DECEMBER 9, 2015 | HARTFORD, CT

Managing the Rapid Transformation of New England's Energy Resources

Connecticut Power and Energy Society

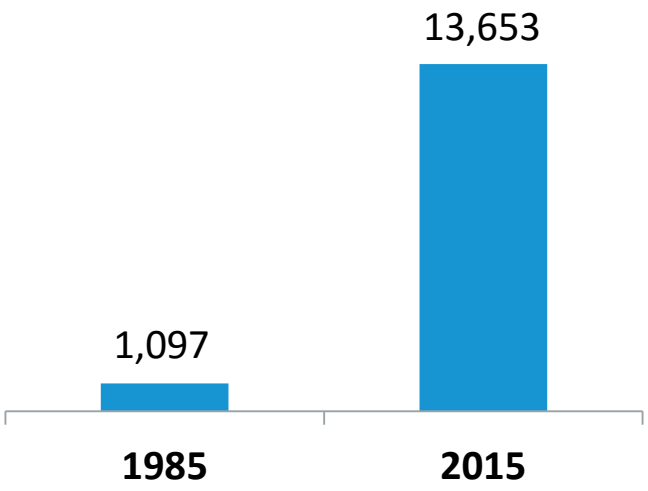
Gordon van Welie

PRESIDENT AND CEO

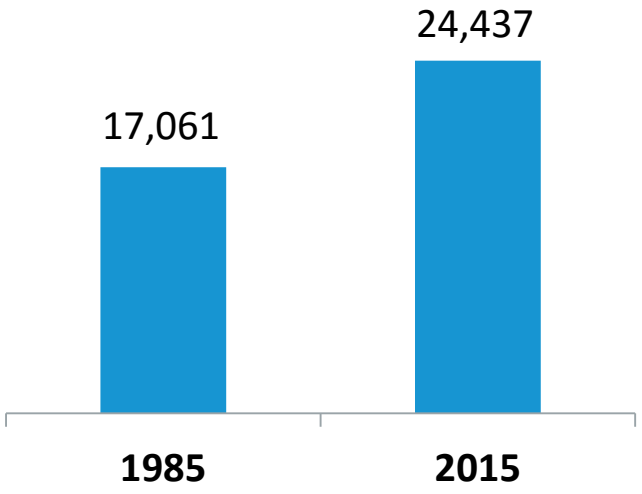
Happy 30th Anniversary to CPES!

What did the New England power system look like in 1985?

Natural Gas-Fired Capacity
Summer Seasonal Claimed Capability
(MW)



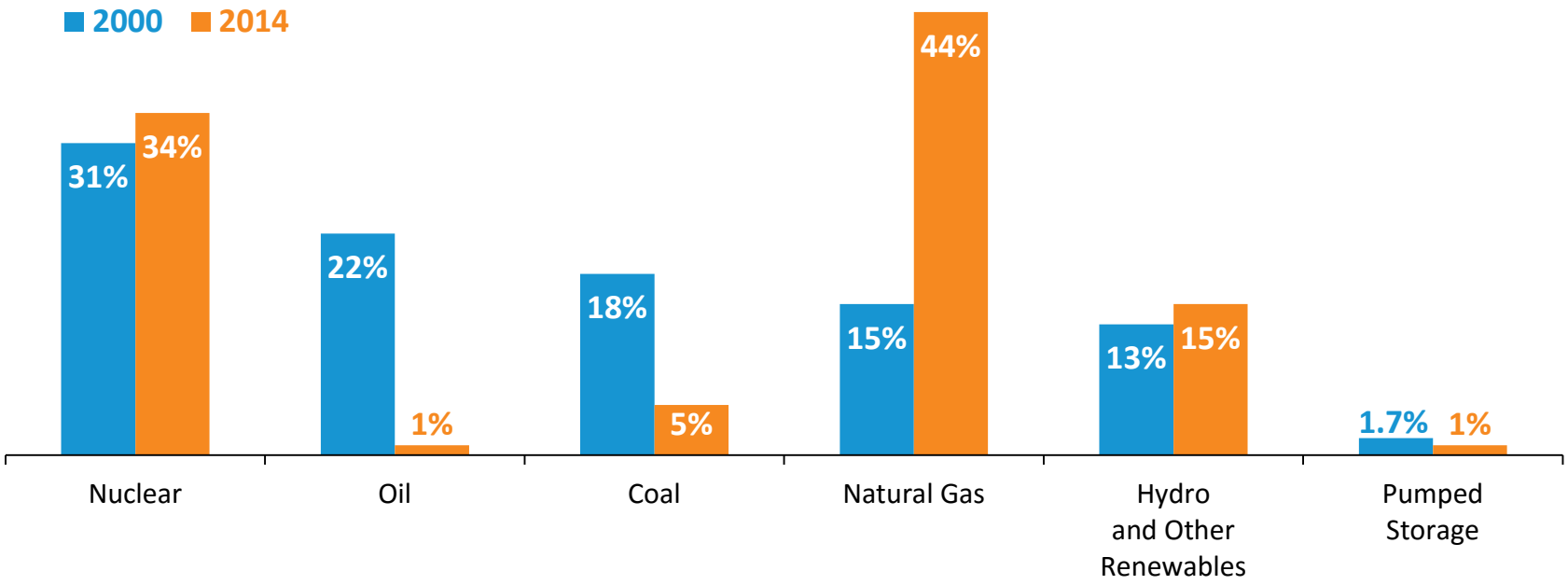
Summer Peak Demand
Actual Summer Peak
(MW)



