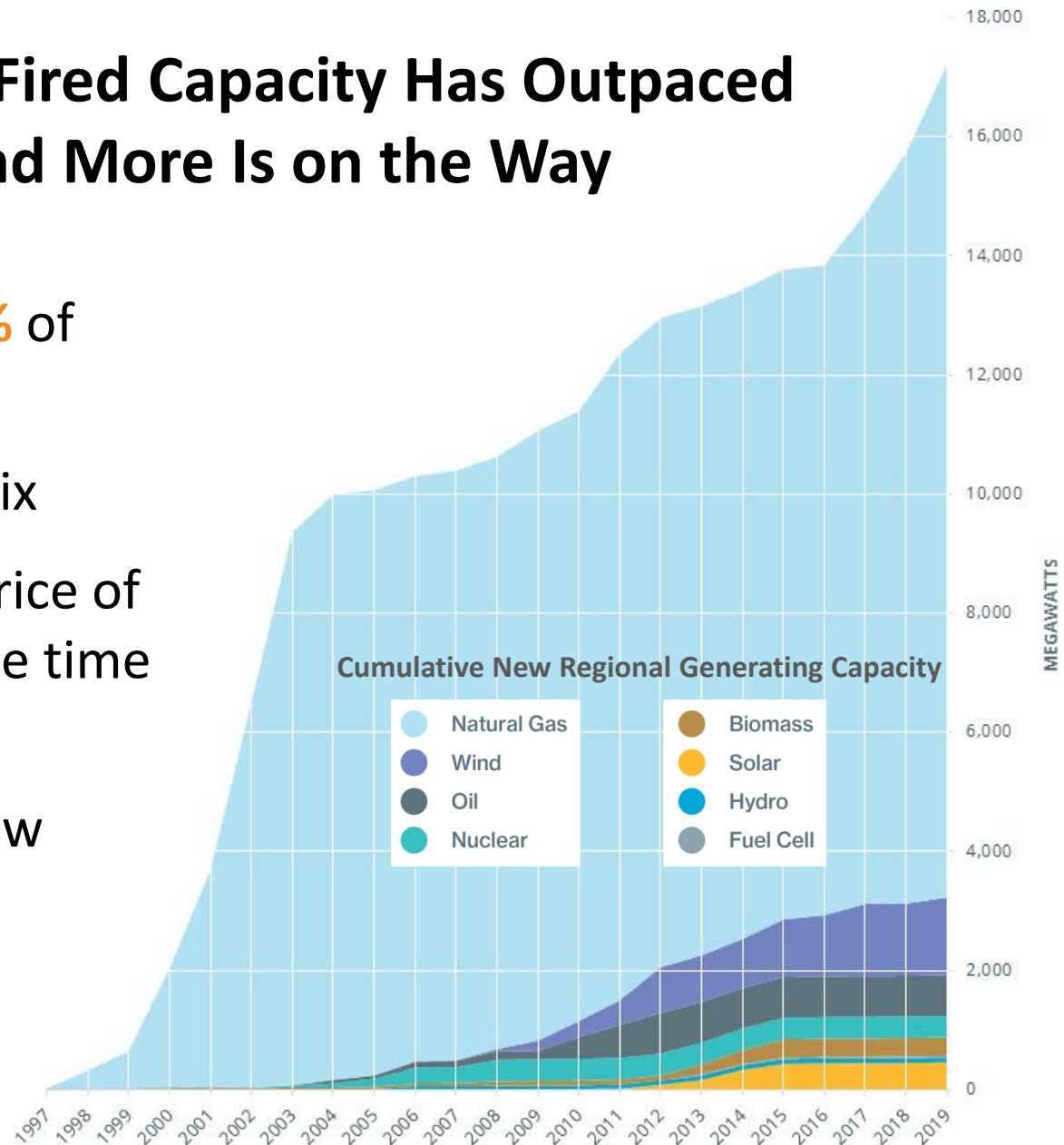
Source: ISO New England [Net Energy and Peak Load by Source](#)

Renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and miscellaneous fuels



Investment in Gas-Fired Capacity Has Outpaced All Other Fuels—and More Is on the Way

- Primary fuel for **44%** of installed capacity
- **49%** of 2016 fuel mix
- Sets the real-time price of electricity **75%** of the time
- Accounts for nearly **35%** of proposed new generating capacity



Note: New generating capacity for years 2017–2019 includes resources clearing in recent Forward Capacity Auctions.

