



ISO New England Overview

*Vermont Senate Natural Resources
and Energy Committee*

Eric Wilkinson

EXTERNAL AFFAIRS REPRESENTATIVE



Logistics



- Restroom location
- Emergency exits
- Designated smoking areas
- Security
 - Sign in and out; return visitor badges at reception area
 - Do not wander halls unescorted
- Recycling
 - Paper recycling bins are located in the conference room; glass, plastic, and metal recycling bins are located throughout the buildings

Agenda

- 10:00 a.m. **Arrival and Badging**
- 10:15 a.m. **ISO Overview Presentation**
Eric Wilkinson, Representative, External Affairs
- 10:45 a.m. **Control Room Tour**
Peter Brandien, Vice President, System Operations
- 11:45 a.m. **Break**
- 12:00 p.m. **Working Lunch and Open Discussion**
Stephen Rourke, VP, System Planning
Eric Johnson, Director External Affairs
- 2:00 p.m. **Adjourn**

ISO NEW ENGLAND OVERVIEW

Eric Wilkinson, Representative, External Affairs

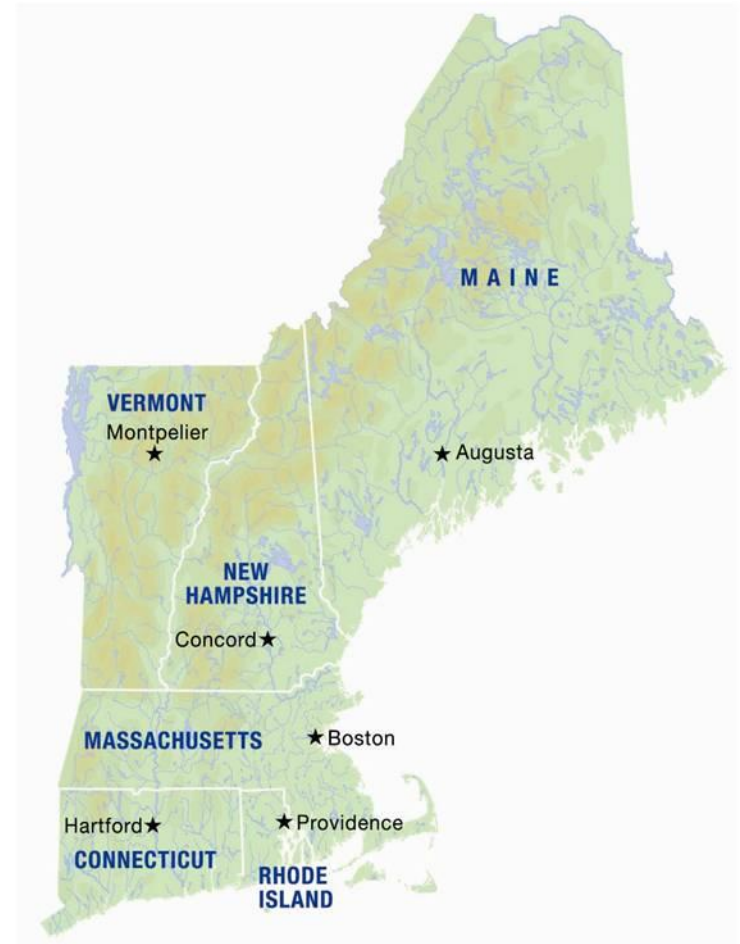
About ISO New England

- **Not-for-profit corporation created in 1997 to oversee New England's restructured electric power system**
 - Regulated by the Federal Energy Regulatory Commission (FERC)
- **Regional Transmission Organization**
 - Independent of companies doing business in the market
 - No financial interest in companies participating in the market
 - Neutral as to resource fuel type
- **Major Responsibilities**
 - Operating the Regional Power System
 - Administering Wholesale Electricity Markets
 - Regional Power System Planning



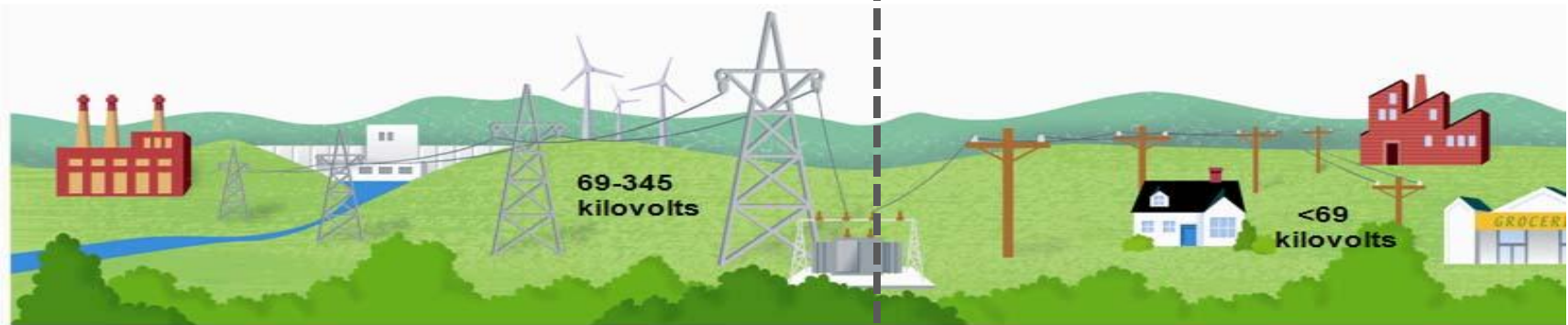
New England's Electric Power Grid at a Glance

- 6.5 million households and businesses; population 14 million
- 350+ generators
- 8,000+ miles of high-voltage transmission lines (115 kV and above)
- 13 interconnections to electricity systems in New York and Canada
- 31,750+ megawatts (MW) of generating capacity and approximately 1,850 MW of demand resources
- 28,130 MW all-time peak demand, set on August 2, 2006
- 500+ buyers and sellers in the region's wholesale electricity markets
- \$5 billion in transmission investment since 2002; approximately \$6 billion planned over next 5 years
- \$5 billion total energy market value in 2012