By 1985, plants like Salem Harbor, Brayton Point, and Bridgeport Harbor had converted from oil to coal due to volatile oil prices. Now, these plants and other "at risk" coal- and oil-fired units are permanently retiring from the New England power system.

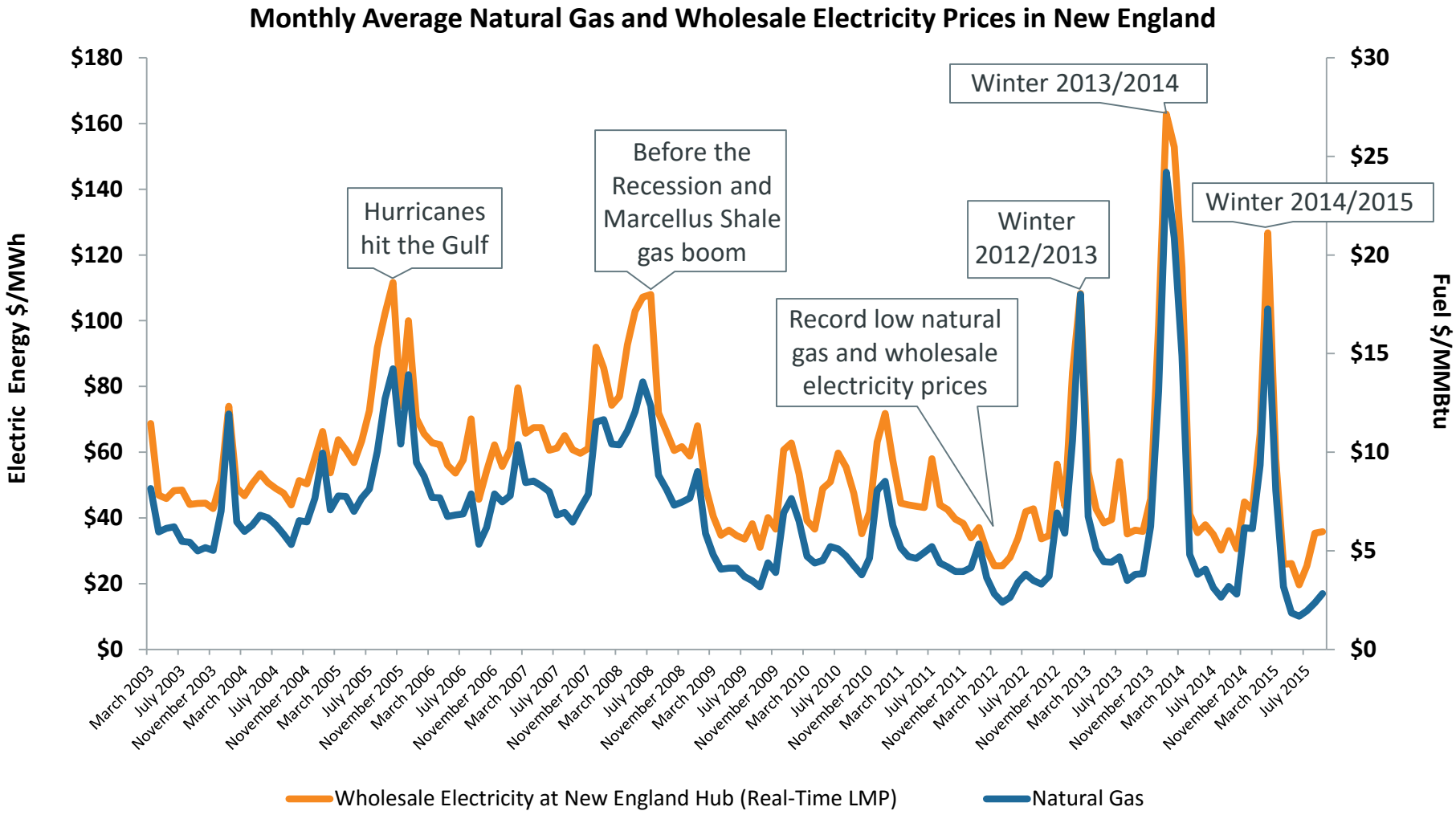
New England Has Seen Dramatic Changes in the Energy Mix: From Oil and Coal to Natural Gas