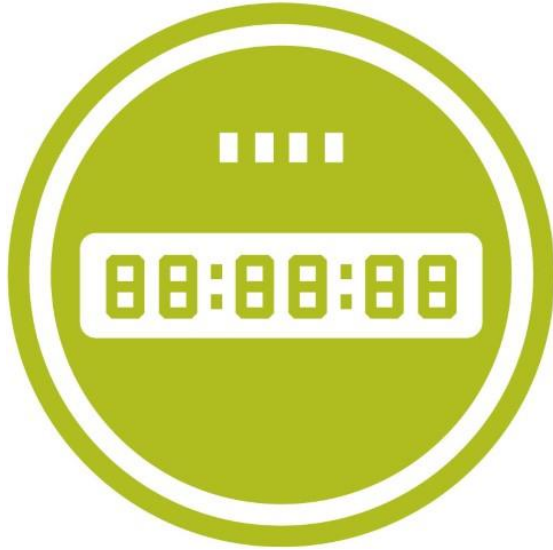
The Region Has Lost—and *Is at Risk of Losing*—Substantial Non-Gas Resources

Major Generator Retirements:

- **Salem Harbor Station (749 MW)**
 - 4 units (coal & oil)
- **Norwalk Harbor Station (342 MW)**
 - 3 units (oil)
- **Mount Tom Station (143 MW)**
 - 1 unit (coal)
- **Vermont Yankee Station (604 MW)**
 - 1 unit (nuclear)
- **Brayton Point Station (1,535 MW)**
 - 4 units (coal & oil)
- **Pilgrim Nuclear Power Station (677 MW)**
 - 1 unit (nuclear)
- **Bridgeport Harbor Station (564 MW)**
 - 2 units (coal & oil)
- *Additional retirements are looming*



The Forward Capacity Market Is Attracting New Resources Amid Retirements



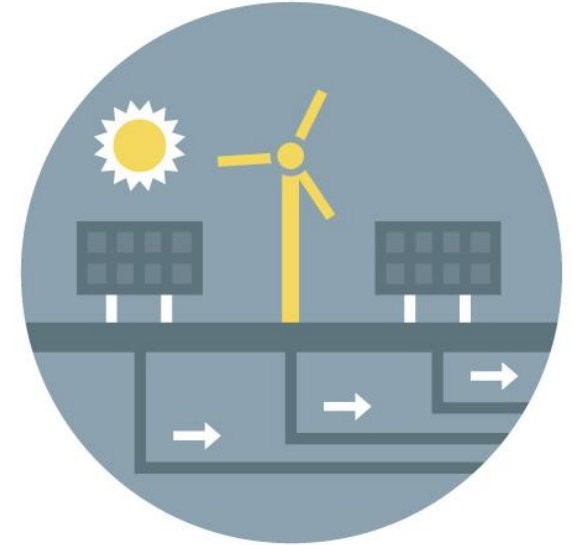
Demand Resources

energy-efficiency
and active demand
response resources



Natural Gas Resources

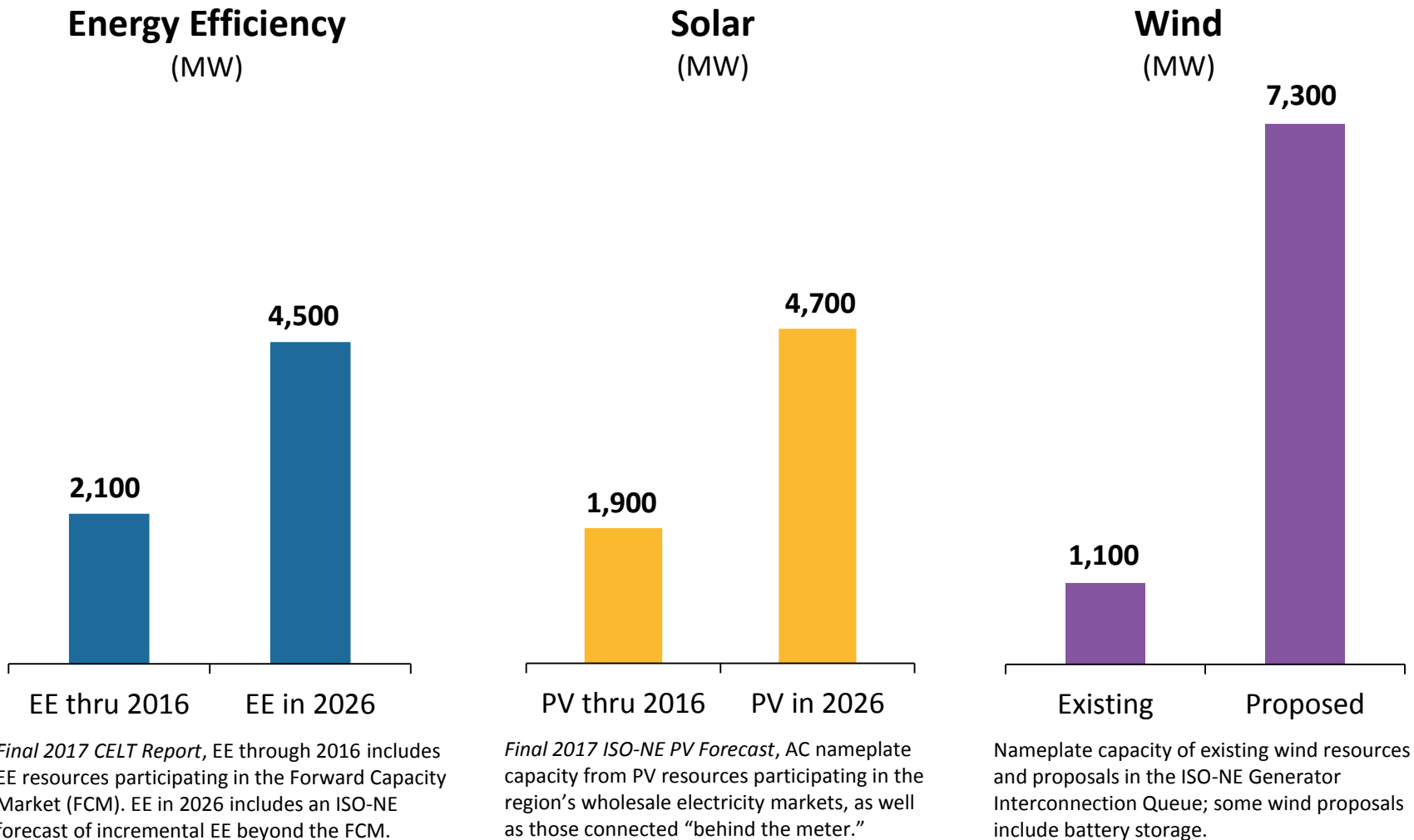
efficient and fast-starting
gas resources, many with
dual-fuel capability



