



ISO New England Overview

Resources Recovery Task Force Meeting

Eric Johnson

DIRECTOR, EXTERNAL AFFAIRS



ISO NEW ENGLAND OVERVIEW

Eric Johnson, Director, External Affairs

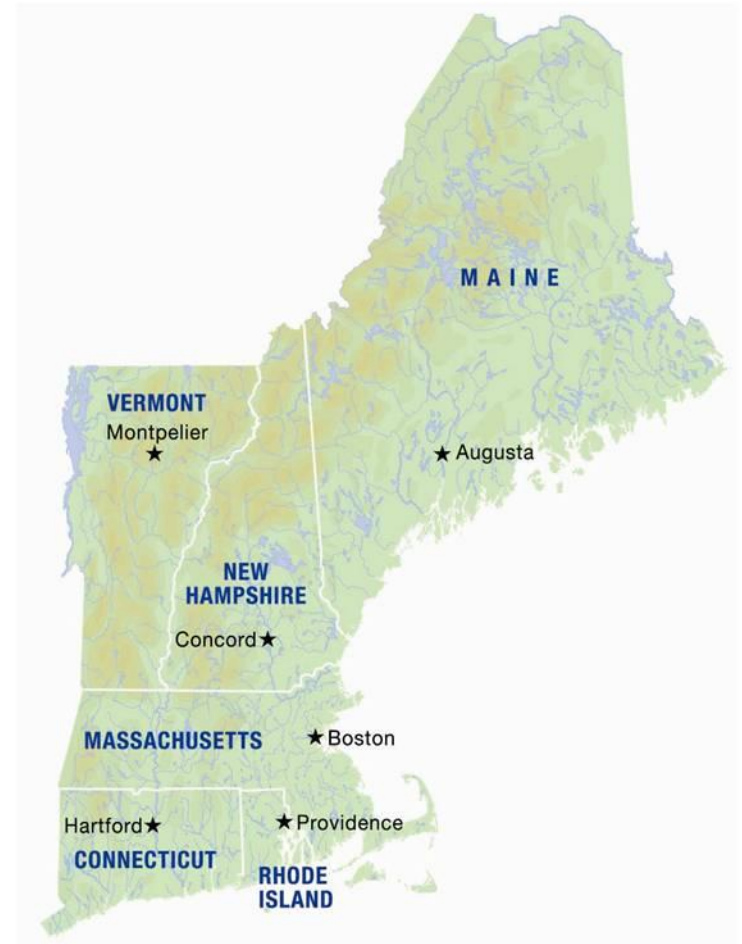
About ISO New England

- **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

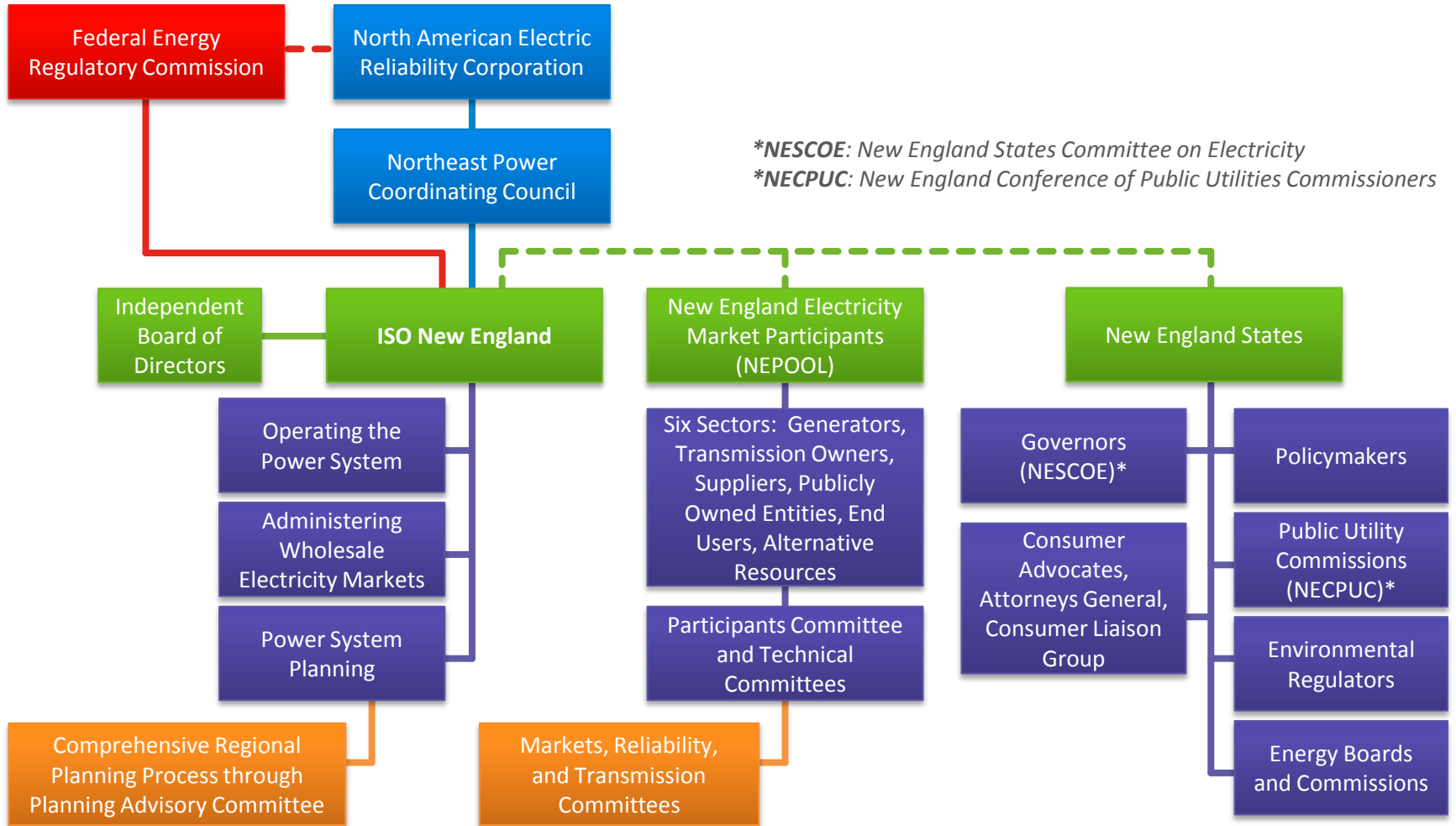


New England's Electric Power Grid at a Glance

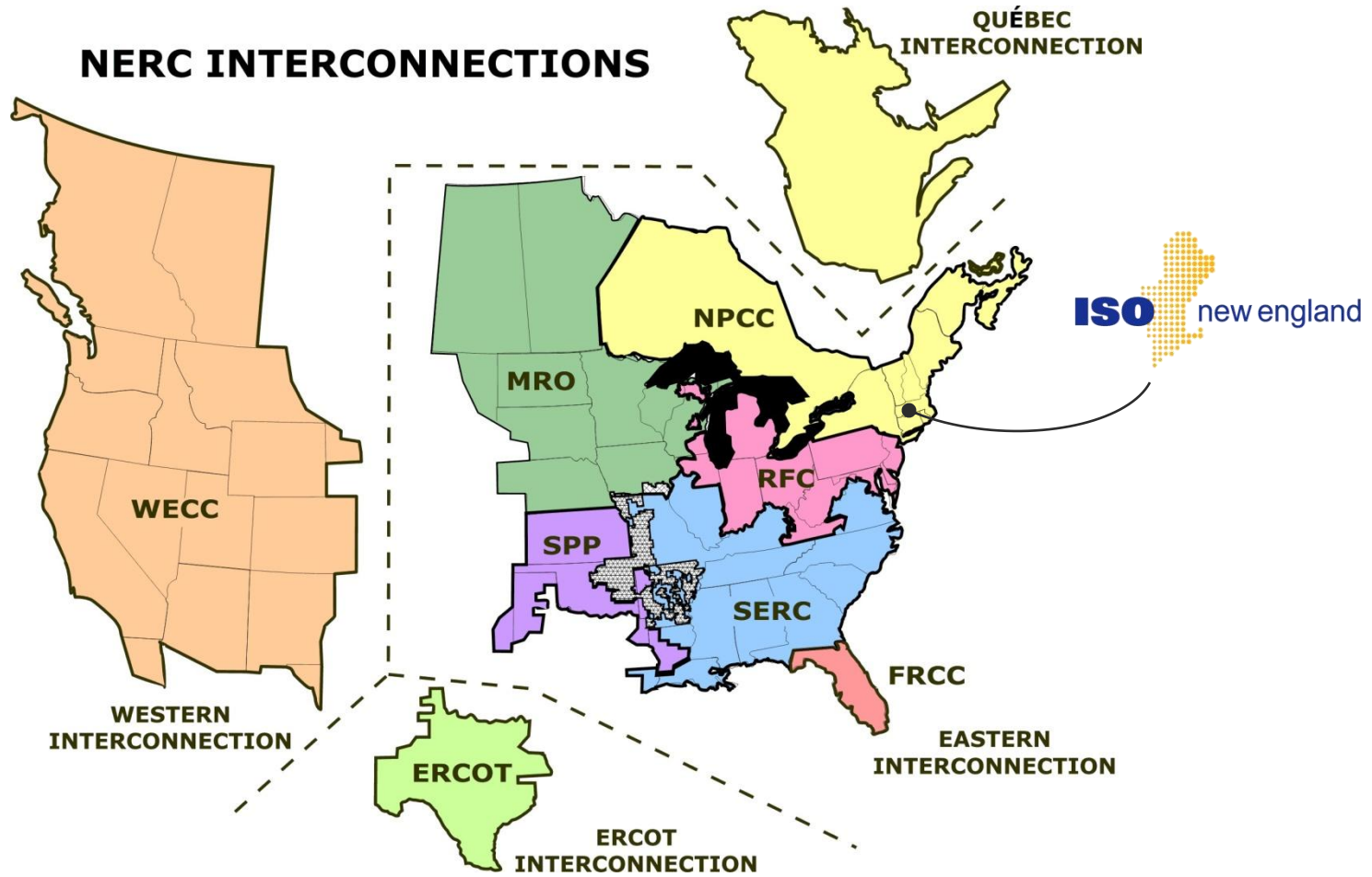
- 6.5 million households and businesses; population 14 million
- 350+ generators
- 8,000+ miles of high-voltage transmission lines (115 kV and above)
- 13 interconnections to electricity systems in New York and Canada
- 31,750+ megawatts (MW) of generating capacity and approximately 1,850 MW of demand 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