Percent of Total **Electric Energy** Production by Fuel Type
(2000 vs. 2014)

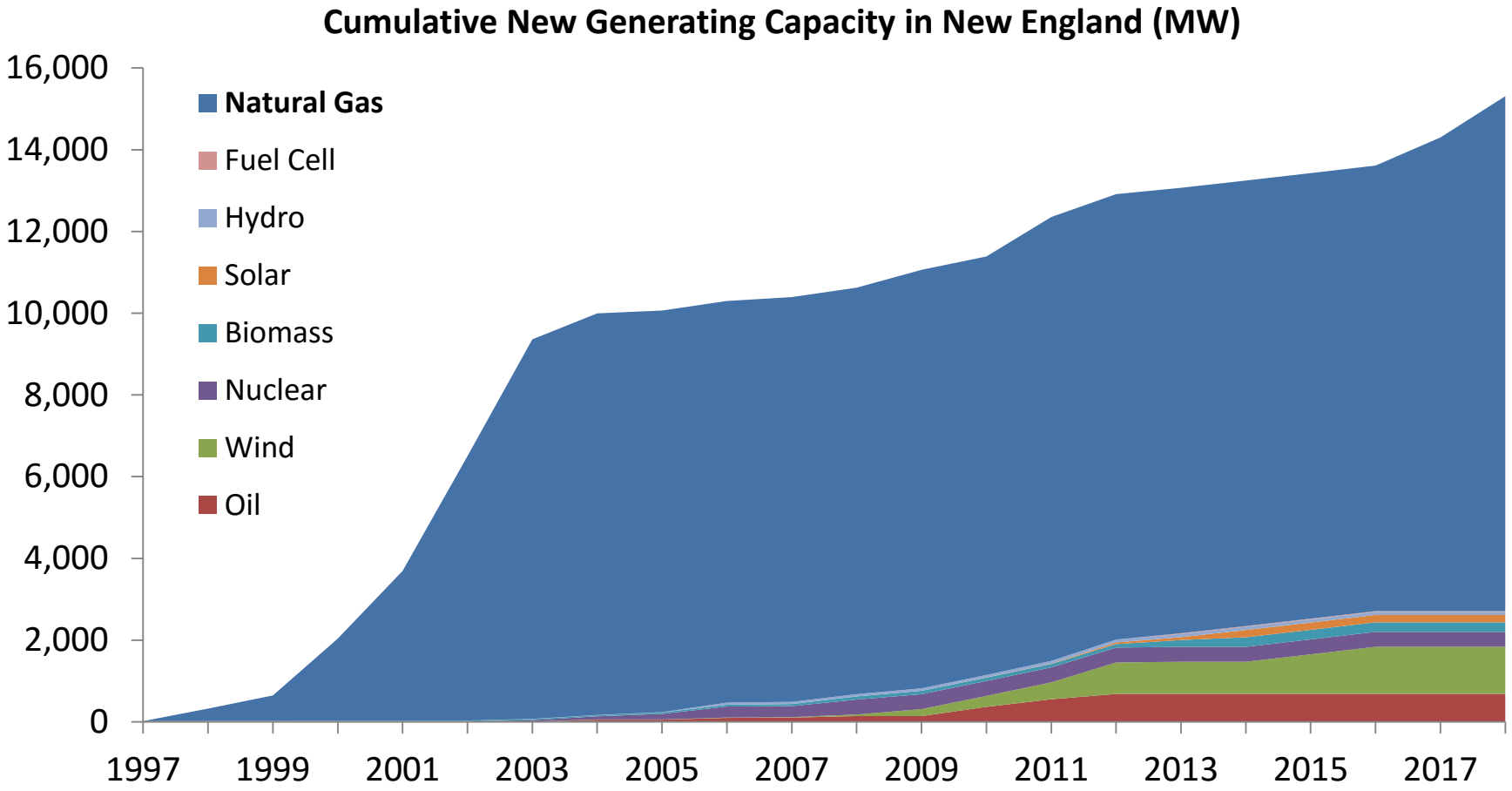


Source: ISO New England Net Energy and Peak Load by Source
Other renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and miscellaneous fuels