Transmission System

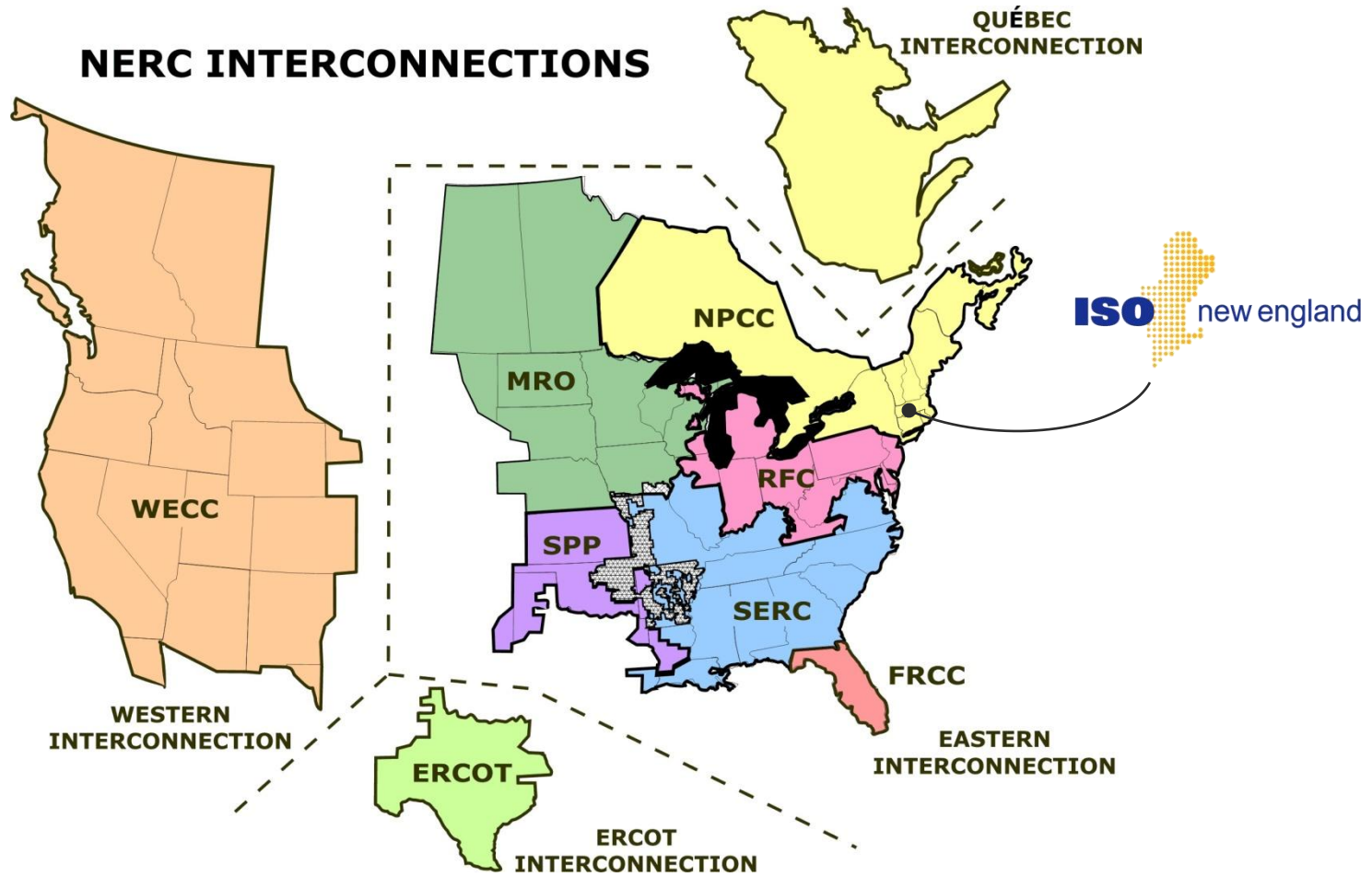
Distribution System



- Electricity produced based on demand
- Region's 8,000 + miles of high-voltage transmission lines move electricity to substations where it is stepped down in voltage to feed into distribution lines
- Federal regulation (FERC)

- Region's 6.5 million homes and businesses create demand
- Utilities distribute electricity to businesses and homes
- State regulation (public utility commissions)

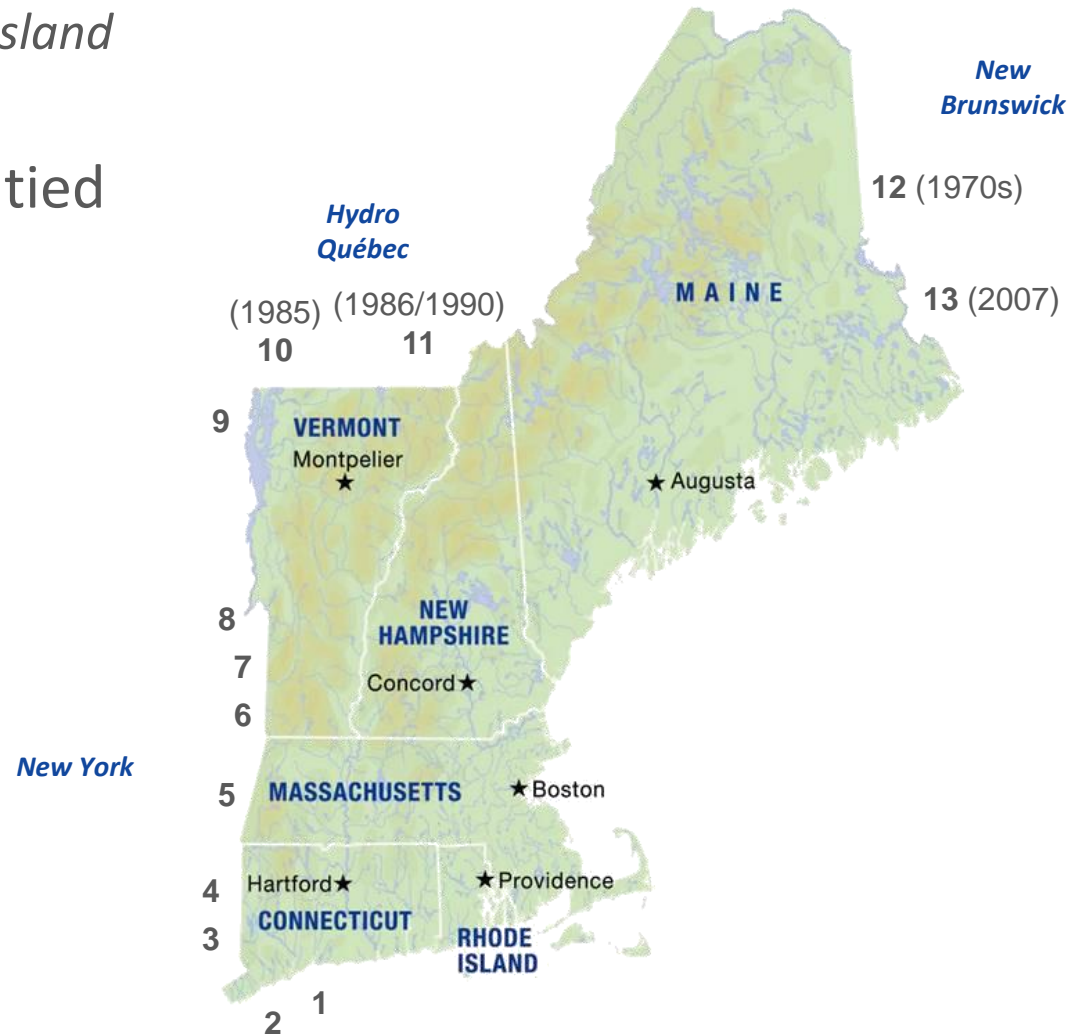
We are Part of the Eastern Interconnection



Ties to Neighboring Regions

New England is not an energy island

- Transmission system is tied to neighboring power systems in the U.S. and Eastern Canada:
 - New York (9 ties)
 - Hydro Québec (2 ties)
 - New Brunswick (2 ties)



ISO New England's Responsibilities

Operating the Regional Power System

- Balance electricity supply and demand every minute of the day by centrally dispatching the generation and flow of electricity across the region's transmission lines.

Administering Wholesale Electricity Markets

- Develop and administer the region's marketplace through which wholesale electricity is bought and sold.