Industry Structure in New England



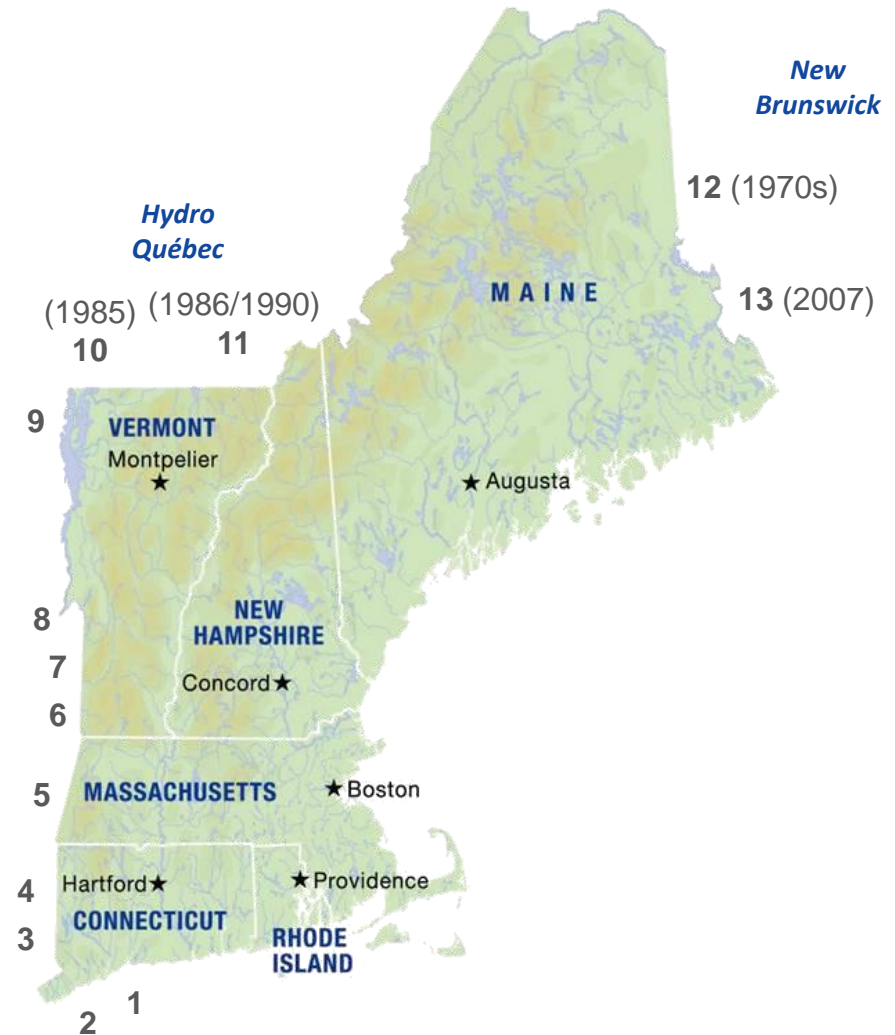
We are Part of the Eastern Interconnection



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

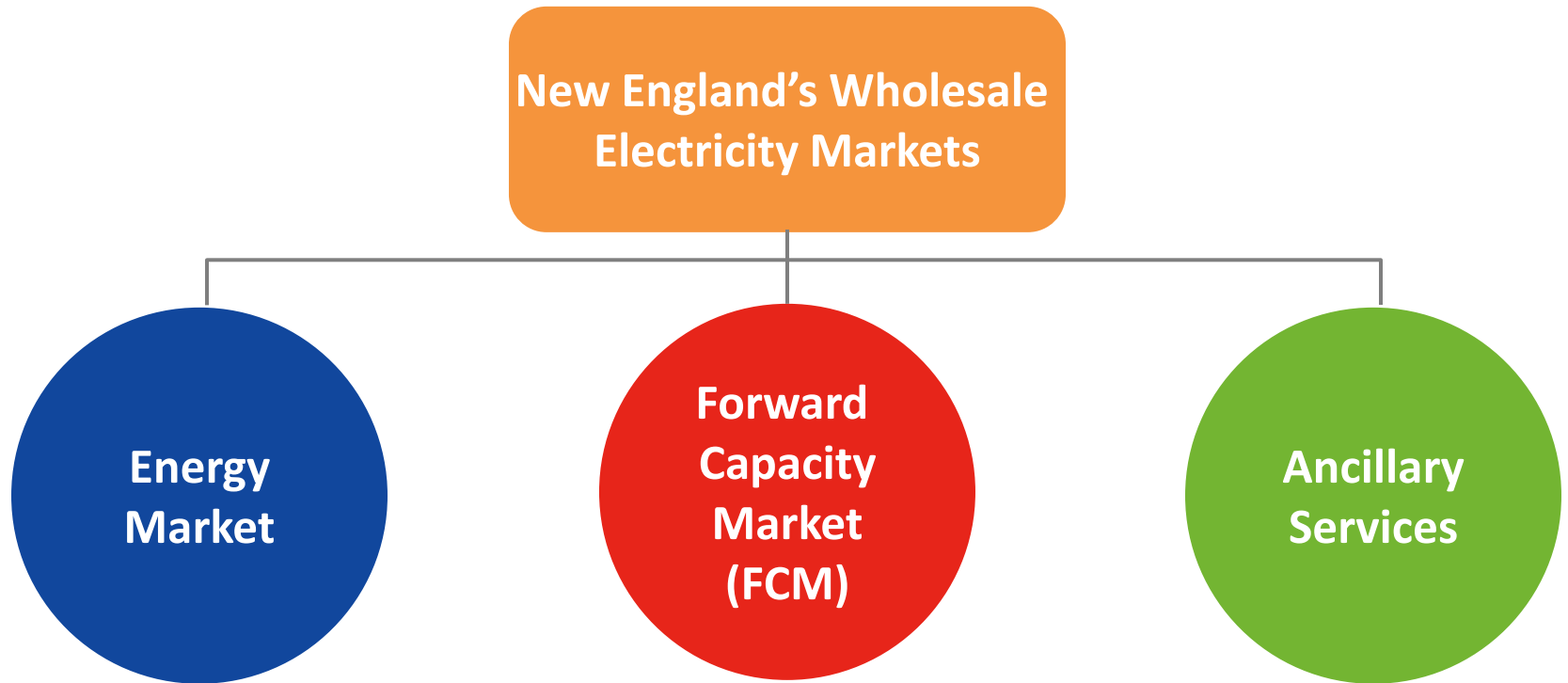
- Ensure the development of a reliable and efficient power system to meet current and future electricity needs.

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 approx. \$6 B to \$14 B over last five years

Major Components



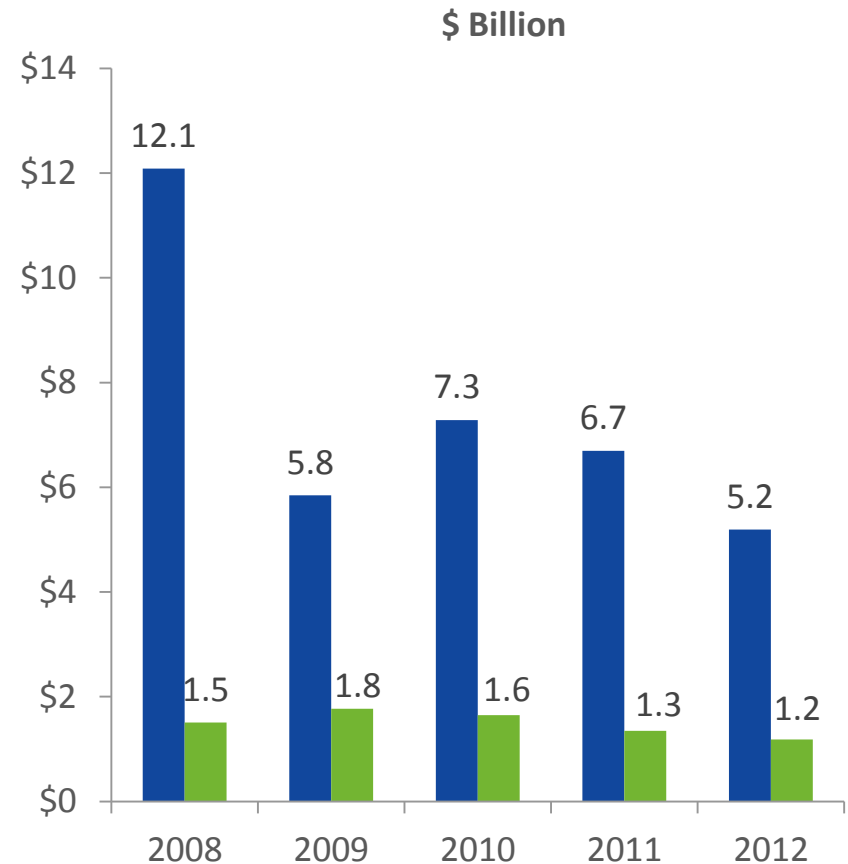
**Energy
Market**

Daily market for wholesale customers to buy and sell electric "energy"



**Capacity
Market**

Three-year forward market that commits "capacity" resources to meet system resource-adequacy needs



Source: New England Wholesale Electricity Costs, 2012 Consumer Liaison Group Report, ISO New England, June 27, 2013.