Natural Gas and Wholesale Electricity Prices Are Linked

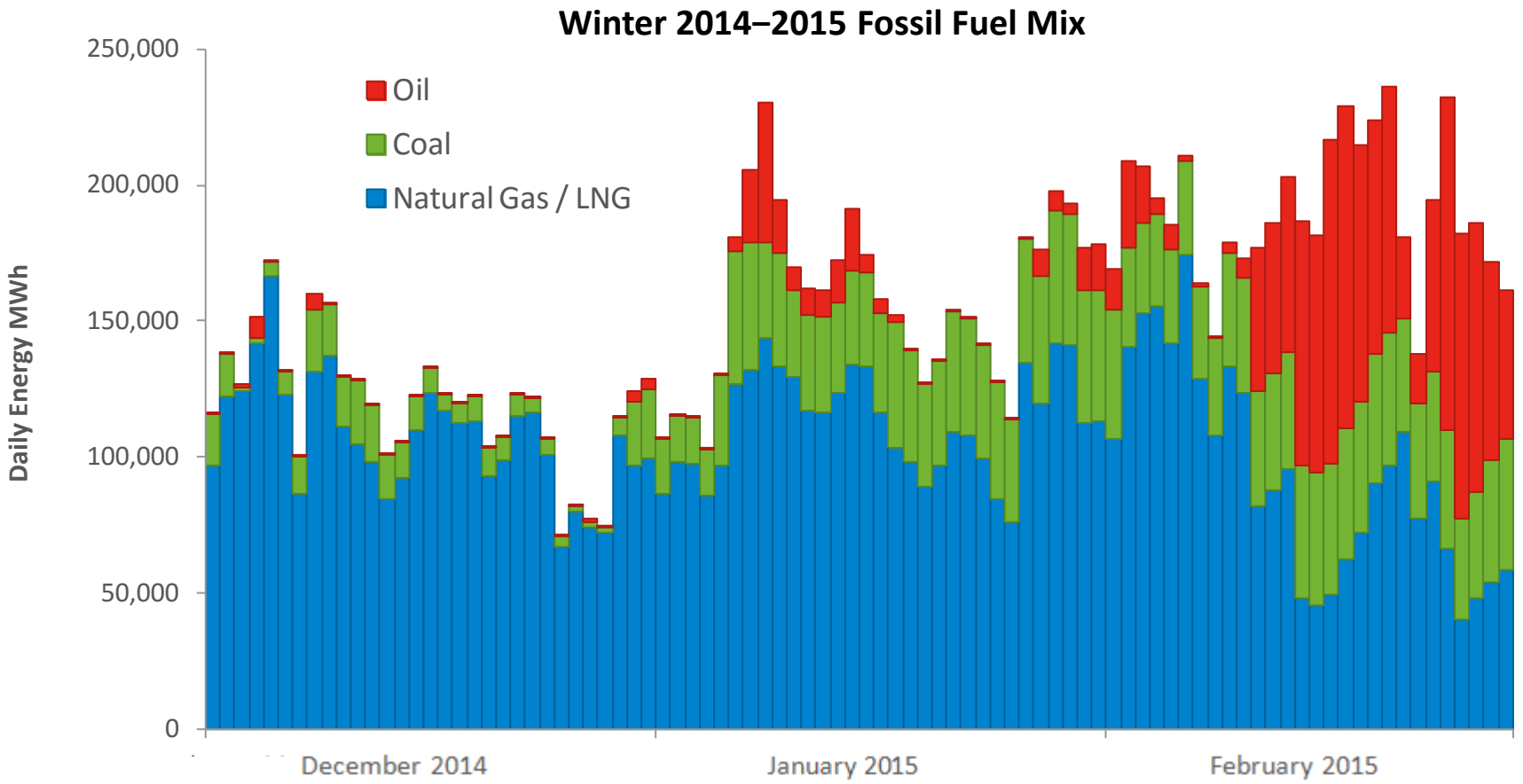


Region Has Not Developed Gas Pipeline Infrastructure to Keep Pace with Growth of Gas-fired Generation



Note: New generating capacity for years 2016 – 2018 includes resources clearing in recent Forward Capacity Auctions.