Regional Power System Planning

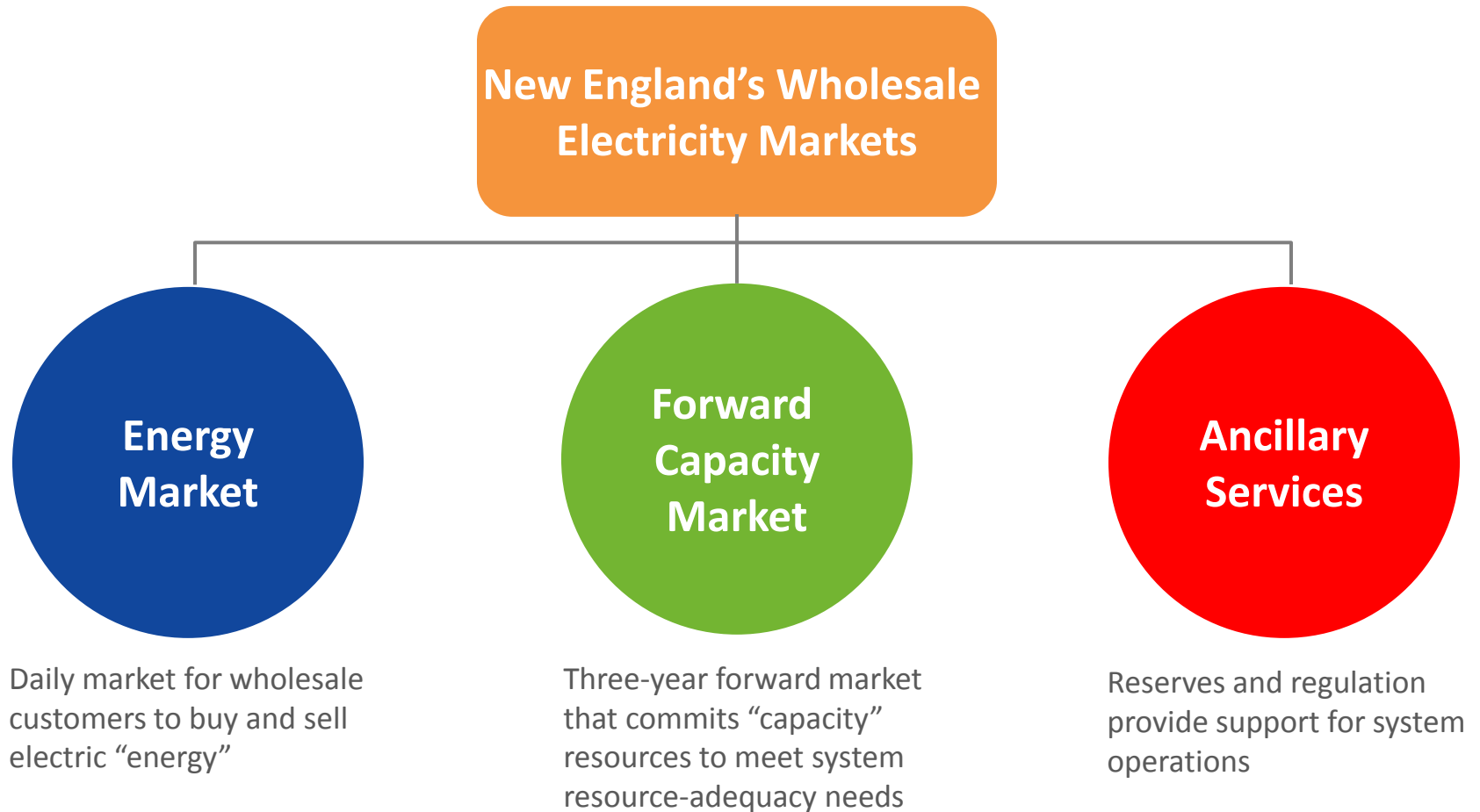
- Ensure the development of a reliable and efficient power system to meet current and future electricity needs.

Operate the Regional Power System

- Maintain minute-to-minute reliable operation of region's power grid
- Perform centralized dispatch of the lowest-priced resources
- Coordinate and schedule maintenance outages
- Coordinate operations with neighboring power systems



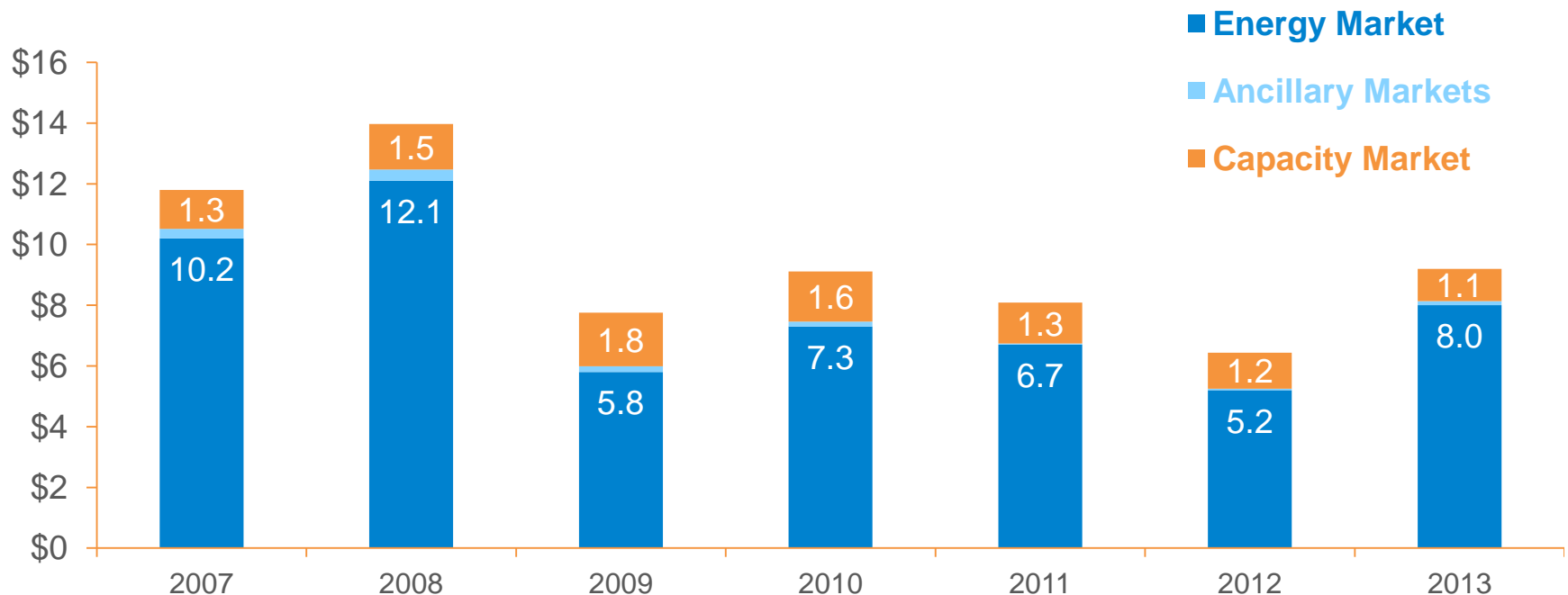
Administer Wholesale Electricity Markets



New England's Wholesale Electricity Markets

Wholesale market costs have ranged from \$6 billion to \$14 billion over last five years

Annual Value of Wholesale Electricity Markets
(in billions)



Regional Power System Planning

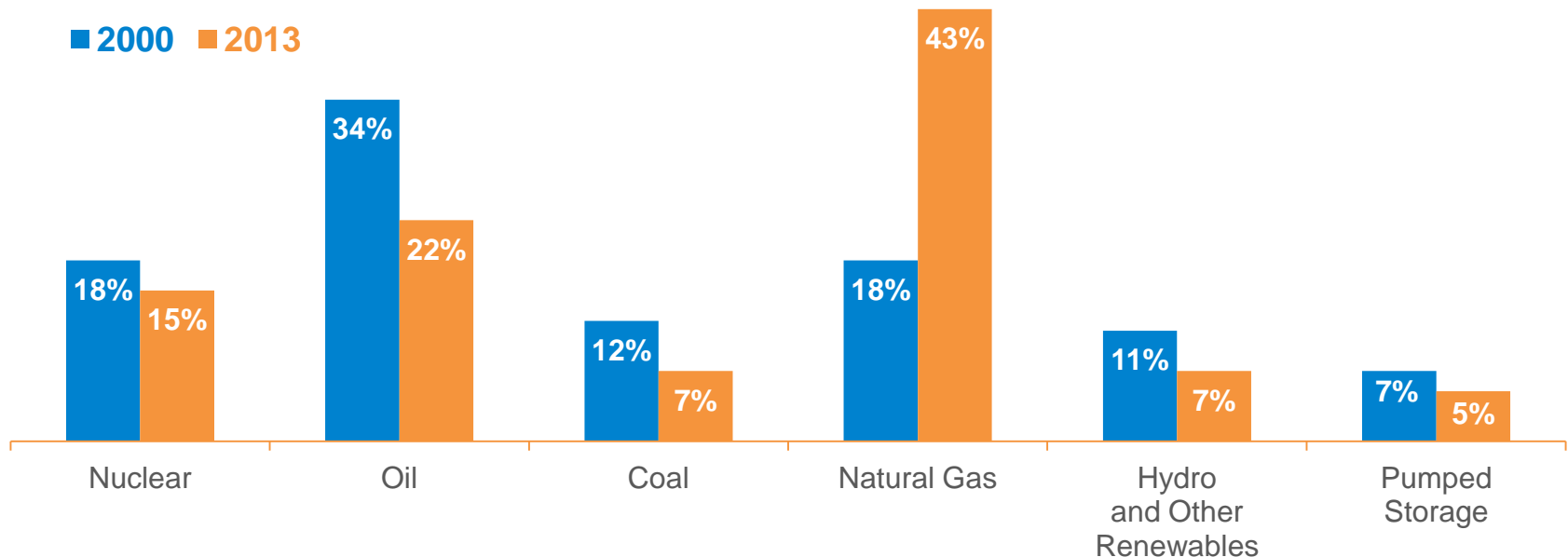
- Administer requests for interconnection of generation, and regional transmission system access
- Conduct transmission system needs assessments
- Plan regional transmission system to provide regional network service
- Develop annual Regional System Plan (RSP)
 - RSP13 looks at system needs 10 years ahead (2013-2022)