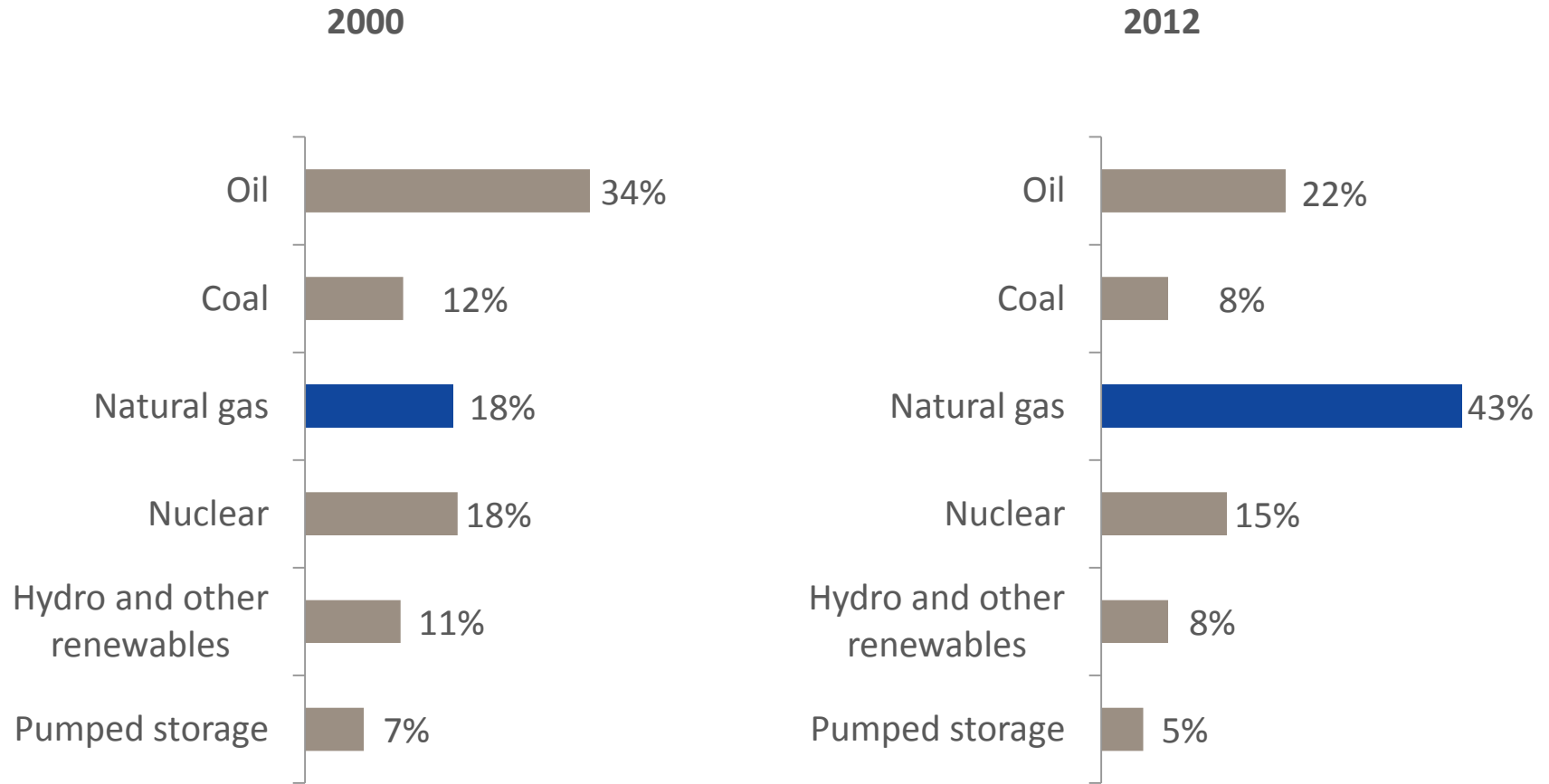
Regional Power System Planning

- 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)



Regional *Capacity* Shifts Toward Natural Gas

Percent of Total System Capacity

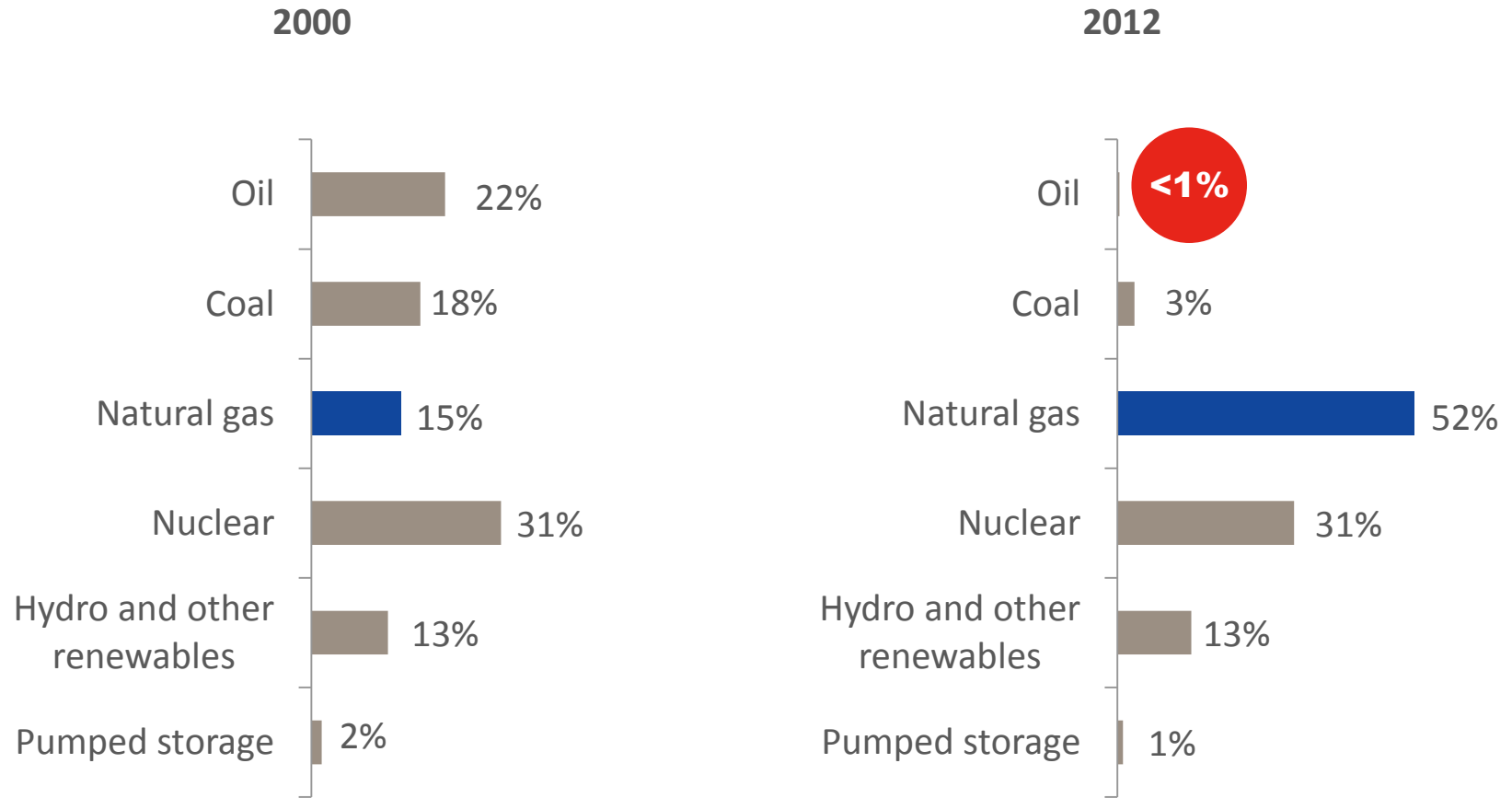


Other renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and misc. fuels.

Source: Regional Profile (2012/13)