Renewable Resources

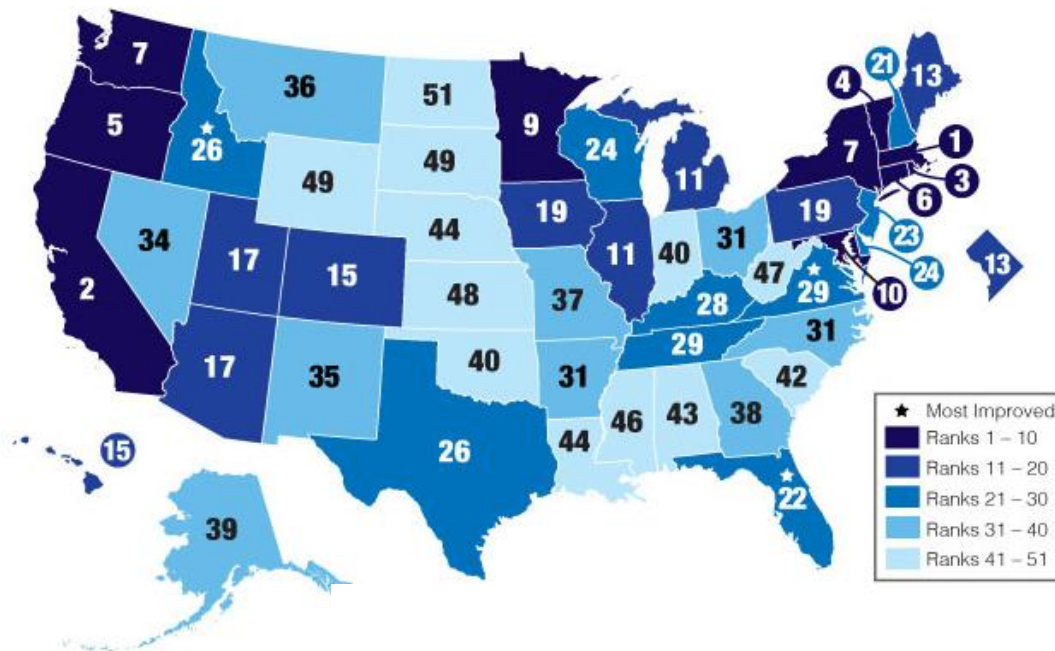
onshore and offshore
wind, solar photovoltaics,
and fuel cells