Dramatic Changes in Power System Resources

The resources making up the region's installed capacity have shifted as a result of economic and environmental factors

Percent of Total System **Capacity** by Fuel Type
(2000 vs. 2013)

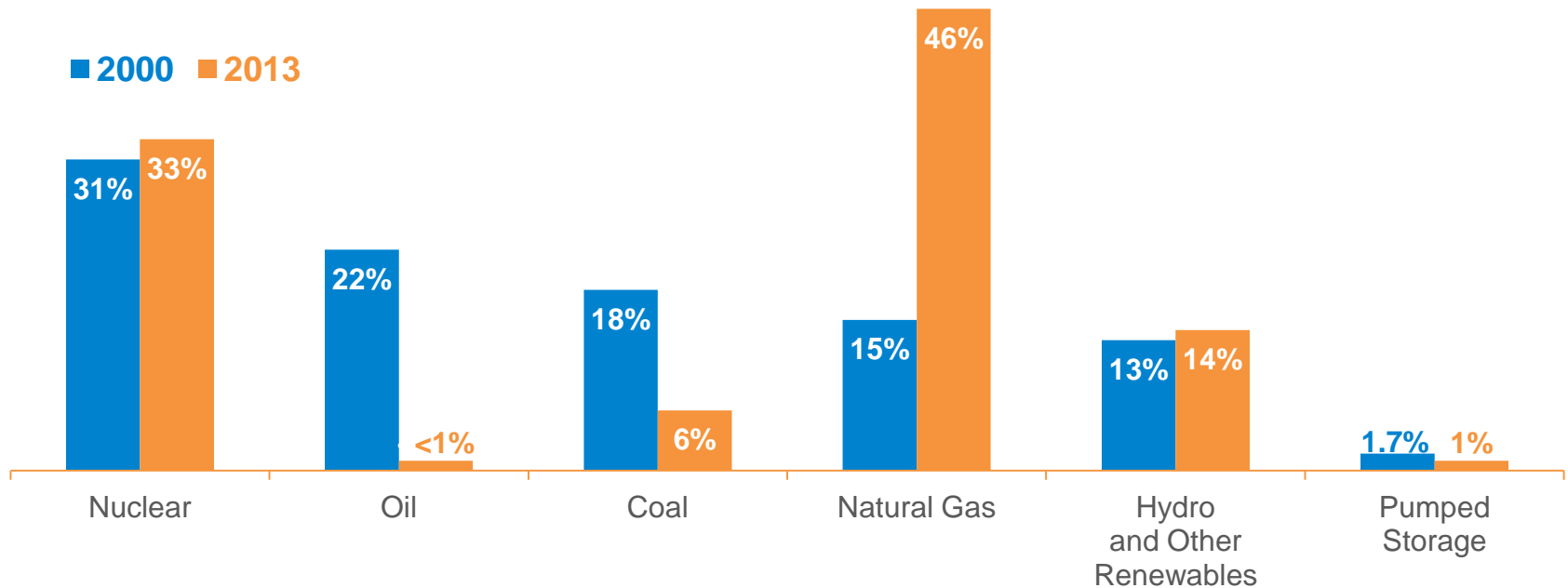


Source: ISO New England 2014 Regional Electricity Outlook

Dramatic Changes in the Energy Mix

The fuels used to produce New England's electric energy have shifted as a result of economic and environmental factors

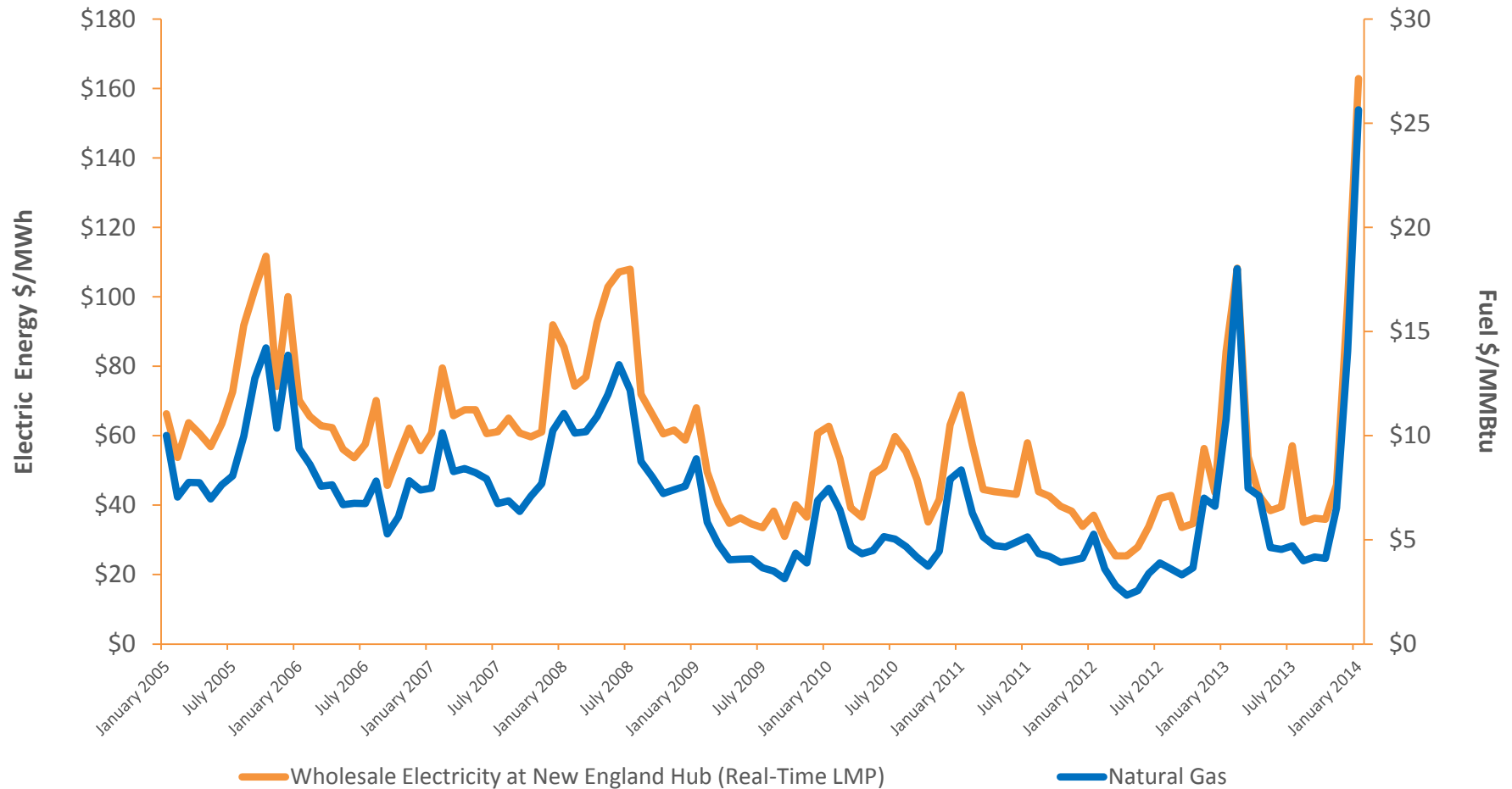
Percent of Total **Electric Energy** Production by Fuel Type
(2000 vs. 2013)