Regional *Energy* Shifts Toward Natural Gas

Percent of Total Electric Energy Production

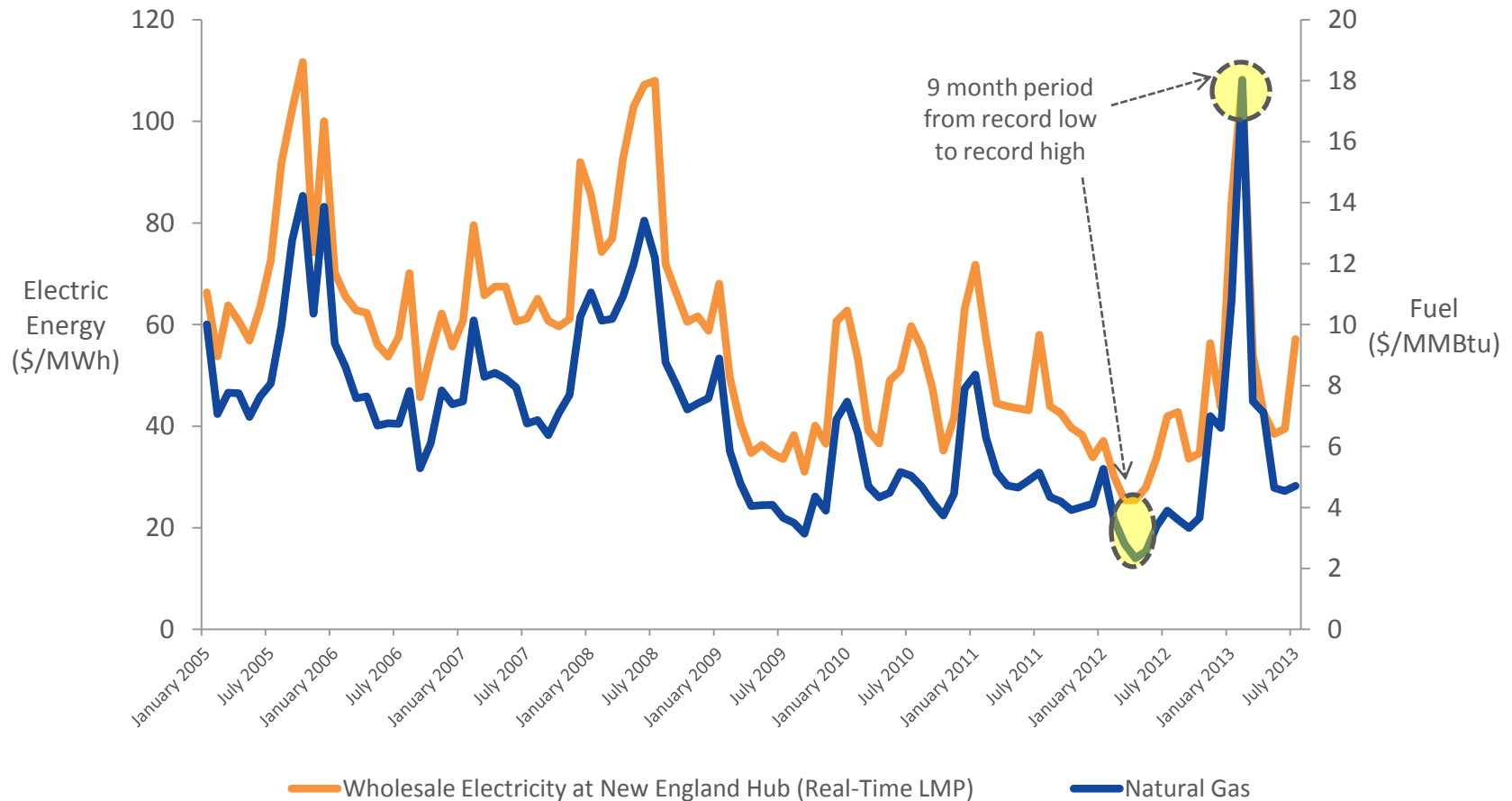


Other renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and misc. fuels.

Source: Regional Profile (2012/13)

Wholesale Markets Select Lowest-Priced Resource

Natural gas-fired power plants are 50% of the supply mix in New England, often set the price in the wholesale electricity market, and displace more expensive resources (such as oil)



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
2011	25.30	57.01	46,959
% Reduction, 2001–2011	↓ 58%	↓ 71%	↓ 11%

Reduction in Average Emission Rates (lb/MWh)

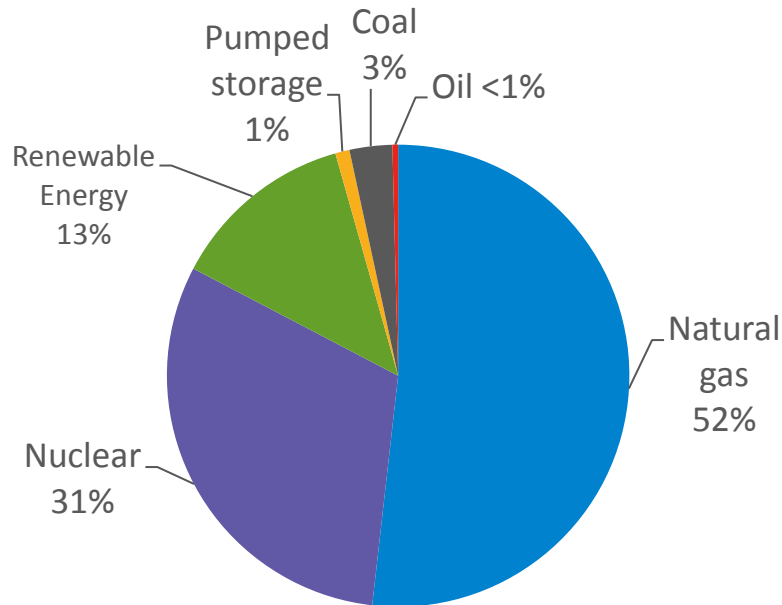
Year	NO _x	SO ₂	CO ₂
2001	1.05	3.51	930
2011	0.42	0.95	780
% Reduction, 2001–2011	↓ 60%	↓ 73%	↓ 16%

Source: [April 24, 2013 PAC Presentation](#); 2011 ISO New England Electric Generator Air Emissions Report

Natural Gas has Become the Dominant Fuel for Power Generation in New England

Existing Generation

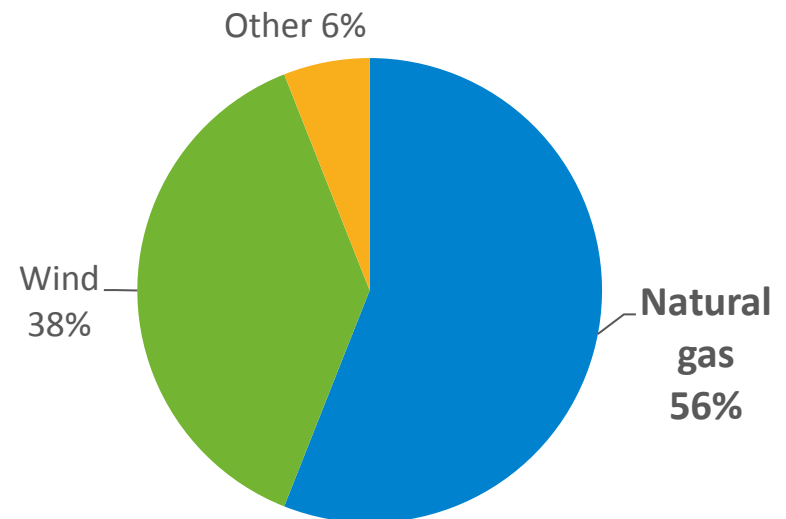
Natural gas has largely displaced oil- and coal-fired generation



Energy by Fuel Type, 2012

Proposed Capacity

Natural gas is the fuel of choice for new capacity and gas-fired generators will be needed to balance variable energy resources



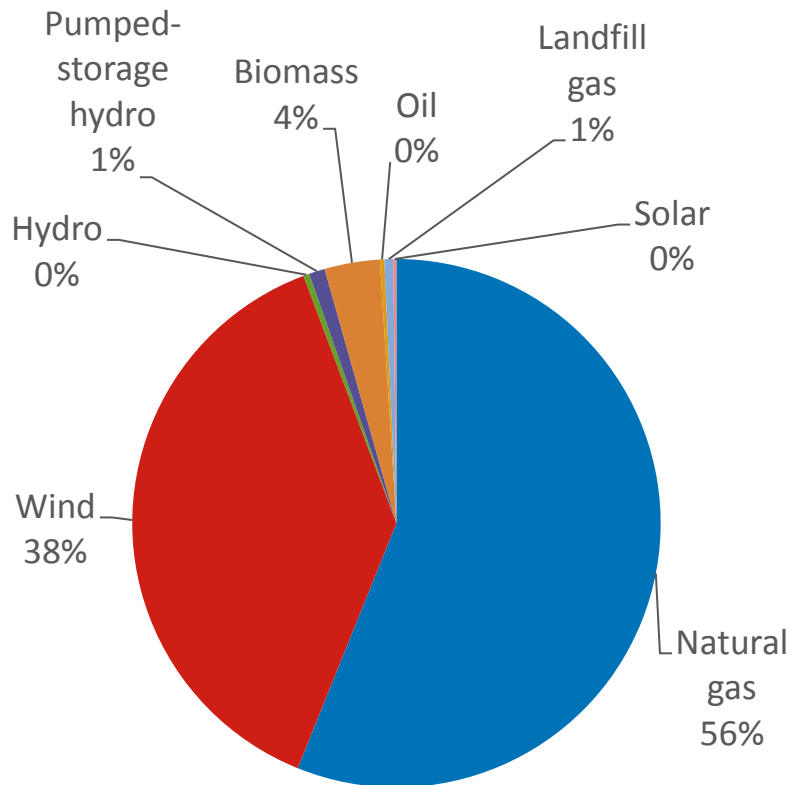
ISO Generator Interconnection Queue (April 2013)