New England Shifts to Coal and Oil in the Winter

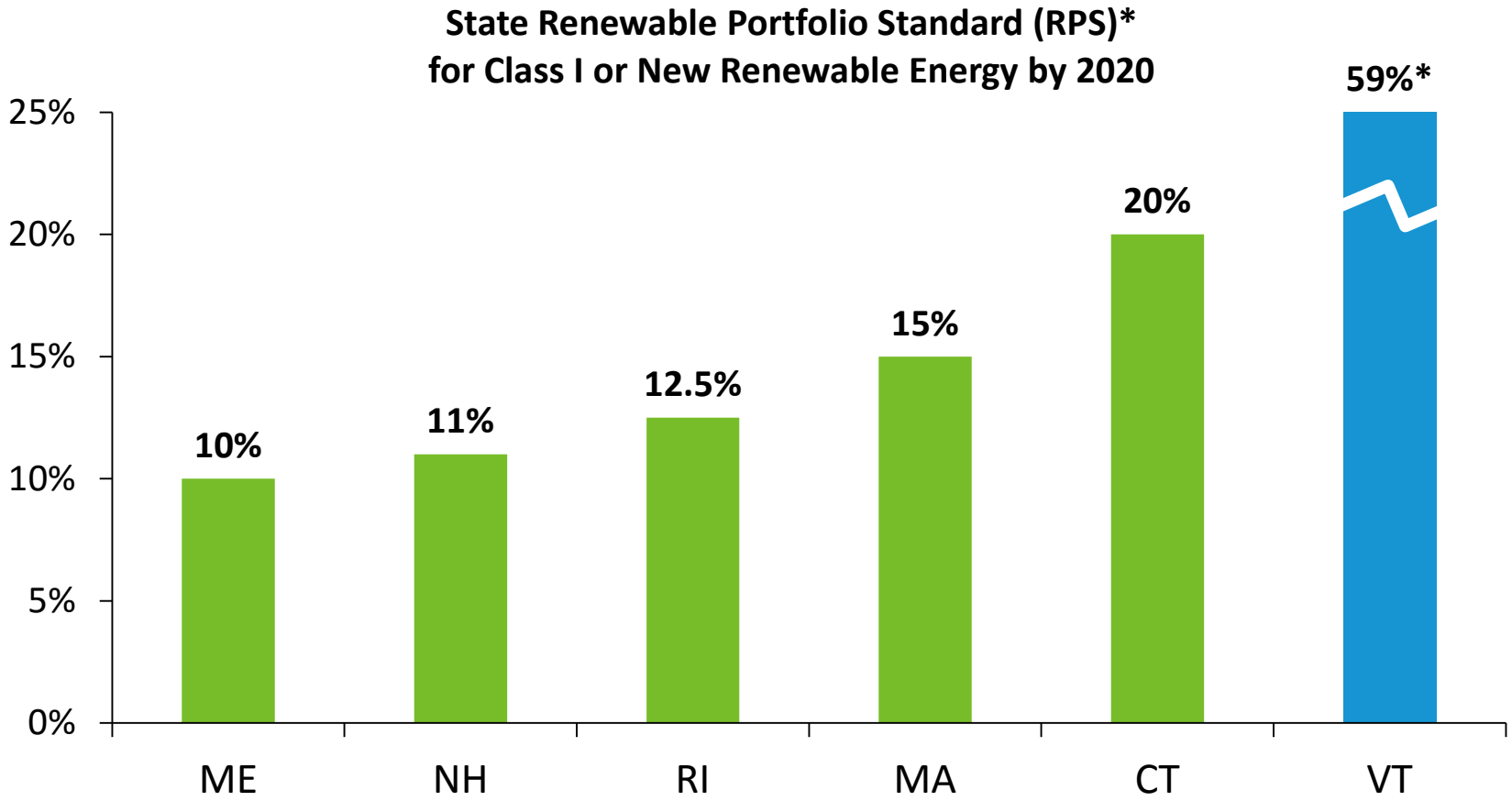


The Region Has Lost—*and Is at Risk of Losing*—Substantial Non-Gas Resources

Major Generator Retirements:

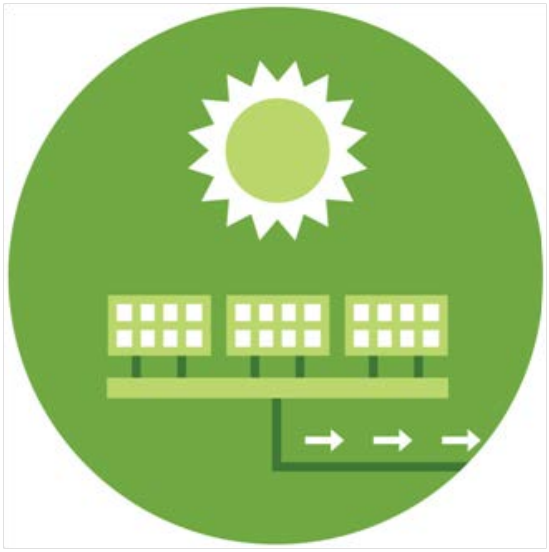
- **Salem Harbor Station (749 MW)**
  - 4 units (coal & oil)
- **Vermont Yankee Station (604 MW)**
  - 1 unit (nuclear)
- **Norwalk Harbor Station (342 MW)**
  - 3 units (oil)
- **Brayton Point Station (1,535 MW)**
  - 4 units (coal & oil)
- **Mount Tom Station (143 MW)**
  - 1 unit (coal)
- **Pilgrim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