Source: ISO New England 2014 Regional Electricity Outlook

Natural Gas and Wholesale Electricity Prices Linked

Because of New England's heavy reliance on natural gas as a fuel source, natural gas typically sets the price for wholesale electricity



Power Plant Emissions have Declined with Changes in the Fuel Mix

Reduction in Aggregate Emissions (ktons/yr)

Year	NO _x	SO ₂	CO ₂
2001	59.73	200.01	52,991
2012	20.32	16.61	41,975
% Reduction, 2001–2012	↓ 66%	↓ 92%	↓ 21%

Reduction in Average Emission Rates (lb/MWh)

Year	NO _x	SO ₂	CO ₂
1999	1.36	4.52	1,009
2012	0.35	0.28	719
% Reduction, 1999–2012	↓74%	↓ 94%	↓ 29%

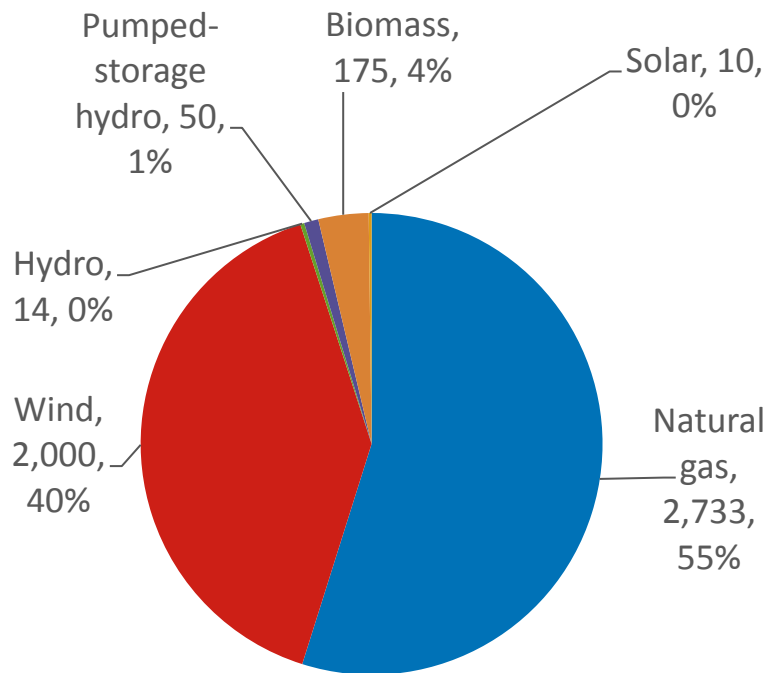
Source: [2012 ISO New England Electric Generator Air Emissions Report](#), January 2014

http://www.iso-ne.com/committees/comm_wkgrps/prtcpts_comm/eag/mtrls/2014/mar52014/2012_emissions_report.pdf

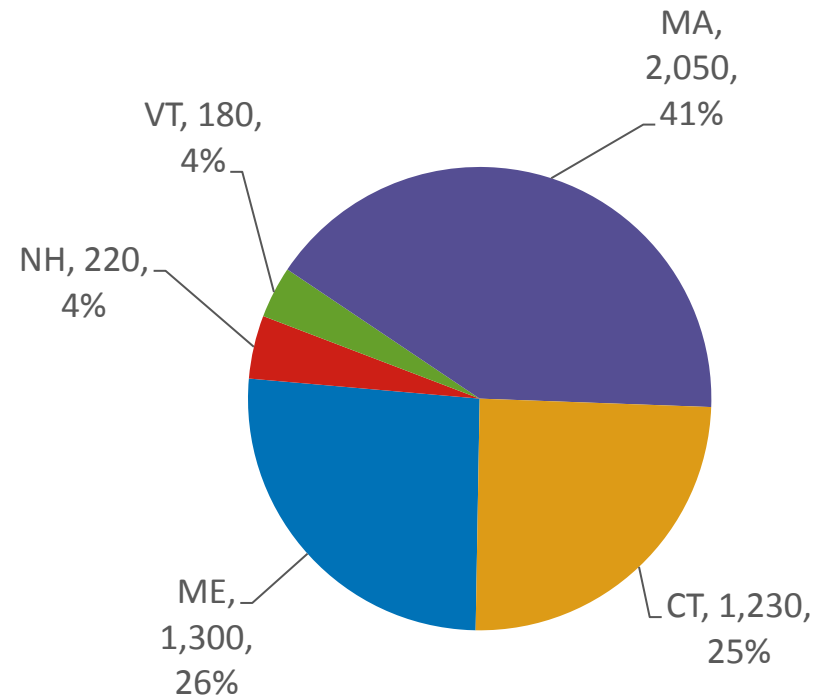
Generator Proposals in the ISO Queue

Approximately 5,000 MW

By Type



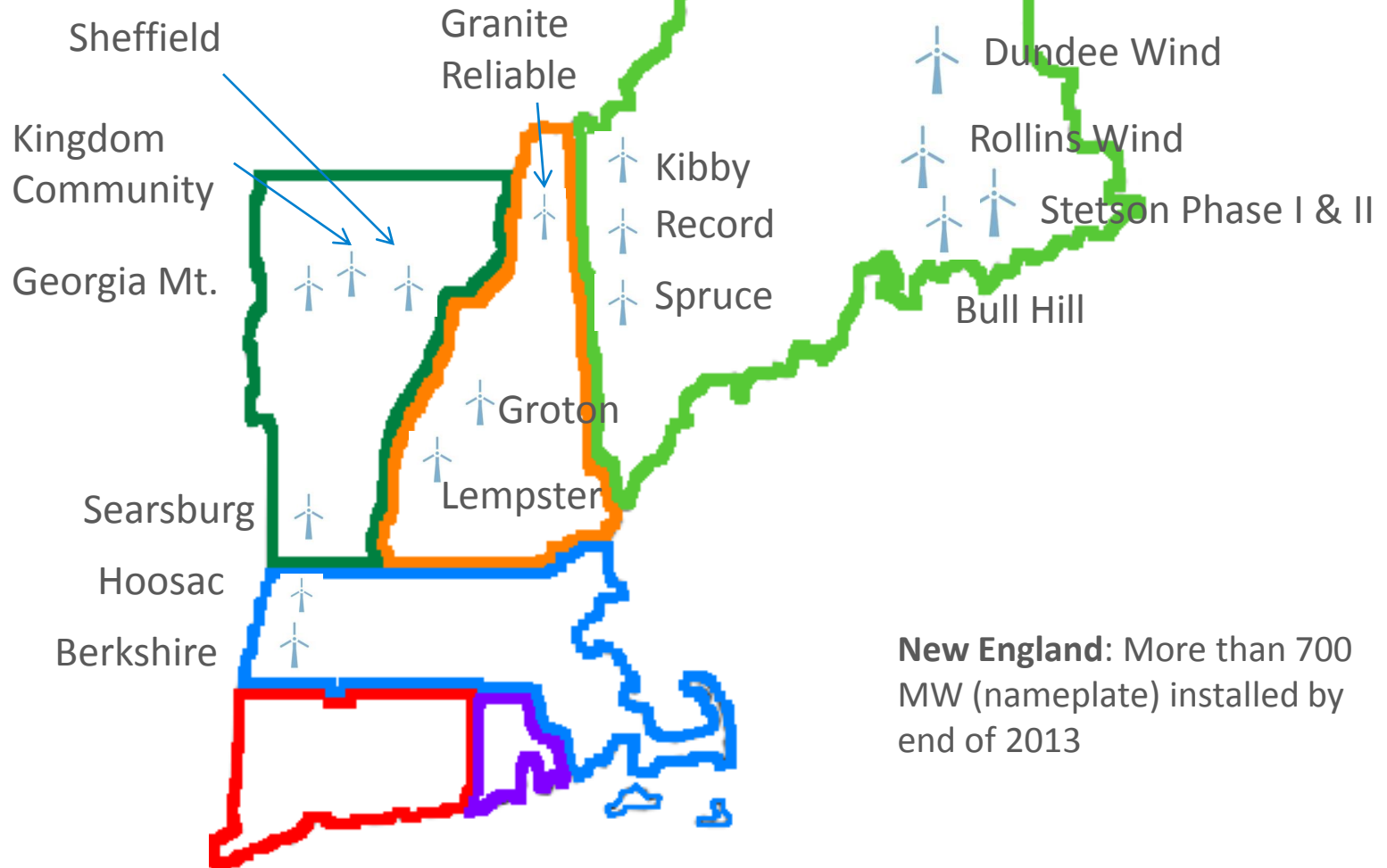
By State



Note: Natural gas and biomass include dual fuel units (oil)