Energy-Efficiency and Renewable Resources Are Trending Up in New England



Energy Efficiency Is a Priority for State Policymakers

2017 State Energy-Efficiency Scorecard



Source: American Council for an Energy-Efficient Economy

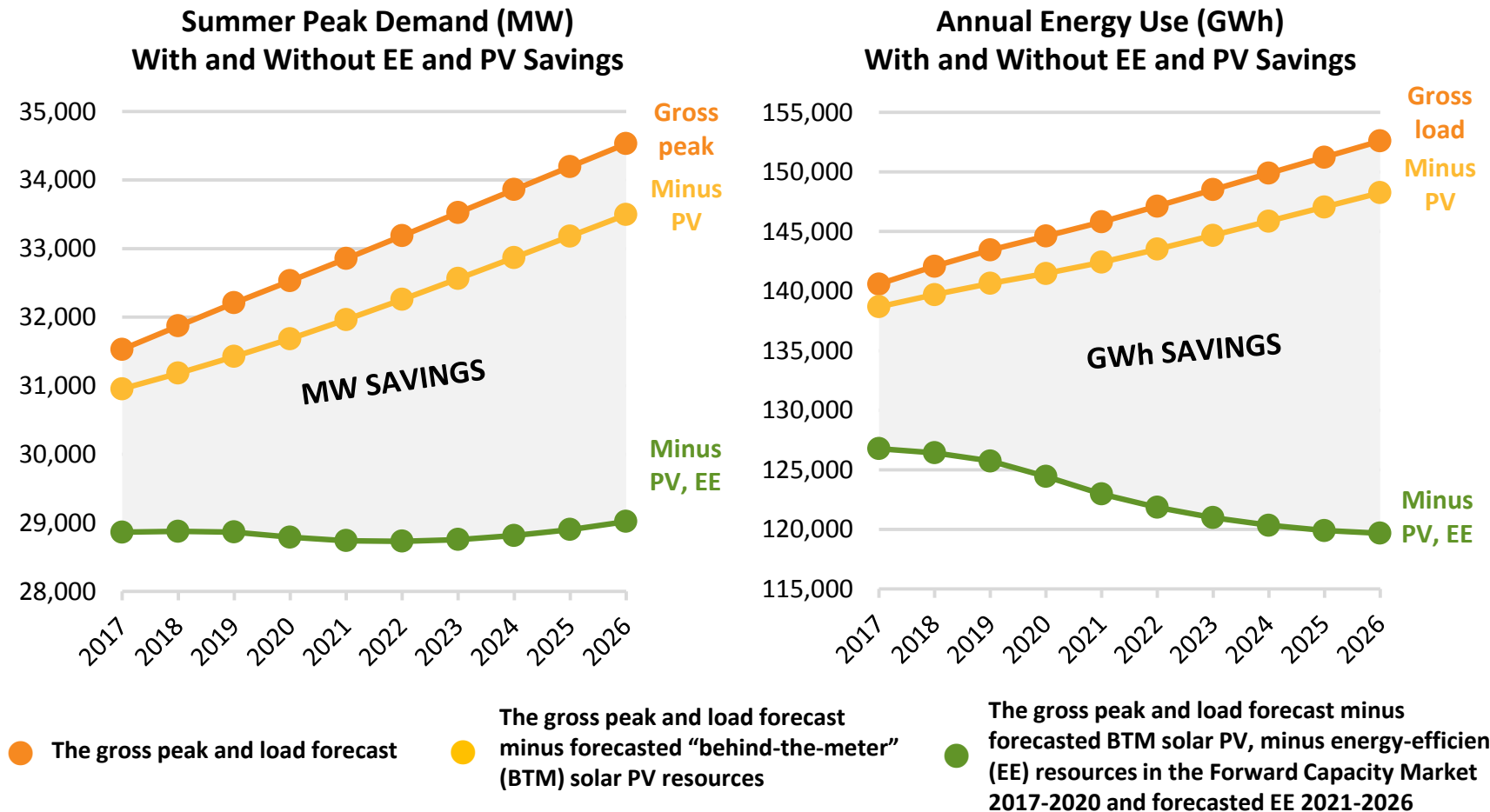
Ranking of state EE efforts by the *American Council for an Energy-Efficient Economy*:

- 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 \$4.5 billion invested from 2010 to 2015
 - ISO estimates \$7.2 billion to be invested in EE from 2021 to 2026