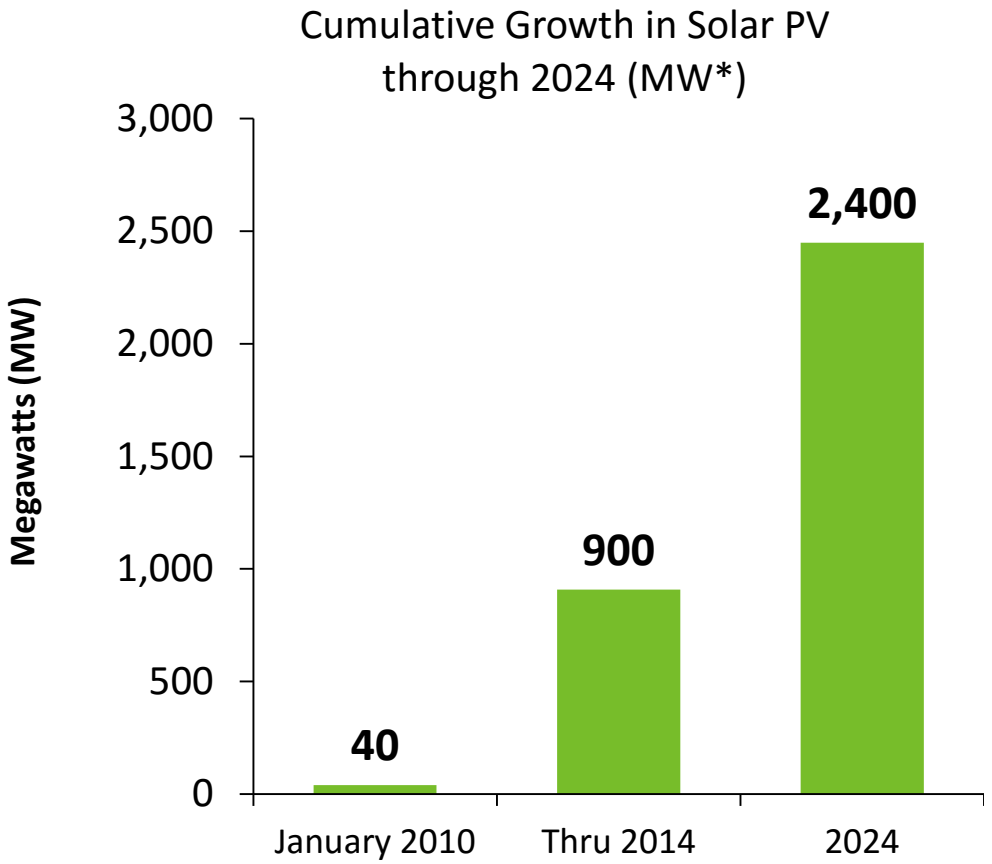
State Policy Requirements Are Driving Proposals for Renewable Energy



* State Renewable Portfolio Standards (RPS) 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. Vermont's new Renewable Energy Standard has a 'total renewable energy' requirement (reflected above), which recognizes large-scale hydro and all other classes of renewable energy.

ISO New England Forecasts Strong Growth in Solar PV



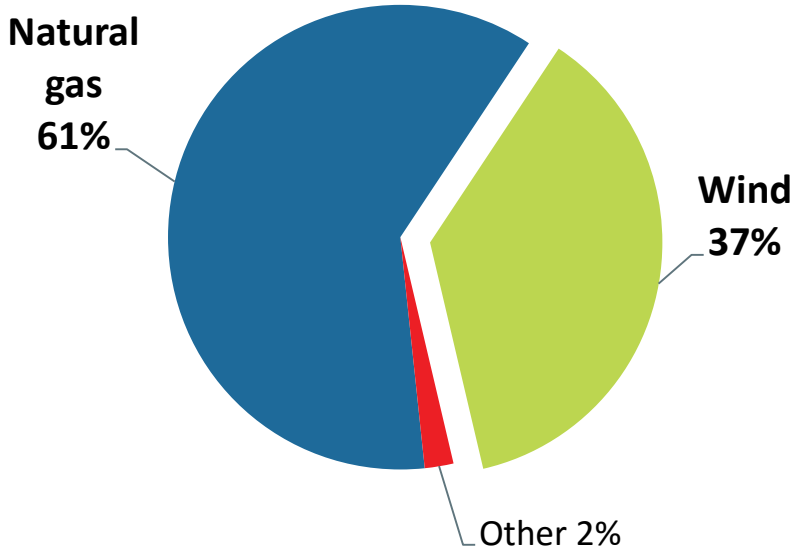


Source: Final PV Forecast (April 2015); Note: MW values are AC nameplate

Natural Gas and Transmission Infrastructure Will Be Needed to Deliver Energy from Proposed Resources