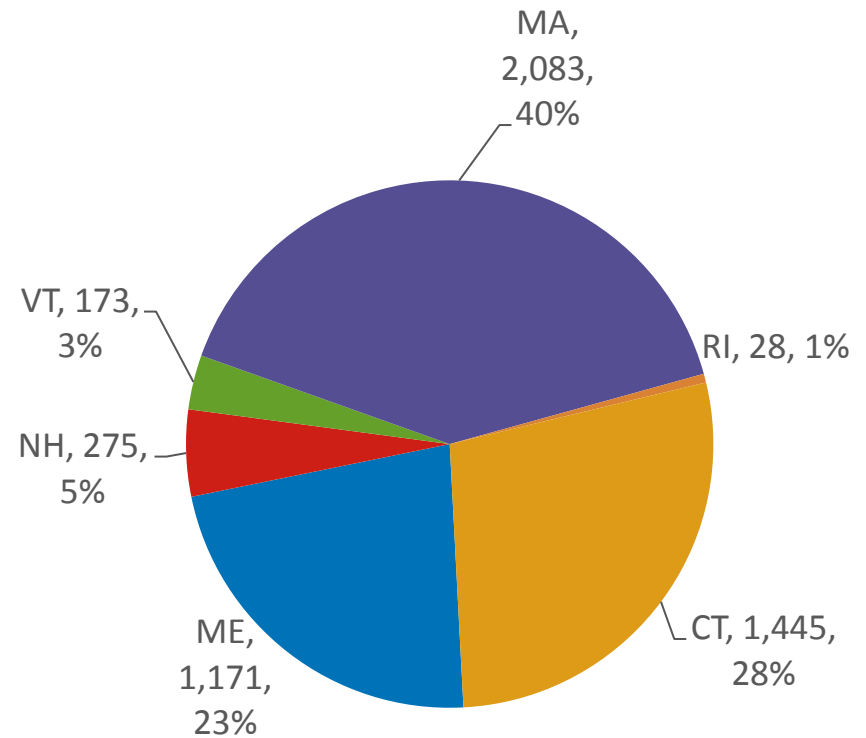
Generator Proposals in the ISO Queue

Approximately 5,000 MW

By Type



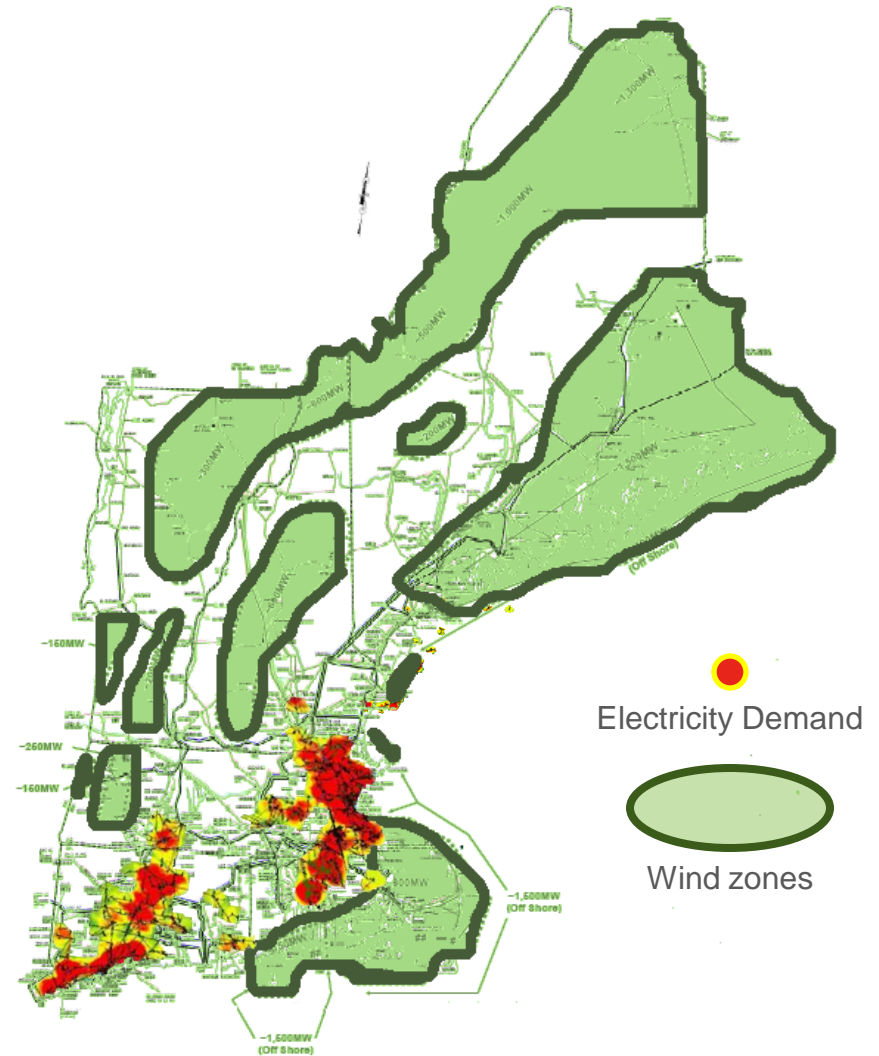
By State



Source: ISO Generator Interconnection Queue (April 2013)

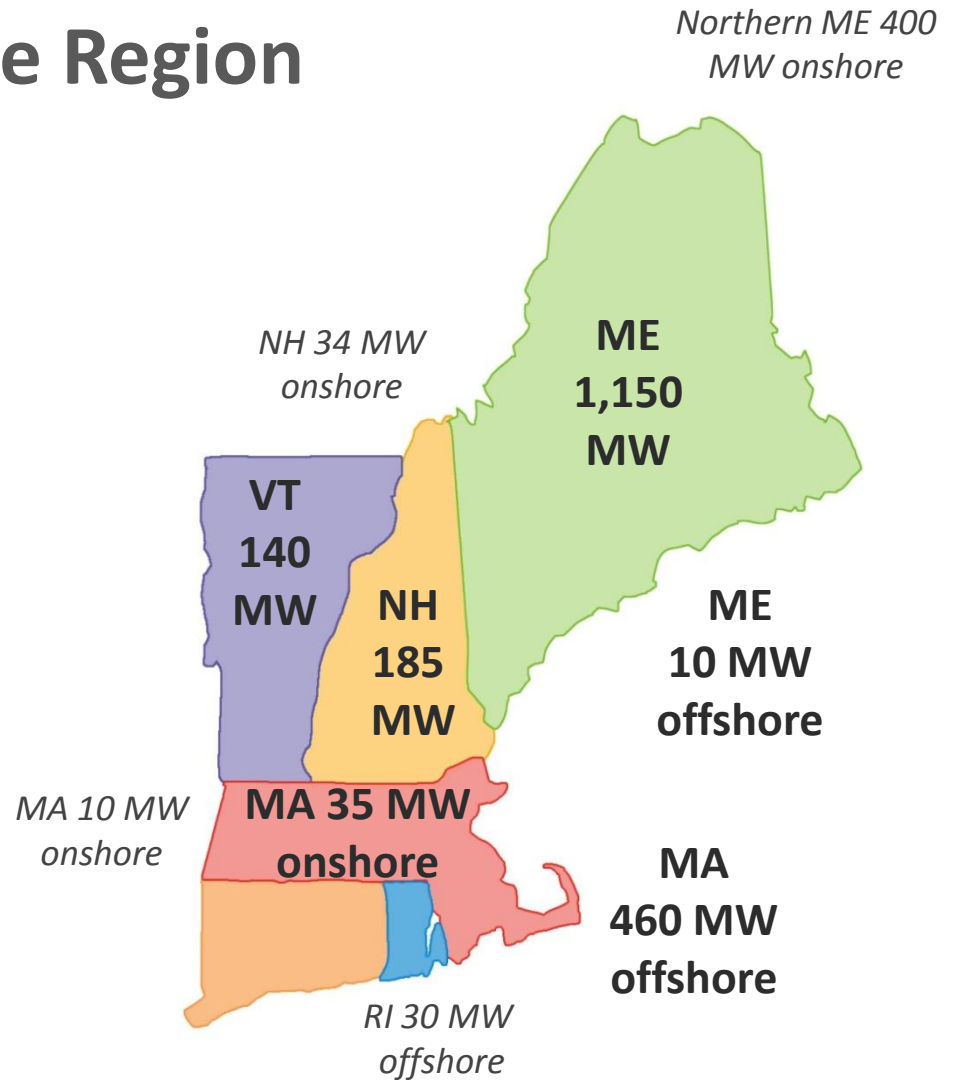
New England has Significant Wind Potential

- Population and electric demand are concentrated along the coast in central and southern New England
- 12,000 MW of onshore and offshore wind potential
 - Preliminary screening eliminated wind sites near urban areas and sensitive geographic locations (e.g., Appalachian Trail)
- Transmission will be required to connect potential wind resources to load centers in New England



Wind Proposed for the Region

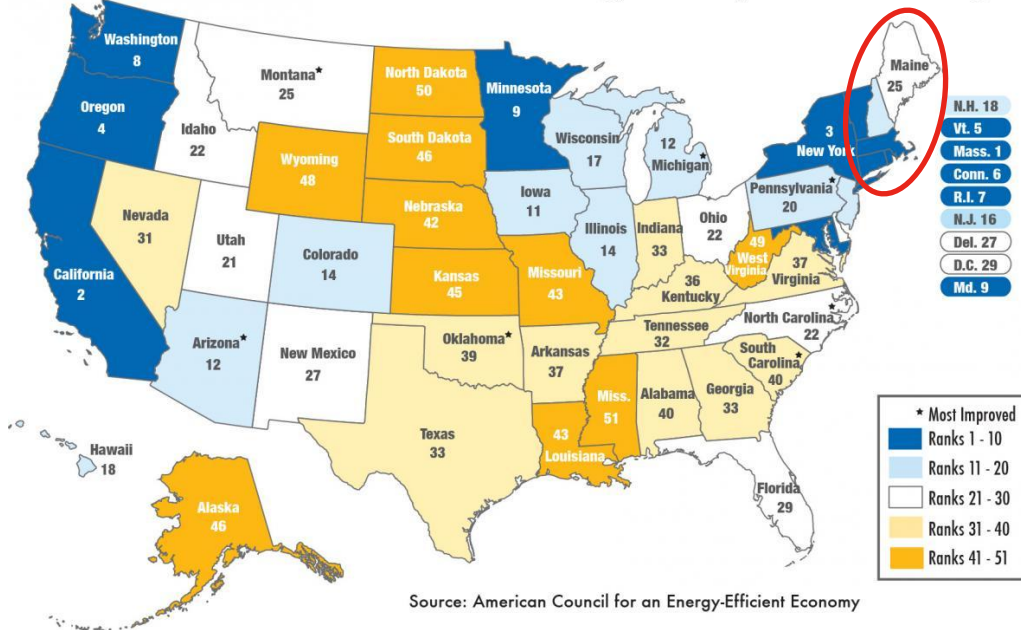
- About 2,400 MW proposed (*includes non-FERC jurisdictional*)
- Majority of wind development proposals in Maine and northern New England
- Large-scale offshore project proposed in Massachusetts



Source: ISO Generator Interconnection Queue (April 2013)