Energy Efficiency and Behind-the-Meter Solar Impact

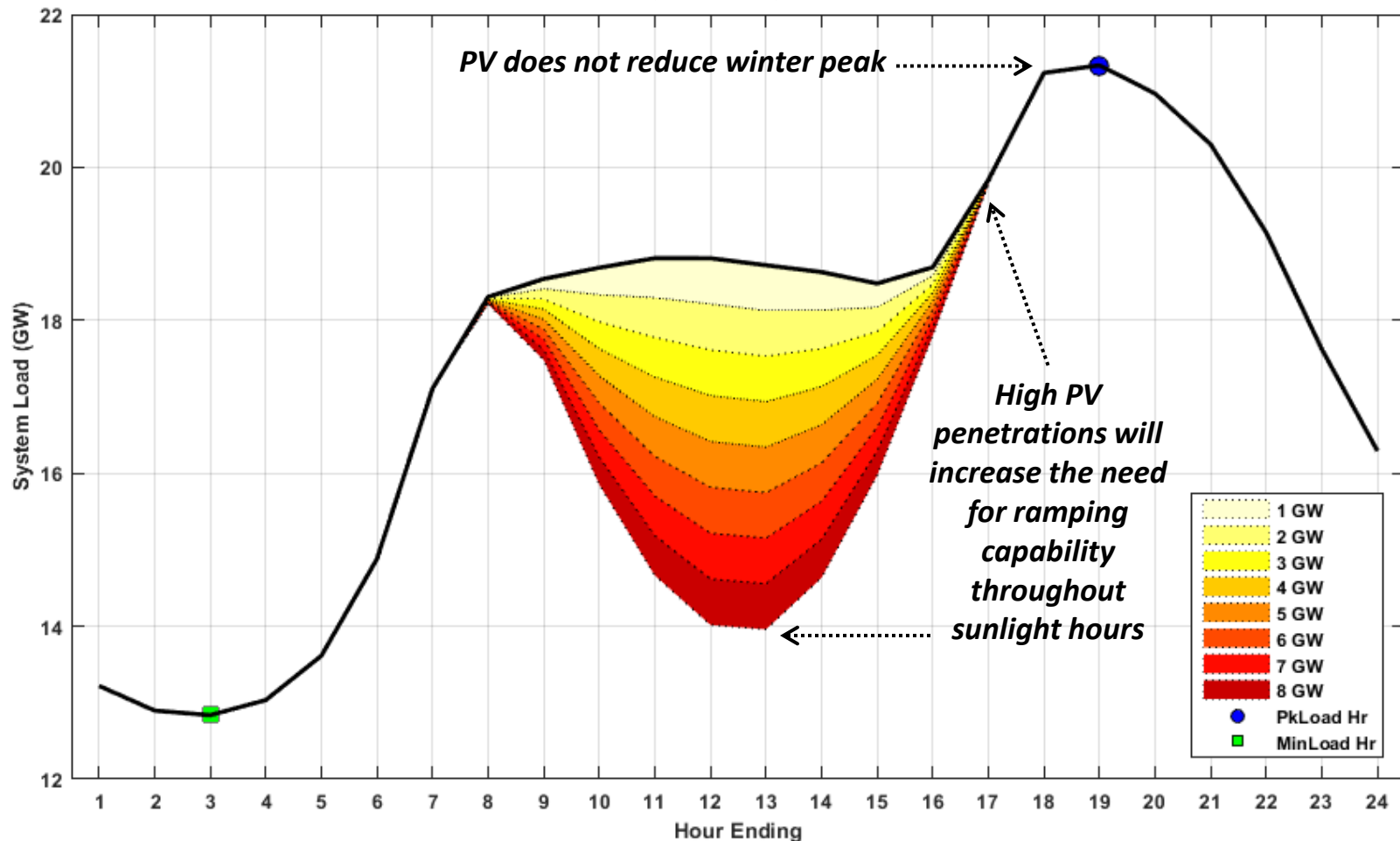
Peak Demand and Annual Energy Use



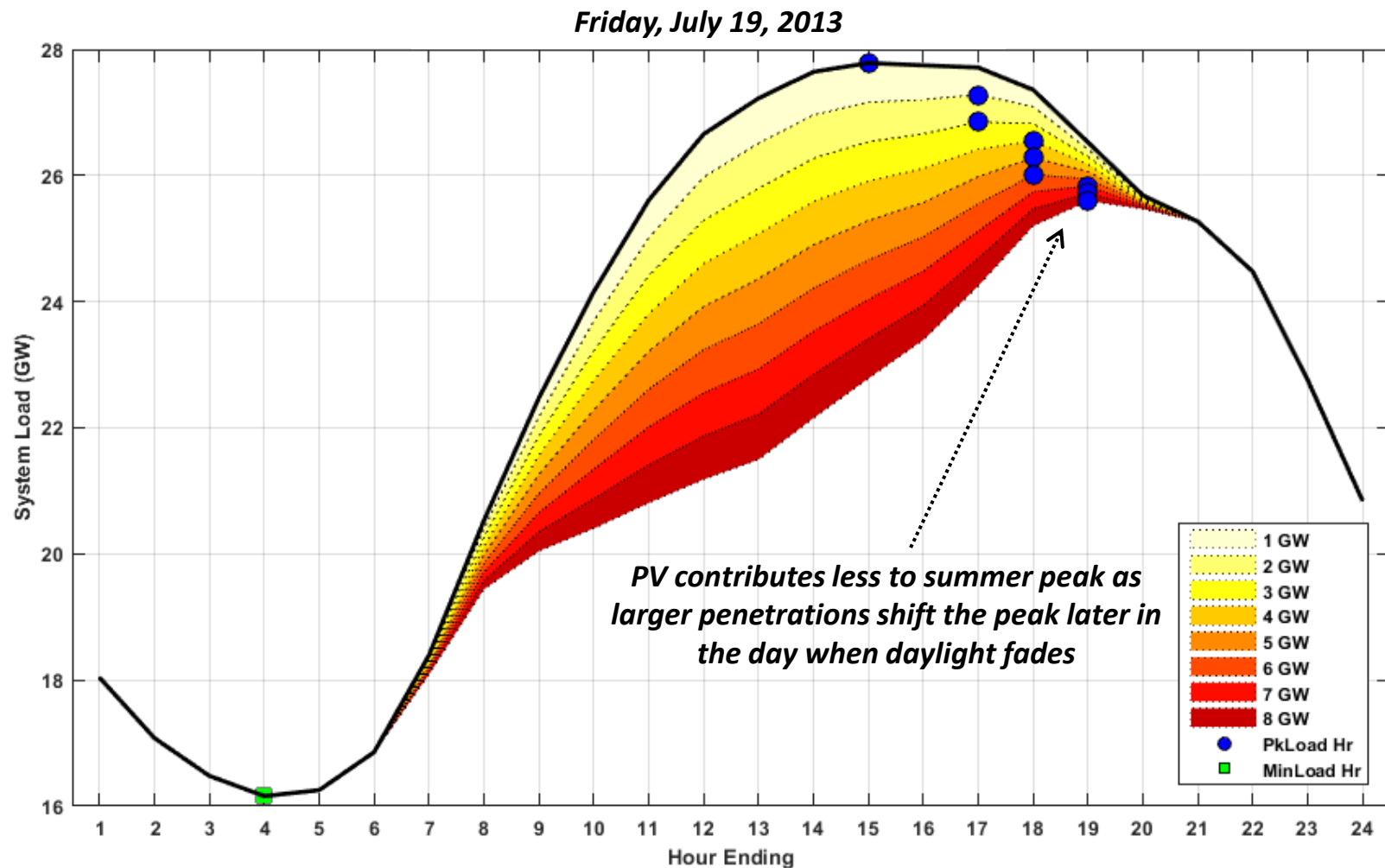
Note: Summer peak demand is based on the "90/10" forecast, which accounts for the possibility of extreme summer weather (temperatures of about 94° F).
 Source: [Final 2017 Solar PV Forecast](#) (April 2017) and [Final ISO New England Energy-Efficiency Forecast 2021-2026](#) (May 2017)