Source: ISO Generator Interconnection Queue (January 2014)

Wind Resources in New England Markets



New England: More than 700 MW (nameplate) installed by end of 2013

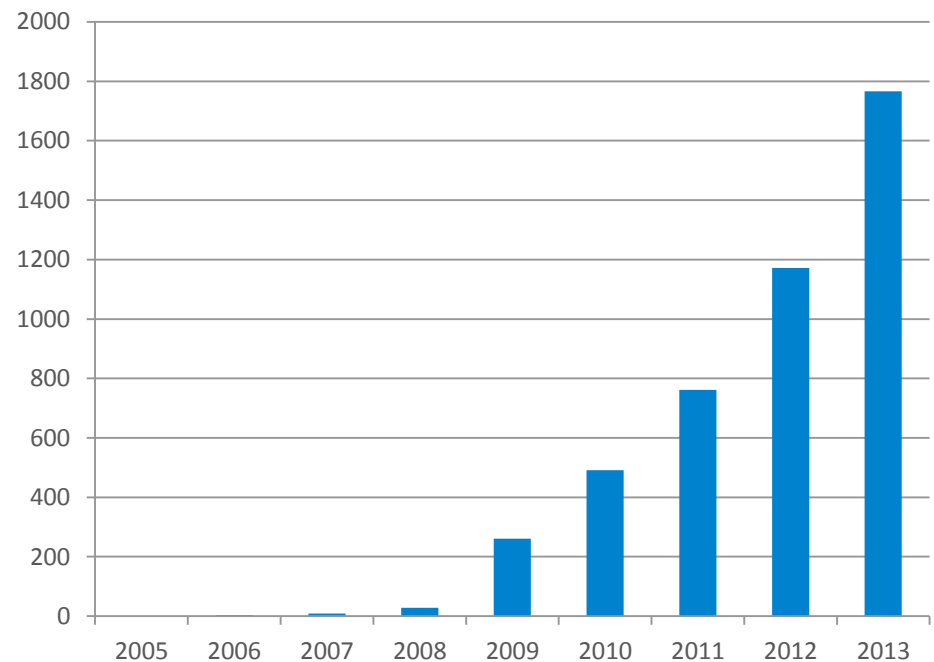
Annual Electricity Produced by Wind Resources

- In 2013, wind resources generated 1,766 GWh within ISO-NE service territory

- Total New England generation in 2013 was 112,040 GWh

– Gas	41,542
– Nuclear	37,183
– All renewables	8,751

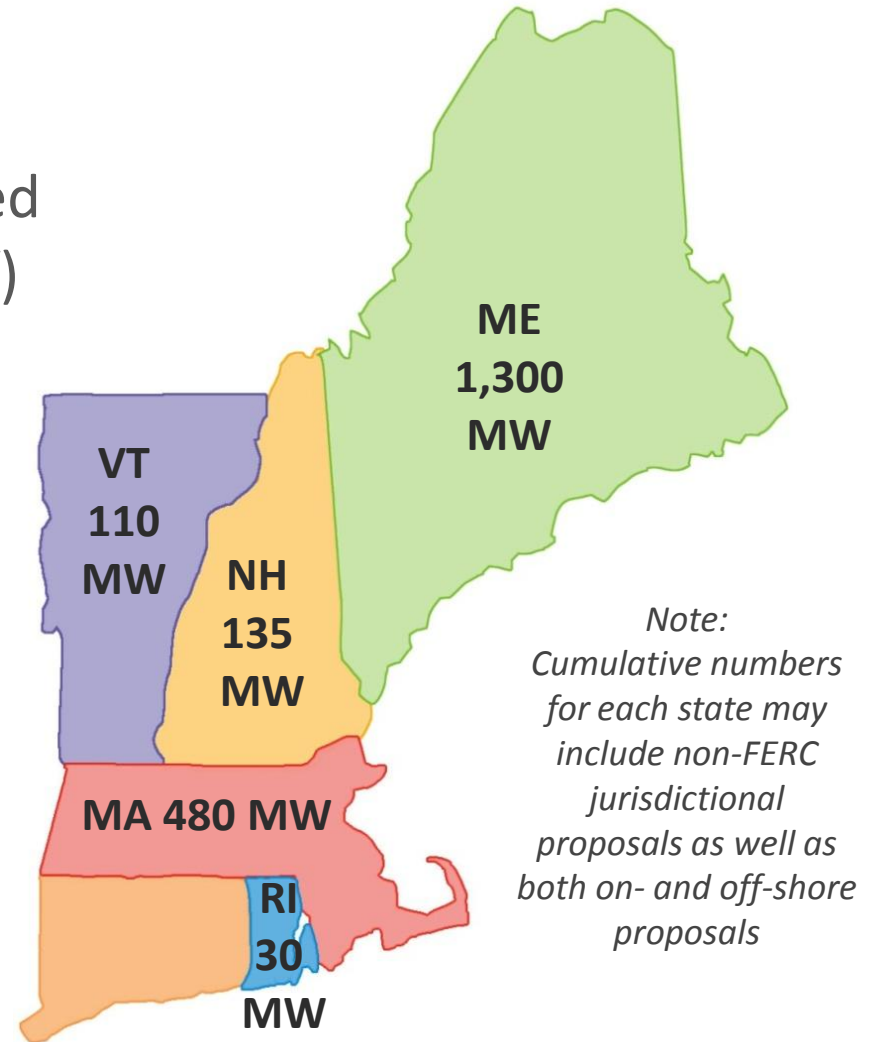
New England Wind Energy Production (GWh)



Wind Proposed for the Region

Represents 40% of proposed generation

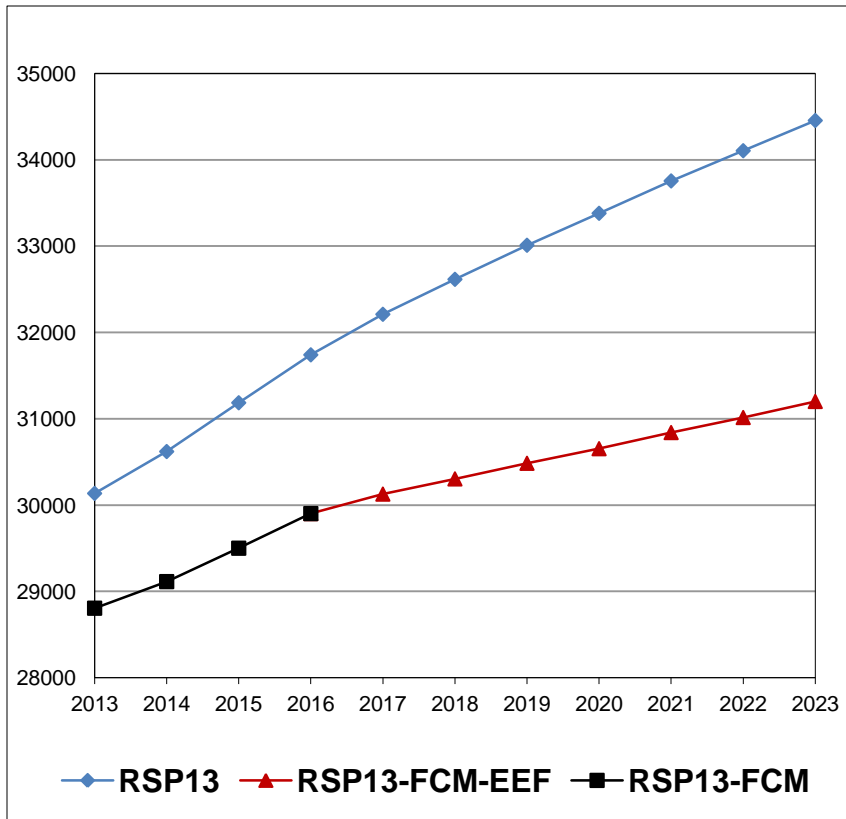
- Over 2,000 MW of wind proposed (*includes non-FERC jurisdictional*)
- Majority of wind development proposals in Maine and northern New England
- Offshore projects proposed in Maine, Massachusetts and Rhode Island