Energy-Efficiency is a Priority for New England

2012 State Energy Efficiency Scorecard Rankings



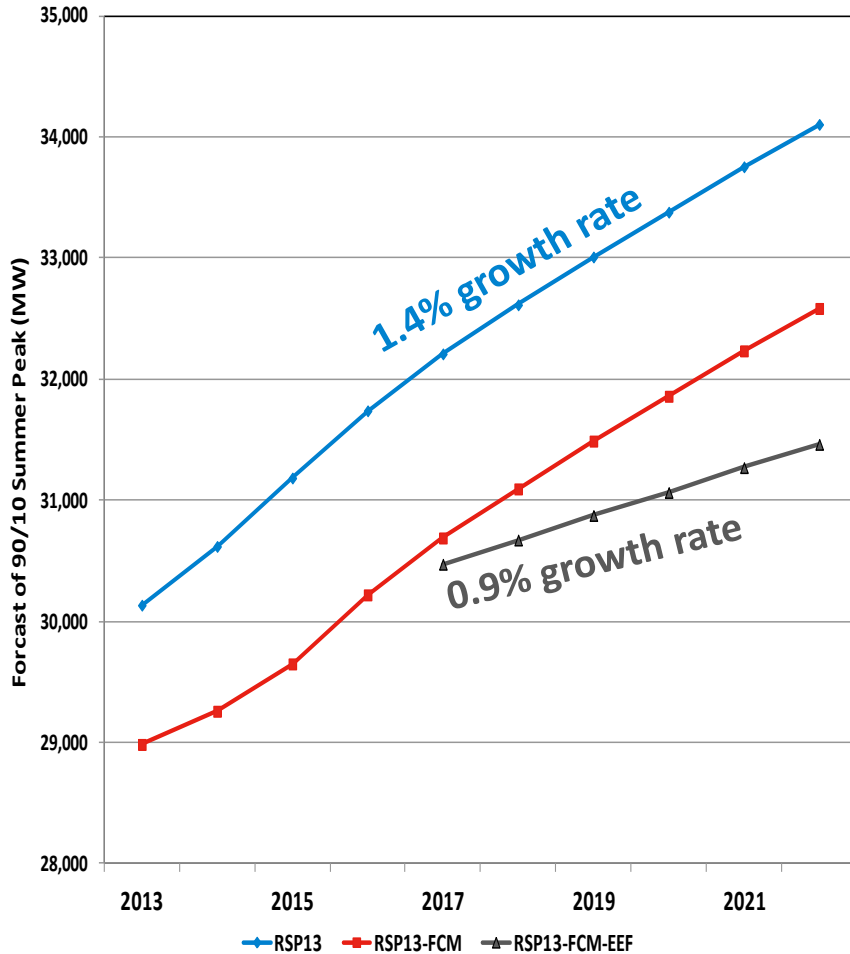
Ranking of state EE efforts by the *American Council for an Energy-Efficient Economy*:

- Massachusetts 1
- Vermont 5
- Connecticut 6
- Rhode Island 7
- New Hampshire 18
- Maine 25

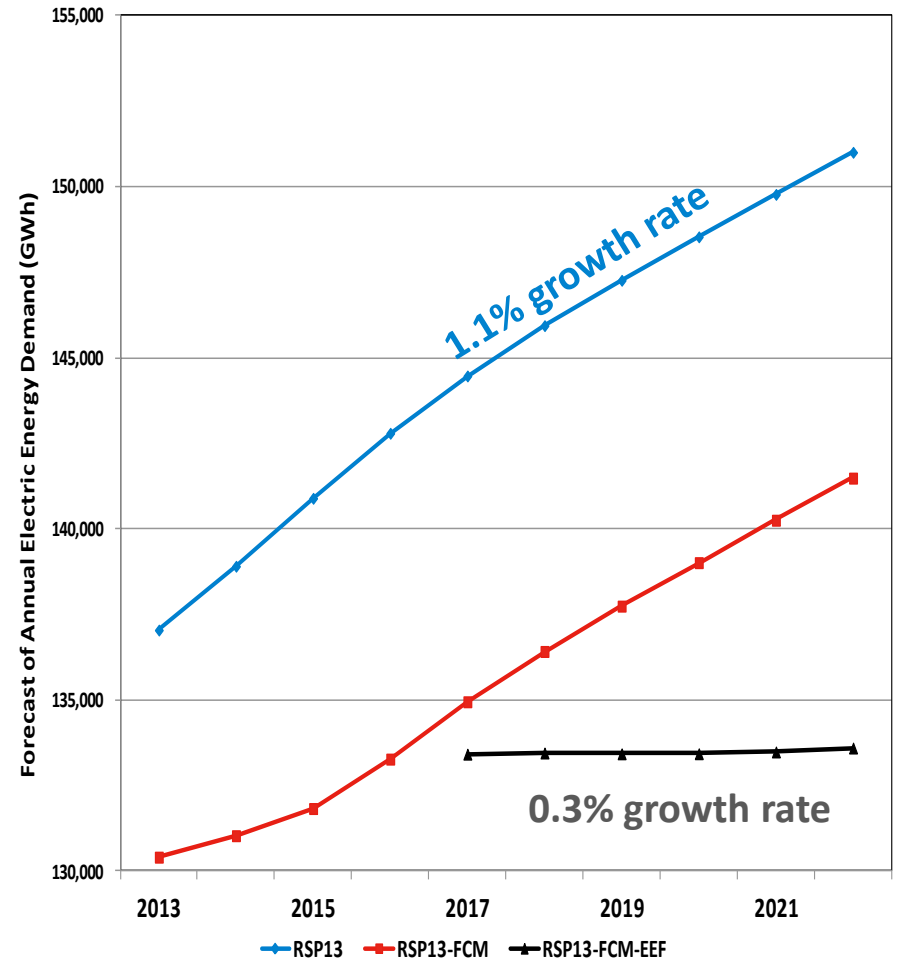
- Billions spent over the past few years; more on the horizon
 - Approximately \$1 billion invested from 2008 to 2010
 - ISO estimates \$5.7 billion to be invested in EE from 2015 to 2021

Energy-Efficiency Forecast

New England: Summer 90/10 Peak (MW)

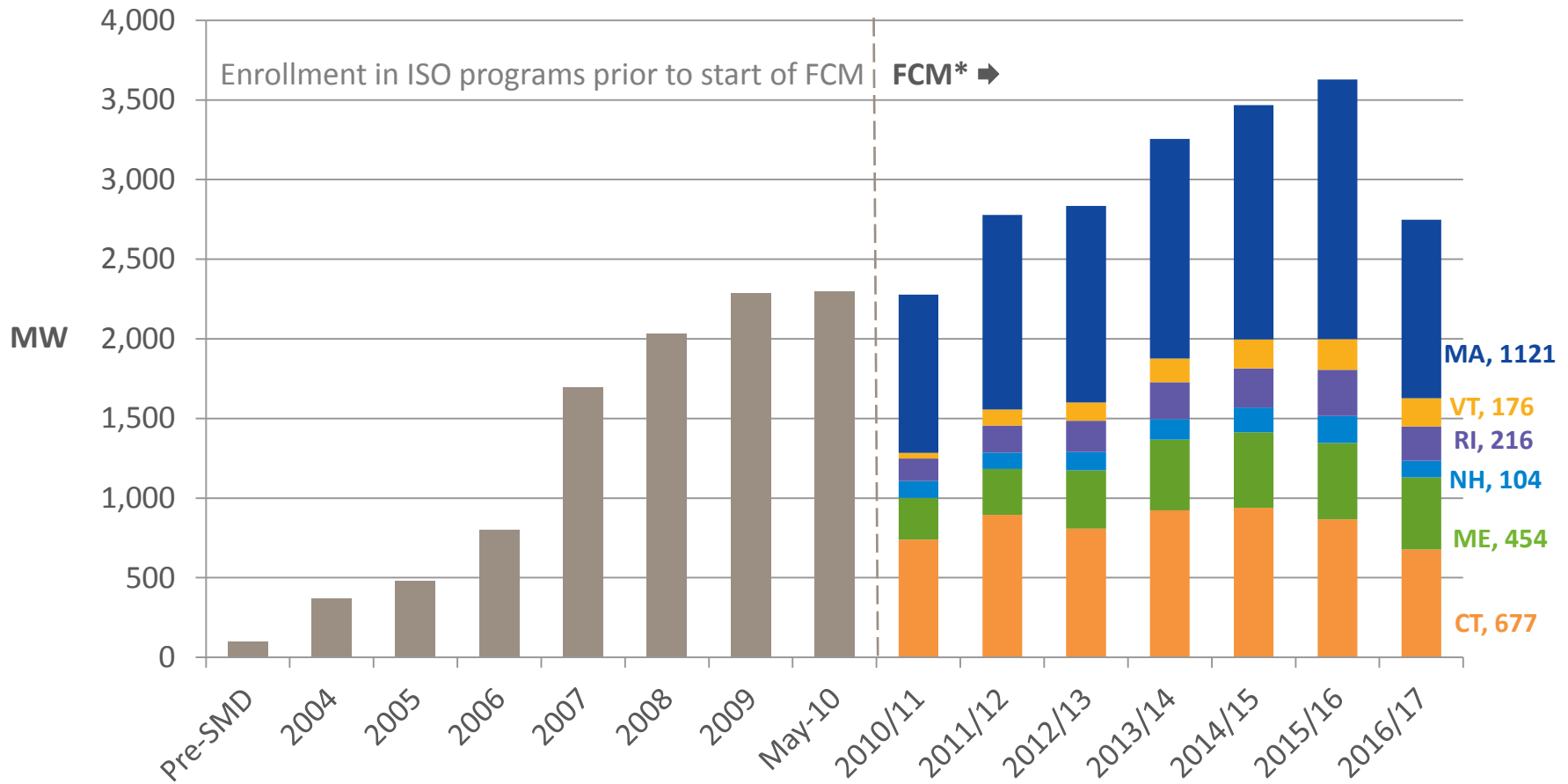


New England: Annual Energy Use (GWh)