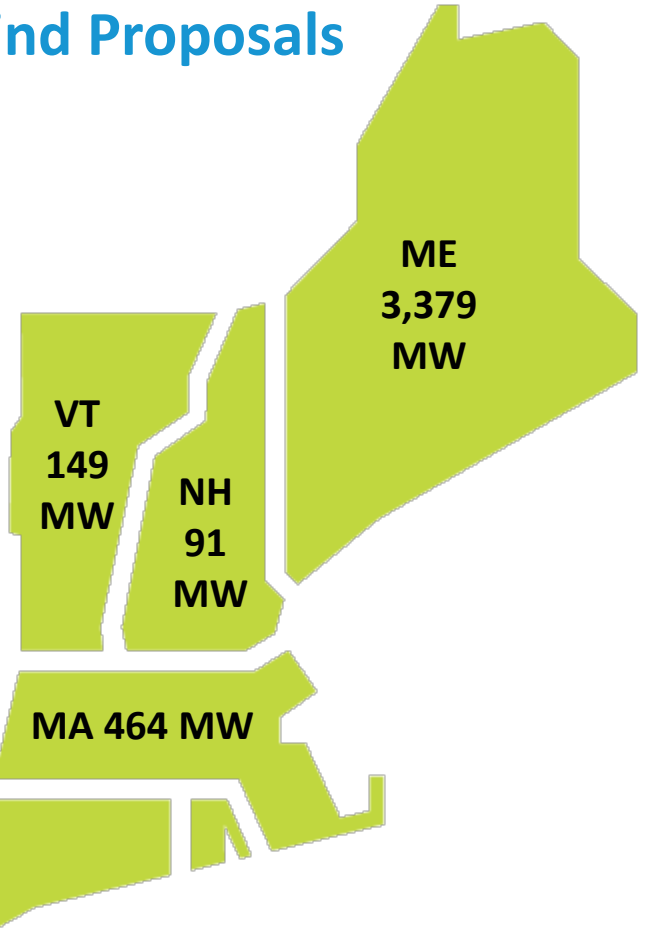
All Proposed Generation

Developers are proposing to build 11,000 MW of generation, including 6,700 MW of gas-fired generation and 4,100 MW of wind

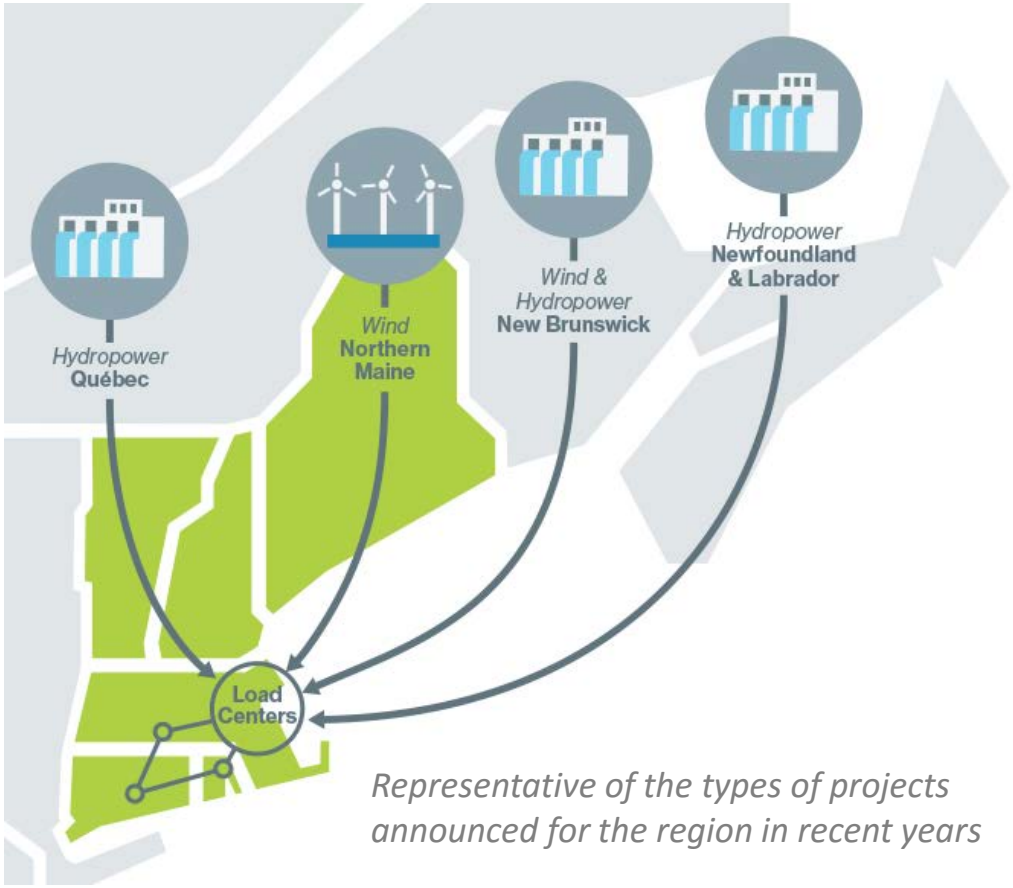


Source: ISO Generator Interconnection Queue (October 2015)
FERC Jurisdictional Proposals Only

Wind Proposals



Transmission Developers Are Proposing to Move Renewable Energy to New England Load Centers