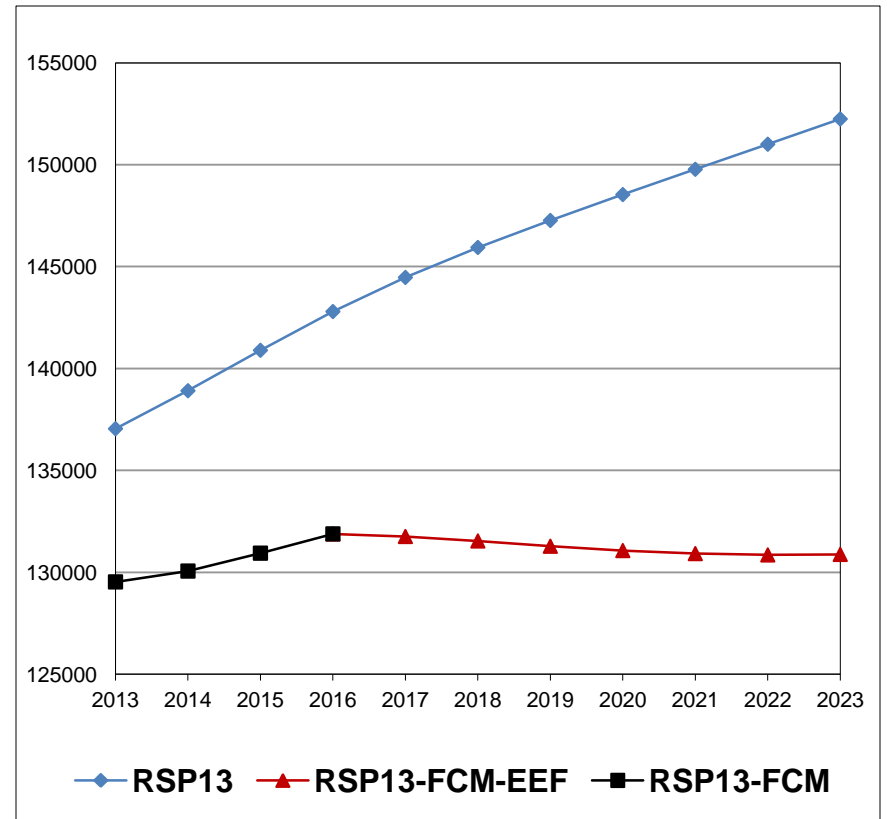
Source: ISO Generator Interconnection Queue (January 2014)

Energy-Efficiency Forecast

New England: Summer 90/10 Peak (MW)



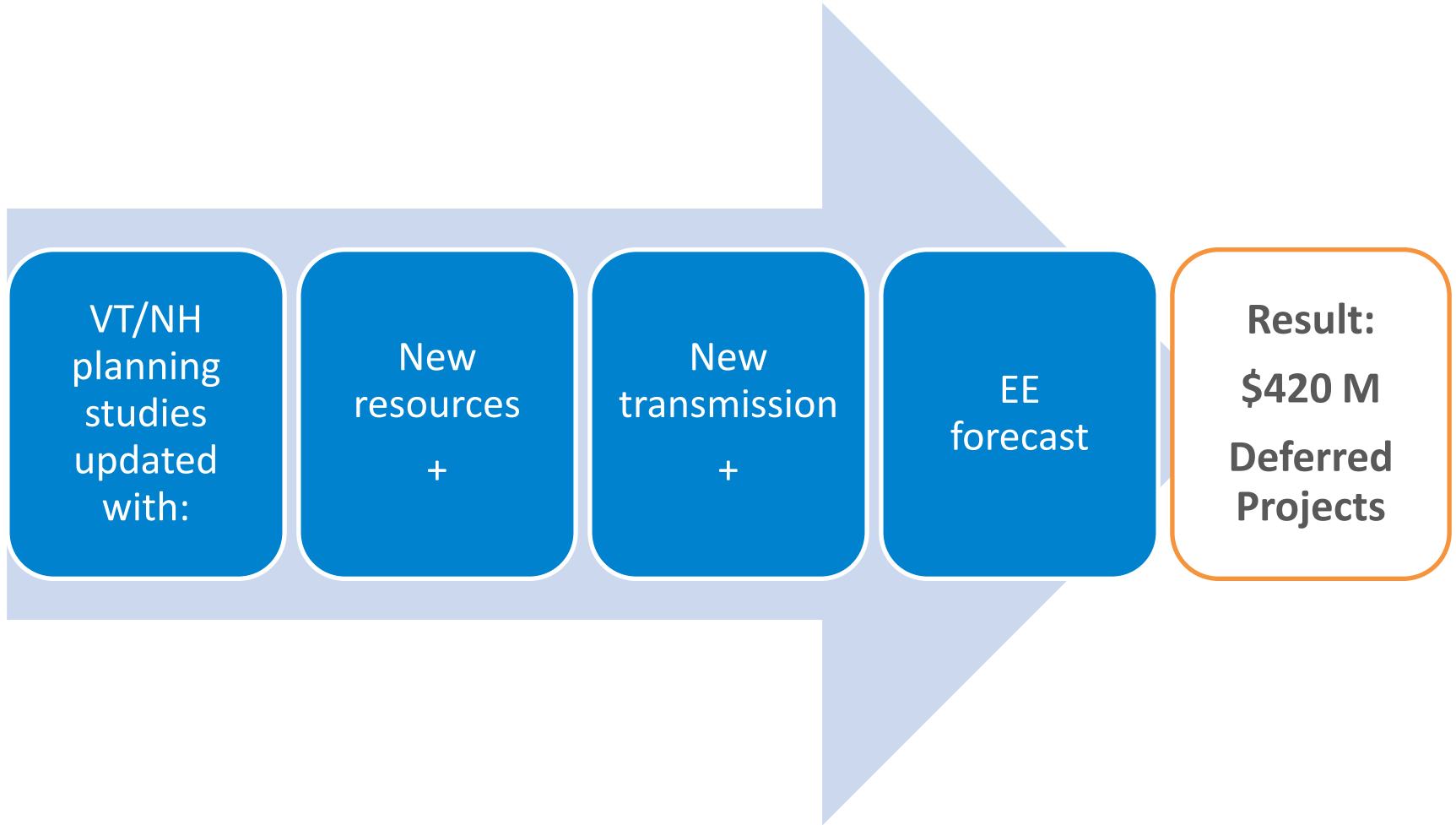
New England: Annual Energy Use (GWh)