Source: ISO-NE EE Forecast for 2016-2022, February 2013

Demand Resources Growing in New England



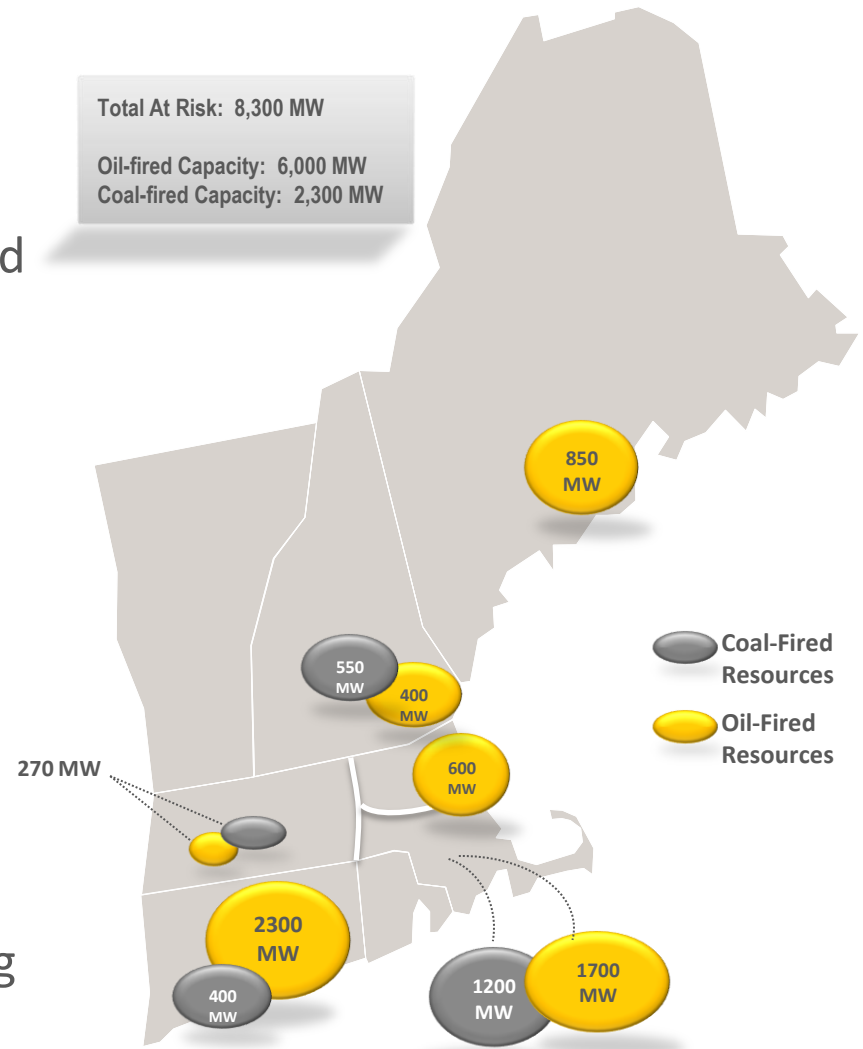
*2010/11–2016/17: Total DR cleared in FCAs 1–7 (New and Existing); Real-Time Emergency Generation capped at 600 MW.

GENERATOR RETIREMENT

Generator Retirement Study

“At Risk” Capacity Resources in New England

- Objective
 - Evaluate reliability impact associated with the assumed retirement of 28 coal- and oil-fired resources with 8,300 MW of capacity by 2020
- Primary Concerns
 - Resource Adequacy
 - Load-Resource Energy Balance
 - Area Transmission Security
- Another Issue
 - Consequence of constraints impacting deliverability of existing capacity resources to load



Generator Non-Price Retirement Requests

More than 3,300 MW of generation plan to retire within the next five years

Major Generator Retirement Requests

- **Salem Harbor Station (749 MW)**
 - Unit 1: 82 MW (coal)
 - Unit 2: 80 MW (coal)
 - Unit 3: 150 MW (coal)
 - Unit 4: 437 MW (oil)
- **Vermont Yankee Nuclear Station (604 MW)**
 - Unit 1: 604 MW (nuclear)
- **Norwalk Harbor Station (342 MW)**
 - Unit 1: 162 MW (oil)
 - Unit 2: 168 MW (oil)
 - Unit 10: 12 MW (oil)
- **Brayton Point Station (1,535 MW)**
 - 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 MW Retiring in New England*	
Connecticut	348 MW
Maine	37 MW
Massachusetts	2,334 MW
New Hampshire	1 MW
Rhode Island	13 MW
Vermont	604 MW
Total	3,337 MW

*Megawatts based on relevant FCA summer qualified capacity

Account for 97% of total MW retiring in New England

Source: Status of Non-Price Retirement Requests; October 7, 2013

Major Non-Gas-Fired Generators Retiring

Account for 97% of total MW retiring within the next five years

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

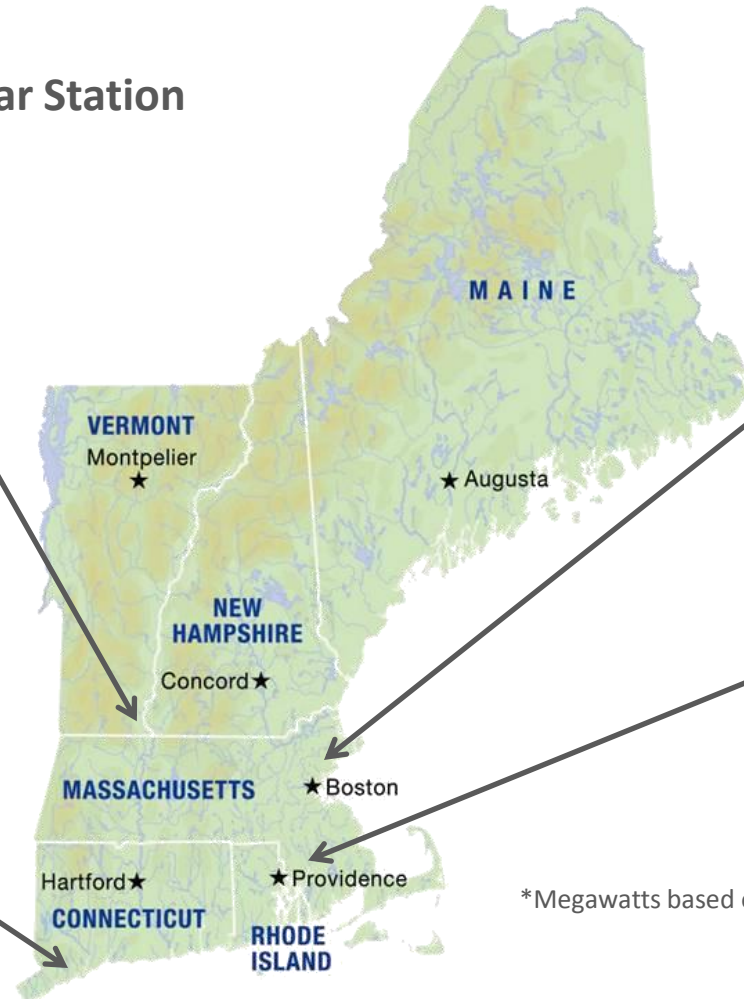
Unit 1: 162 MW (oil)
Unit 2: 168 MW (oil)
Unit 10: 12 MW (oil)

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: 1,535 MW



*Megawatts based on relevant FCA summer qualified capacity

Source: Status of Non-Price Retirement Requests; October 7, 2013

Resources Assumed to be “At Risk” of Retirement

Unit	Unit Type	MW Maximum Assumed	In-service Date	Age in 2020	Unit	Unit Type	MW Maximum Assumed	In-service Date	Age in 2020
BRAYTON POINT 1	Coal	261	01-Aug-63	57	MONTVILLE 6	Oil	418	01-Jul-71	49
BRAYTON POINT 2	Coal	258	01-Jul-64	56	MOUNT TOM 1	Coal	159	01-Jun-60	60
BRAYTON POINT 3	Coal	643	01-Jul-69	51	MYSTIC 7 GT	Oil	615	01-Jun-75	45
BRAYTON POINT 4	Oil	458	01-Dec-74	46	NEW HAVEN HBR	Oil	483	01-Aug-75	45
BRIDGEPORT HBR 2	Oil	190	01-Aug-61	59	NEWINGTON 1	Oil	424	01-Jun-74	46
BRIDGEPORT HBR 3	Coal	401	01-Aug-68	52	NORWALK HBR 1	Oil	173	01-Jan-60	60
CANAL 1	Oil	597	01-Jul-68	52	NORWALK HBR 2	Oil	179	01-Jan-63	57
CANAL 2	Oil	599	01-Feb-76	44	SCHILLER 4	Coal	51	01-Apr-52	68
MERRIMACK 1	Coal	121	01-Dec-60	60	SCHILLER 6	Coal	51	01-Jul-57	63
MERRIMACK 2	Coal	343	30-Apr-68	52	W. SPRINGFIELD 3	Oil	111	01-Jan-57	63
MIDDLETOWN 2	Oil	123	01-Jan-58	62	YARMOUTH 1	Oil	56	01-Jan-57	63
MIDDLETOWN 3	Oil	248	01-Jan-64	56	YARMOUTH 2	Oil	56	01-Jan-58	62
MIDDLETOWN 4	Oil	415	01-Jun-73	47	YARMOUTH 3	Oil	122	01-Jul-65	55
MONTVILLE 5	Oil	85	01-Jan-54	66	YARMOUTH 4	Oil	632	01-Dec-78	42