Deep Load Reductions During Winter Daylight Hours Result in Steep Ramp Into the Evening Peak

Tuesday, January 7, 2014

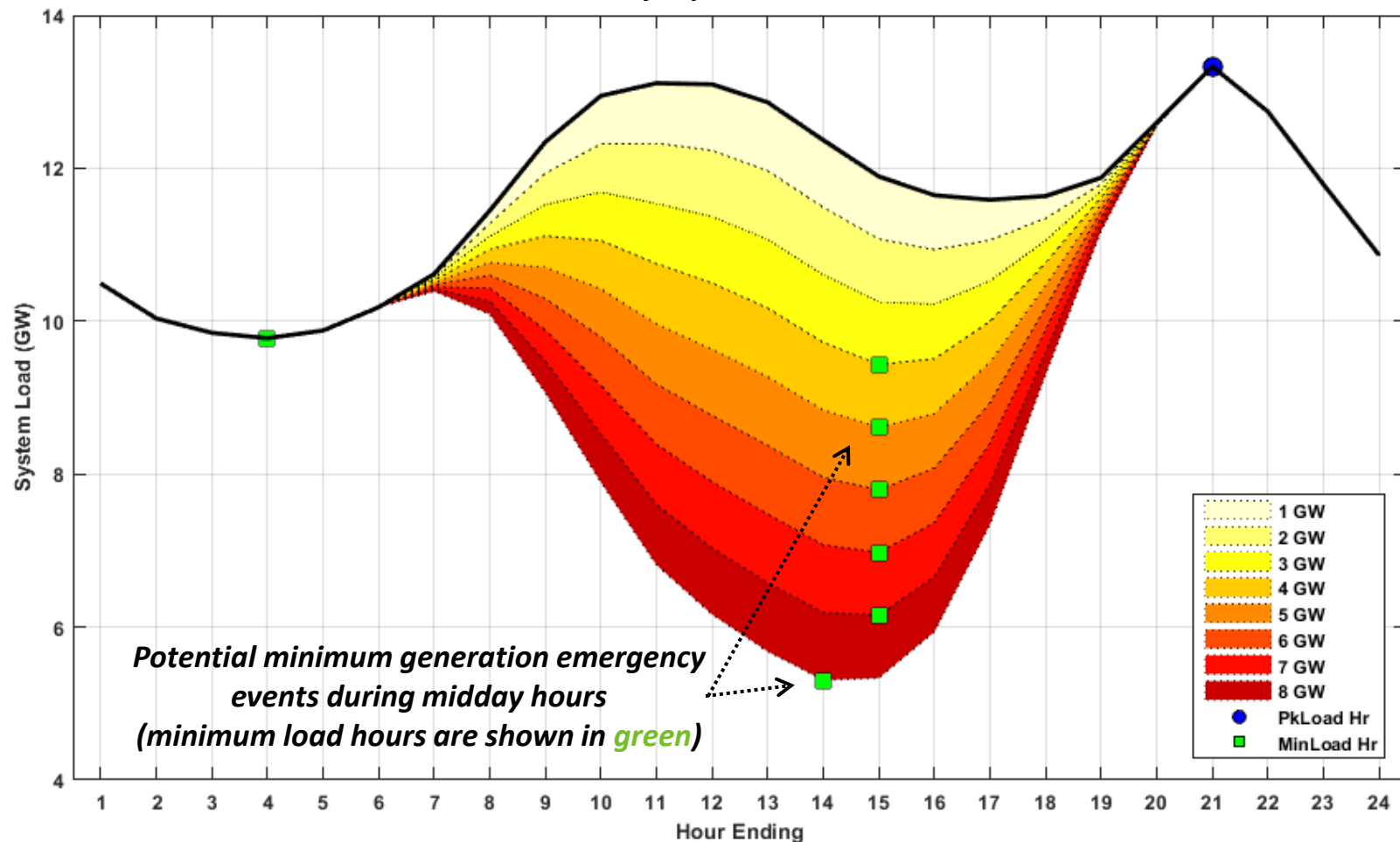


Solar PV Penetration Shifts Timing of Hourly Peaks Later in the Day During Summer



Solar in Spring/Fall Displaces Generation and Increases Need to Back Down Generation in Low-Load Hours

Sunday, April 20, 2014



New Energy Storage Is Emerging in the ISO Generator Interconnection Study Queue

- As of December 1, 2017, battery storage projects totaling more than **400 MW** of capacity have requested interconnection to the regional power system
- New England has benefited from grid-scale electrical energy storage capabilities for more than 40 years in the form of pumped storage



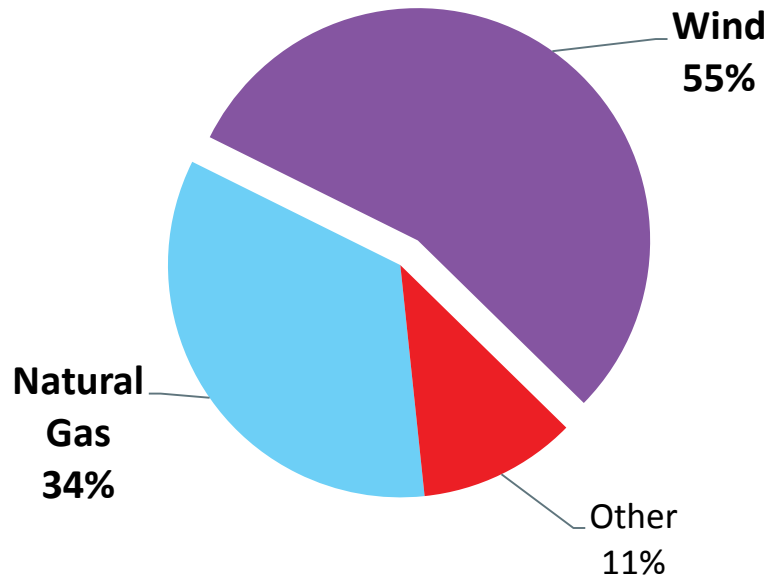
Source: [ISO Interconnection Queue](#) (as of December 1, 2017)