Source: ISO-NE EE Forecast for 2017-2023, February 2014

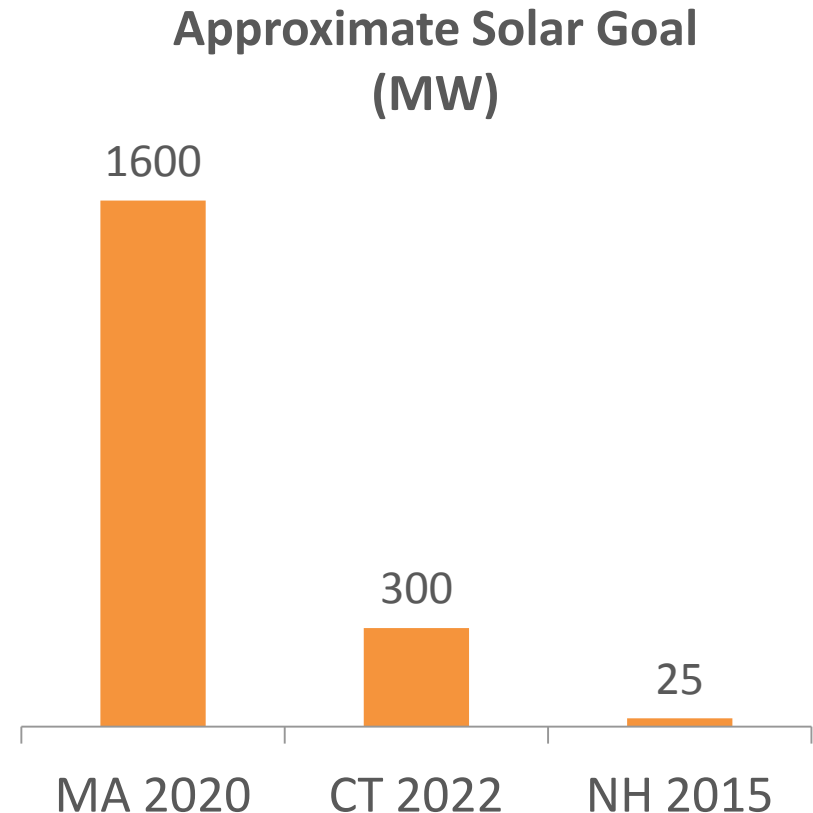
EE Forecast Is Affecting Grid Planning

Previously Identified Transmission in Vermont & New Hampshire Deferred



Region Experiencing Growth of Solar and Other Distributed Generation (DG)

- About 2,500 MW of nameplate DG capacity anticipated across New England by 2020
- Solar (PV) will likely be the dominant DG technology
 - 500 MW installed by end of 2013
- VT, RI, ME have DG programs without specific solar goals



Distributed Generation Forecast Working Group

- The ISO began an initiative in September 2013, working with the states and regional utilities, to forecast long-term incremental DG growth
- In support of this effort, the ISO created a regional Distributed Generation Forecast Working Group (DGFWG) as a vehicle to collect data on DG policies and implementation from states and utilities
- DGFWG assists the ISO in developing the forecast
- The ISO released a preliminary draft DG forecast in December 2013 based on state policy goals for DG
 - A data-driven methodology is under development to forecast DG going forward

Resource Shift Creates Reliability Challenges

- **ISO New England** is increasingly reliant on resources with uncertain performance and availability
 - **Intermittent resource growth** with inherently uncertain output
 - **Natural gas resources** lack fuel storage and rely on “just-in-time” fuel
 - **Coal, oil-steam fleet** is being displaced by more efficient resources
- ISO estimates **up to 8,300 MW of non-gas-fired generation is “at risk” for retirement by 2020** (28 older oil and coal units)
 - If all retire, ISO estimates 6,300 MW of new or repowered capacity will be needed in the region
- Almost **3,400 MW of generation plan to retire within the next five years**
 - Source: Status of Non-Price Retirement Requests; October 23, 2013

Major Non-Gas-Fired Generators Retiring

Vermont Yankee Nuclear Station

Unit 1: 604 MW
Total: 604 MW

Salem Harbor Station

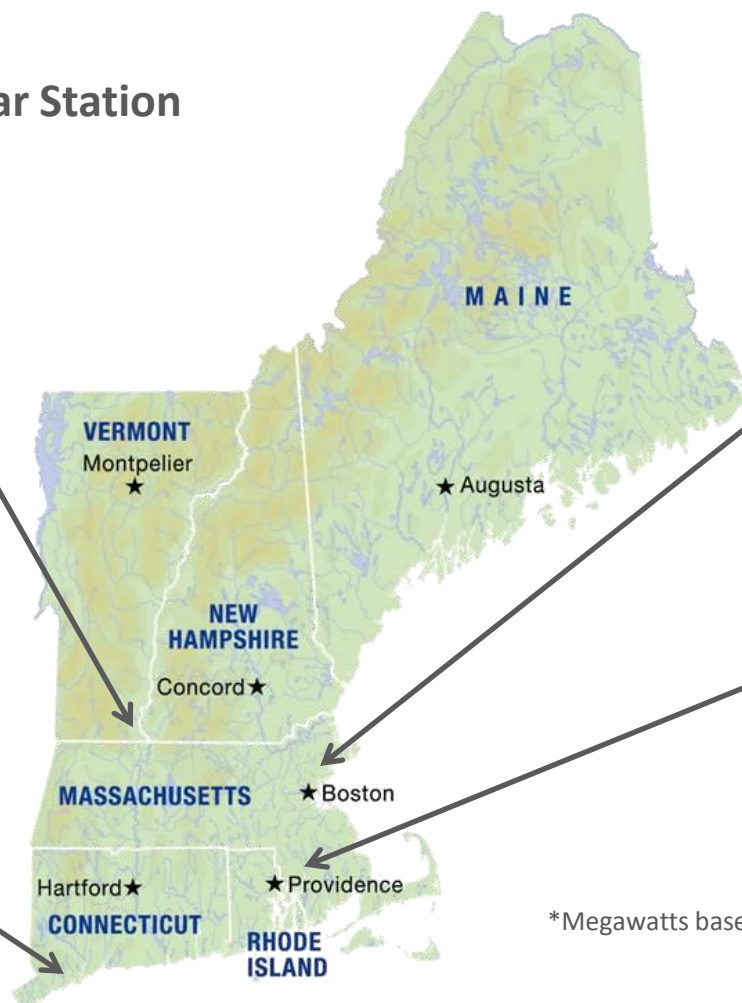
Unit 1: 82 MW (coal)
Unit 2: 80 MW (coal)
Unit 3: 150 MW (coal)
Unit 4: 437 MW (oil)
Total: 749 MW

Norwalk Harbor Station

Unit 1: 162 MW (oil)
Unit 2: 168 MW (oil)
Unit 10: 12 MW (oil)
Total: 342 MW

Brayton Point Station

Unit 1: 239 MW (coal)
Unit 2: 239 MW (coal)
Unit 3: 612 MW (coal)
Unit 4: 435 MW (oil)
Brayton Diesels 1-4: 10 MW
Total: 1535 MW



*Megawatts based on relevant FCA summer qualified capacity

Source: Status of Non-Price Retirement Requests; December 20, 2013

New England Governors Commit to Regional Cooperation on Energy Infrastructure Issues

- Dec. 2013: Region's governors announced the need for strategic investments in energy resources and infrastructure:
 - Energy efficiency
 - Renewable generation
 - Natural gas pipelines
 - Electric transmission
- Ensure a reliable, affordable and diverse energy system
- Enable states to meet clean energy and greenhouse gas reduction goals and improve economic competitiveness



New England Governors Request ISO's Support to Develop Electric and Natural Gas Infrastructure

- January 2014: Governors, through NESCOE, request ISO technical support and tariff filings at FERC to support their objectives to expand energy infrastructure
- **New Electric Transmission Infrastructure**
 - Enable delivery of 1,200 MW to 3,600 MW of clean energy into New England from no and/or low carbon emissions resources
- **Increased Natural Gas Capacity**
 - Increase firm pipeline capacity into New England by 1000 mmcf/day above 2013 levels, or 600 mmcf/day beyond announced projects
 - Targeted to be in-service by winter 2017/18
- **Cost recovery through ISO tariff**
 - States to decide on cost allocation

Conclusion

- Energy landscape is changing rapidly
- Region is seeing growth in renewable energy, energy efficiency and distributed generation
- Region is also seeing the retirement of older fossil-fueled generators
- ISO New England is planning for this changing energy landscape to ensure reliable system operations



Questions