Representative of the types of projects announced for the region in recent years

- As of **October 1, 2015**, seven elective transmission projects had been proposed in the ISO Interconnection Queue, totaling more than **4,000 MW** of potential capacity
  - Primarily large-scale **hydro** resources from eastern Canada and **wind** resources from northern New England
- These projects seek to address public policy goals, not reliability needs

Source: ISO Interconnection Queue (October 2015)
http://www.iso-ne.com/system-planning/transmission-planning/interconnection-request-queue

Seeking Compatibility Between Two Public Policy Goals

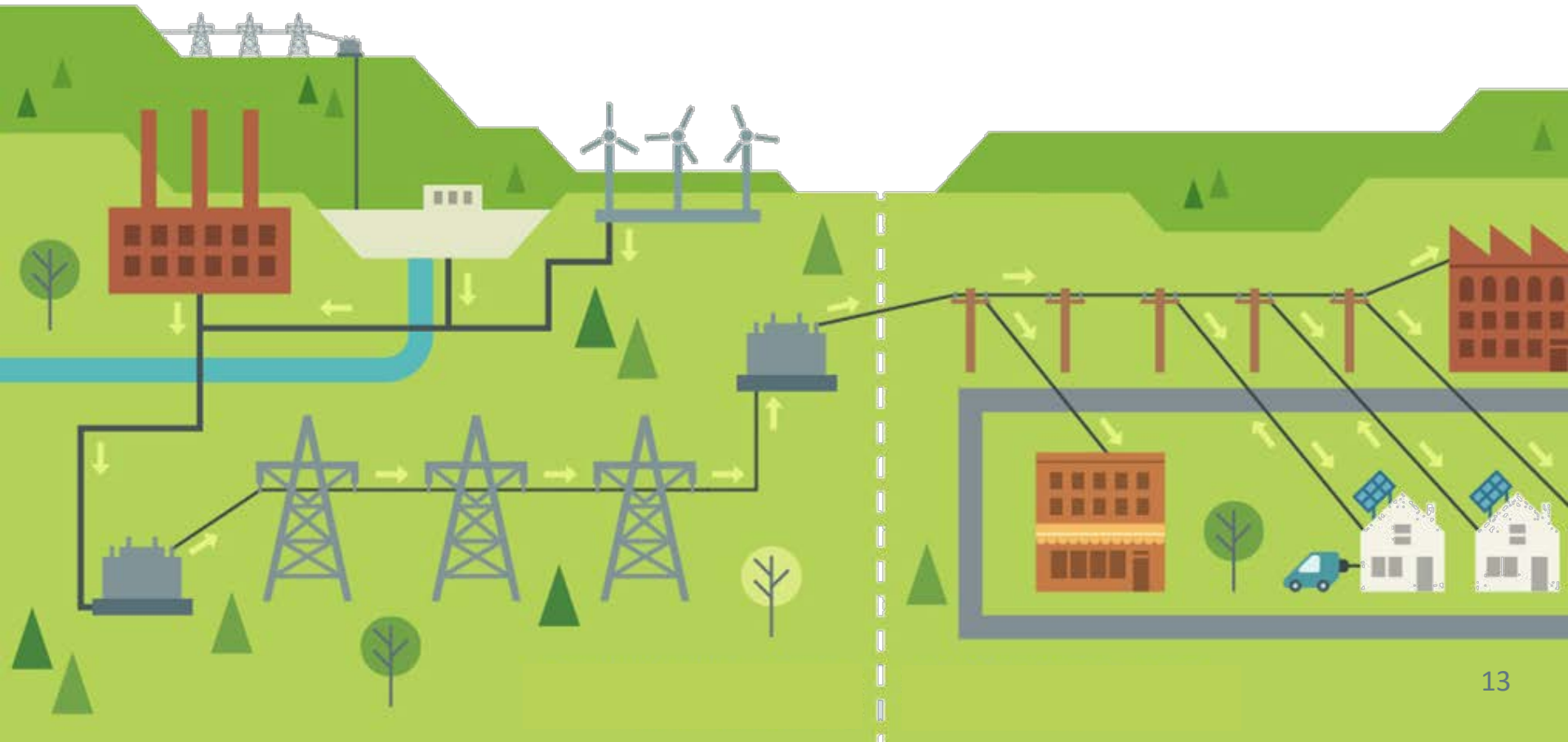
Region's policymakers have supported two public policy goals:

1. Achieving reliability through **competitive wholesale markets** administered by the ISO
   - Competitive wholesale markets select the lowest-cost resources to meet the demand for electricity regardless of fuel or technology type
   - Price formation in the energy and capacity markets is key

2. Achieving **reductions in carbon emissions** (not a specific role for the ISO)
   - By implication, this public policy goal is driving the transition of the fleet to lower carbon-emitting resources

Electric Grid Will Look Very Different in 5 to 10 Years

"Hybrid" grid with grid-connected and distributed resources, and a continued shift toward natural gas and renewable energy

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