Wind Power and Natural Gas Dominate New Resource Proposals in the ISO Queue

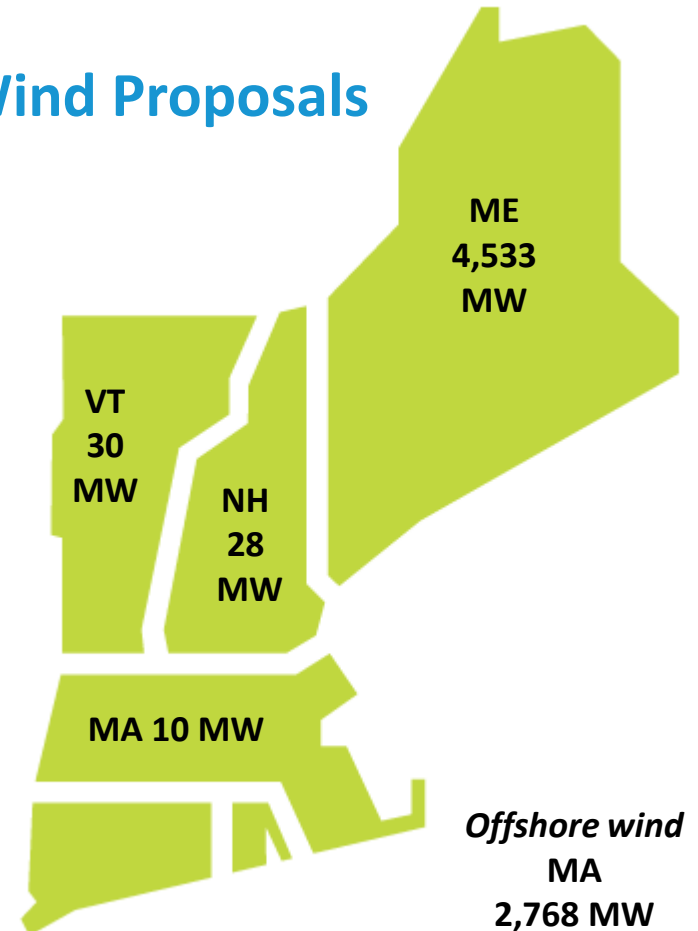
All Proposed Generation

Developers are proposing to build roughly 13,500 MW of generation, including nearly 4,600 MW of gas-fired generation and more than 7,300 MW of wind



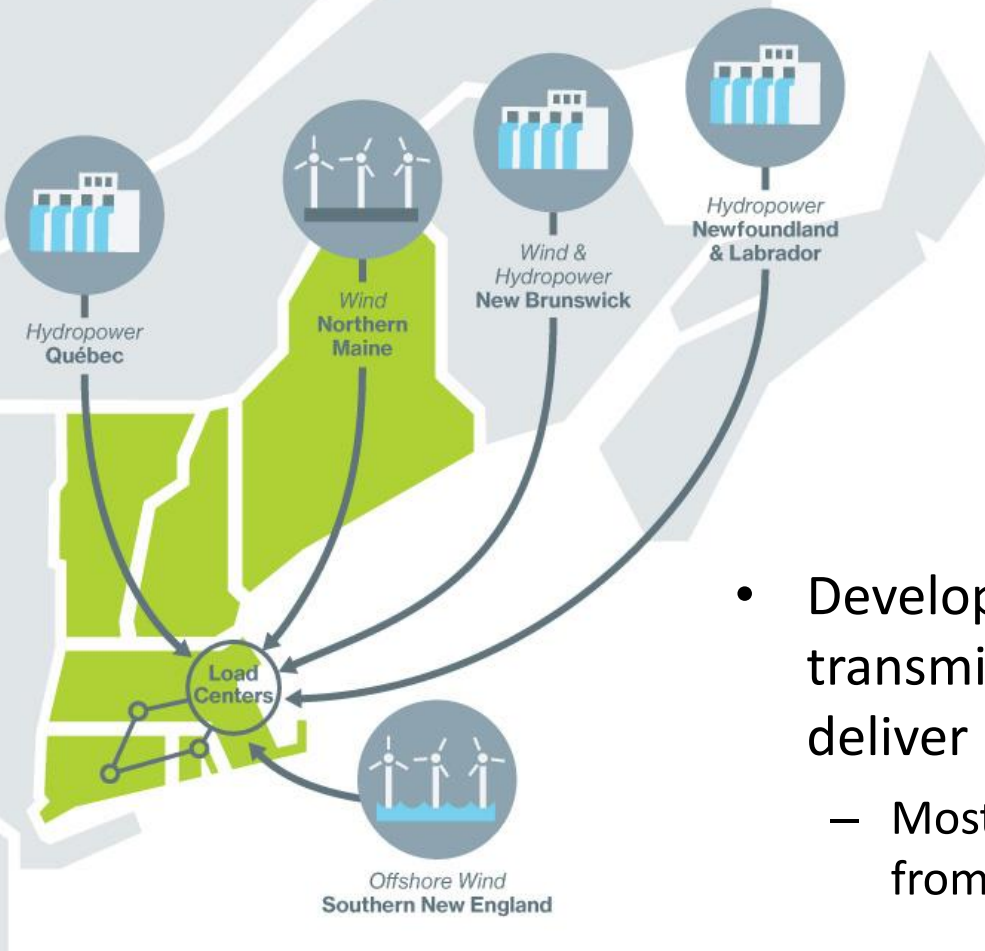
Source: ISO Generator Interconnection Queue (December 1, 2017)
FERC Jurisdictional Proposals Only; Nameplate Capacity Ratings

Wind Proposals



Note: Some wind proposals include battery storage.

Developers Are Proposing Large-Scale Transmission Projects to Help Deliver Clean Energy to Load Centers



Map is representative of the types of projects announced for the region in recent years

- Developers are proposing **23** elective transmission upgrades (ETUs) to help deliver **16,000+ MW** of clean energy
 - Mostly Canadian hydro and onshore wind from northern New England
- Wind projects make up **55%** of proposed new power resources, but most are remote
- Massachusetts has plans to contract for **1,600 MW** of offshore wind

Source: [ISO Interconnection Queue](#) (as of December 1, 2017)

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



Making Every Season Bright

Happy Holidays from **ISO** new england



Questions