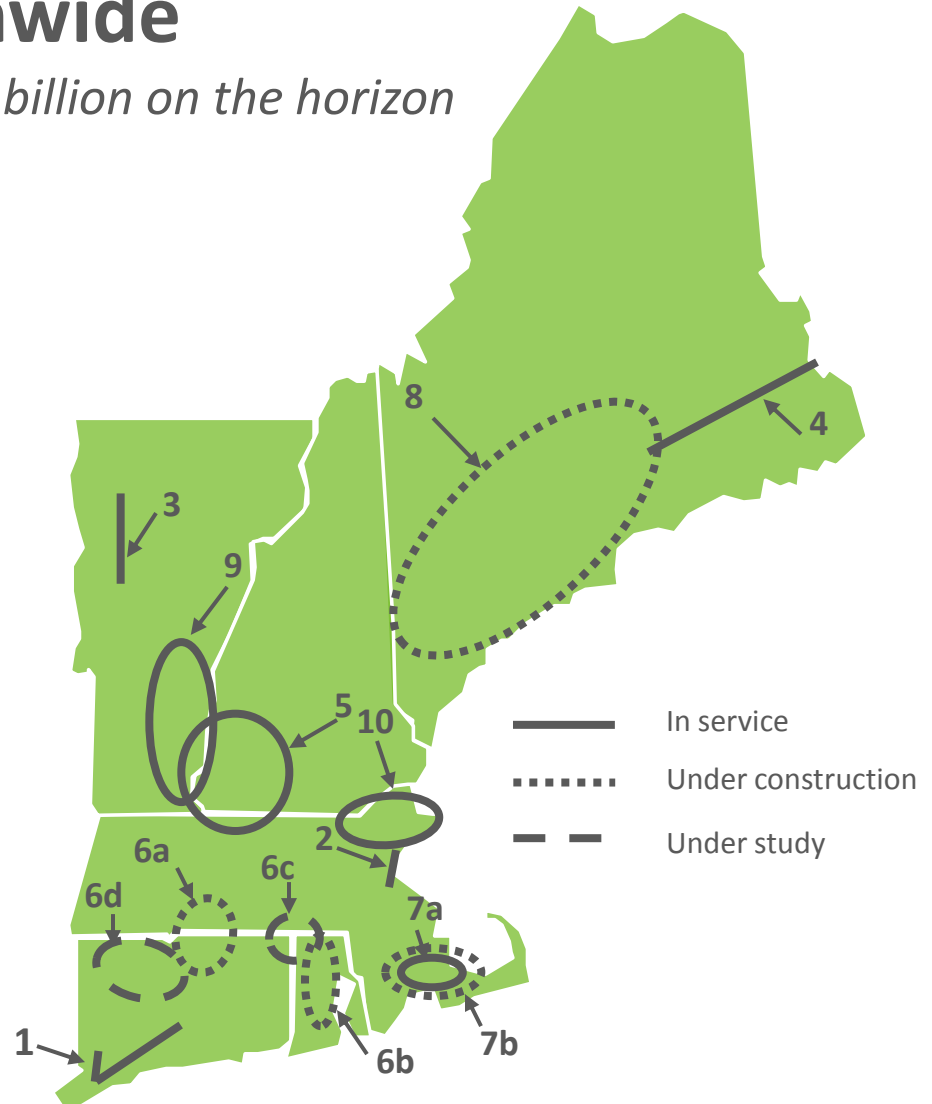
TOTAL 8,281 MW

TRANSMISSION DEVELOPMENT

Transmission Projects to Maintain Reliability are Progressing Regionwide

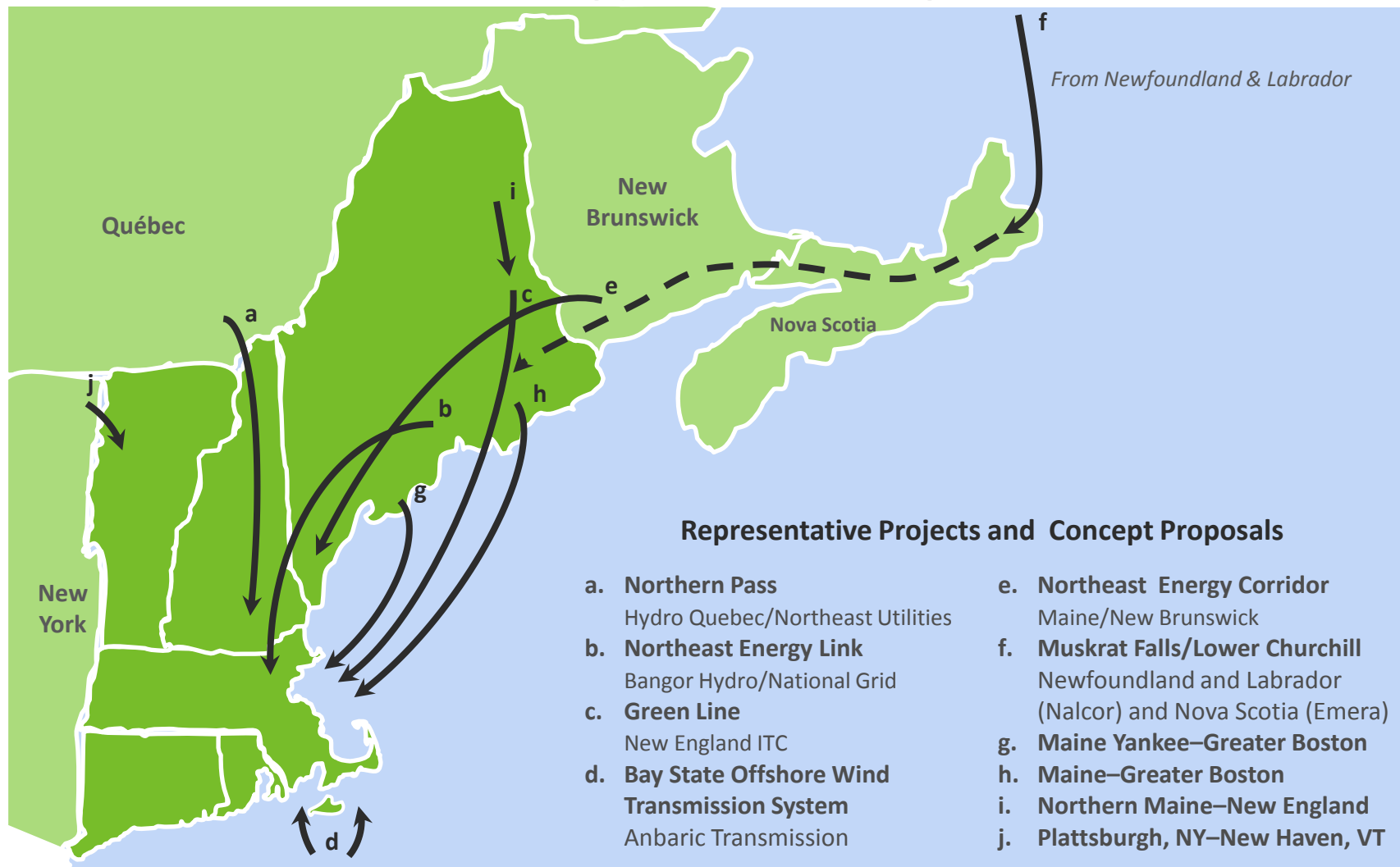
\$5.5 billion invested since 2002, \$5.7 billion on the horizon

1. Southwest CT Phases I & II
2. NSTAR 345 kV Project, Phases I & II
3. Northwest Vermont
4. Northeast Reliability Interconnect
5. Monadnock Area
6. New England East-West Solution
 - a. Greater Springfield Reliability Project
 - b. Greater Rhode Island Reliability Project
 - c. Interstate Reliability Project
 - d. Central Connecticut Reliability Project
7. Southeast Massachusetts
 - a. Short-term upgrades
 - b. Long-term Lower SEMA Project
8. Maine Power Reliability Program
9. Vermont Southern Loop
10. Merrimack Valley/North Shore Reliability



Source: RSP Transmission Project Listing, June 2013; (does not include "concept" projects)

On- and Off-shore Transmission Proposals Vying to Move Renewable Energy to New England Load Centers



Note: These projects are NOT reliability projects, but ISO New England's role is to ensure the reliable interconnection of these types of projects.

STRATEGIC PLANNING INITIATIVE

ISO New England's Strategic Planning Initiative

Focused on developing solutions to the top five challenges facing the region



1. Resource Performance and Flexibility
2. Increased Reliance on Natural Gas-Fired Capacity
3. Retirement of Generators
4. Integration of a Greater Level of Variable Resources
5. Alignment of Markets with Planning

Why the ISO and Stakeholders are Taking Action

- Operational and market improvements are needed to address emerging concerns for New England's increasing reliance on natural gas for power generation and resource performance issues in the region



Summary: Recent and Coming Improvements

Working with stakeholders to improve electric market efficiency and enhance coordination with the natural gas market

Recently Implemented (2012–2013)	Near-Term Actions (2013–2014)	Longer-Term Actions (2018–2019)
<ul style="list-style-type: none">• Ongoing improvements to information sharing with natural gas pipelines• Moved Day-Ahead Market timeline in 2013• Increased forward reserve requirements (2013)	<ul style="list-style-type: none">• 2013-2014 Winter Reliability Program (approved by FERC)• Proposed to tighten FCM Shortage Event trigger (pending at FERC)• Developed energy market offer-flexibility enhancements (take effect in Dec. 2014)	<ul style="list-style-type: none">• Strengthen Forward Capacity Market Performance Incentives “Pay-for-Performance”

For More Information

- ISO Training
<http://www.iso-ne.com/support/training/index.html>
- ISO Express data portal
<http://isoexpress.iso-ne.com/guest-hub>
- ISO to Go mobile app
 - For iPhone and Android
 - <http://www.iso-ne.com/support/isotogo/>

