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ISO New England's Strategic Transmission Analysis

New England Electricity Restructuring Roundtable: Generation Retirement Study & 2020 Resource Options

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Five Regional Challenges Identified

SPI
STRATEGIC PLANNING INITIATIVE

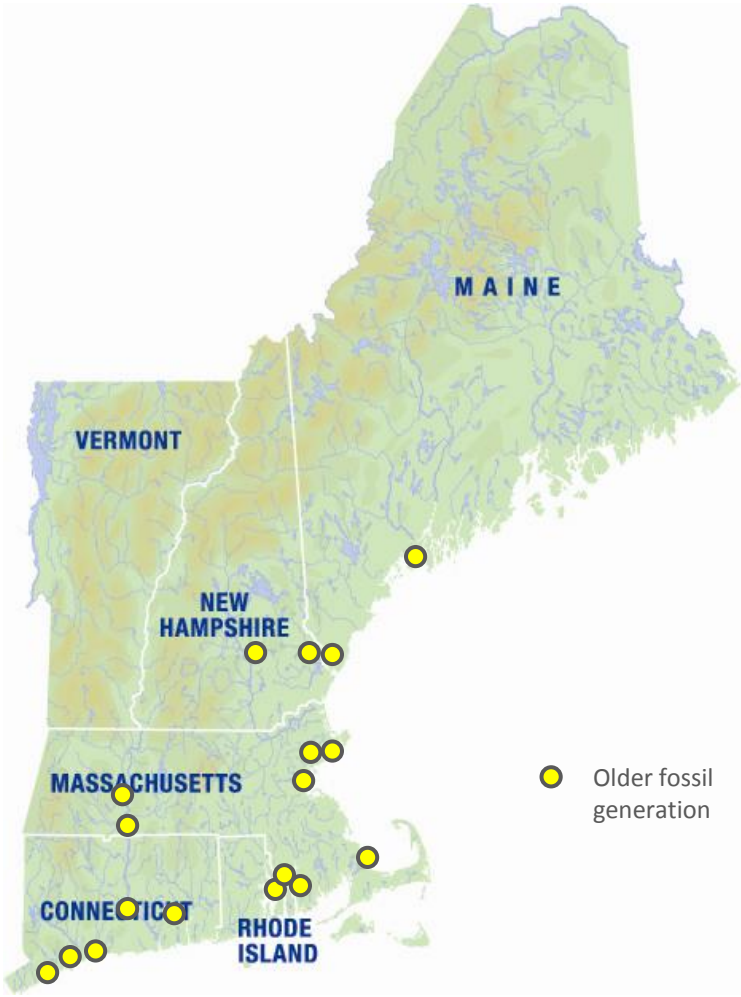
1. Resource performance and flexibility
2. Increased reliance on natural-gas-fired capacity
3. ***Retirement of generators***
4. Integration of a greater level of variable resources
5. ***Alignment of markets and planning needs improvement***

Strategic Transmission Analysis (STA) to shed light on two challenges

Strategic Transmission Analysis Study Objective

- Evaluate the reliability impacts associated with the retirement of 28, 40+ year-old coal- and oil-fired resources by 2020

- Determine whether these retirements totaling 8.3 GW pose transmission security or resource adequacy issues

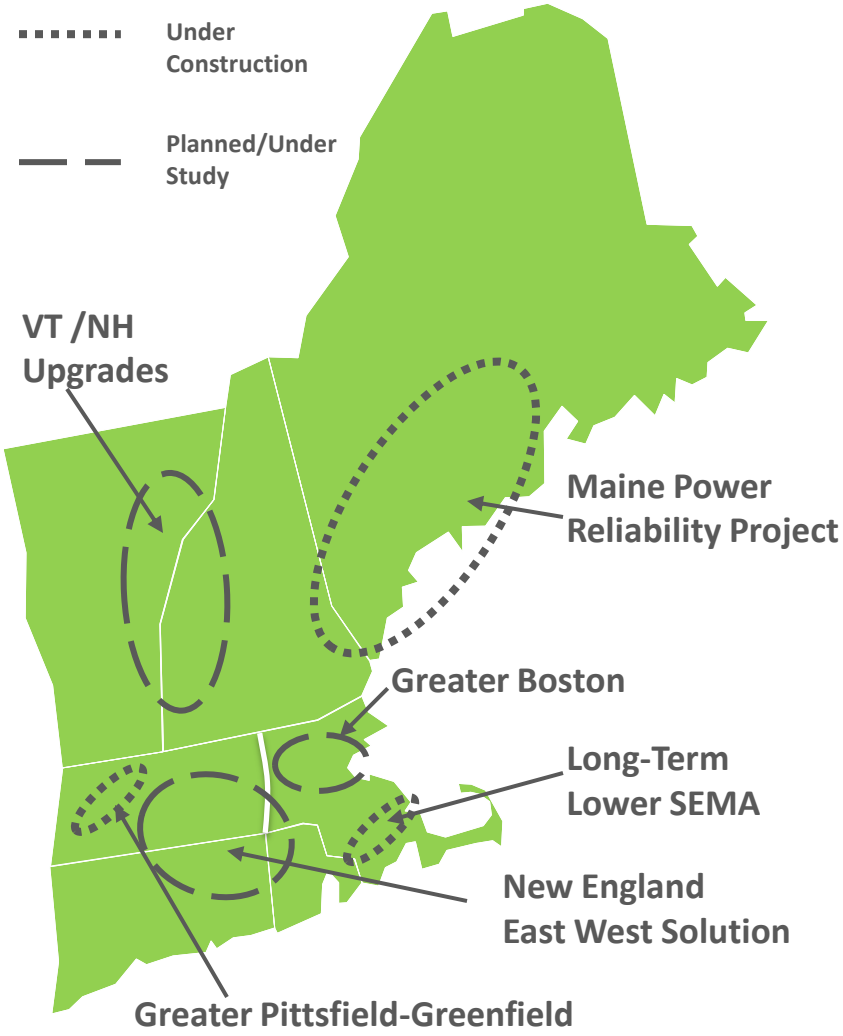


Capacity Resources Assumed to be at Risk of Retirement (from 2010 Economic Study)

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

TOTAL 8,281 MW

Future Transmission Incorporated into Study



- Regional transmission projects expected to be in service before 2020 were included in study
- These transmission projects facilitate retirements, improve deliverability of existing resources, and provide significant flexibility for locating new replacement resources

Transmission Projects Impact Retirements

- **NEEWS**
  - Allows higher import capability into CT and RI; improves east-west and west-east transferability; and, at least in part, facilitates retirements in Boston, eastern and western MA, RI and CT
- **Greater Boston**
  - Upgrades improve import capability into Boston; has a positive impact on facilitating retirements and delivery of NH and ME resources to Boston
- **Long-Term Lower SEMA**
  - Facilitates improved load serving capability in lower SEMA/Cape Cod area allowing for the retirement of some resources in SEMA
- **Maine Power Reliability Program**
  - Facilitates deliverability to load in Maine and supports possible retirements of at-risk resources
- **Vermont/New Hampshire**
  - Affect deliverability in VT/NH areas facilitating reliable retirements of at-risk resources in NH

Retirements Alone Result in Capacity Shortfalls

Region will be challenged to meet 2020 Installed Capacity Requirements absent replacements, repowering or the addition of new resources

Qualified Capacity Assumed Available in 2020 including EE Forecast	37,000 MW
Representative Installed Capacity Requirement in 2020 (net of HQICC)	34,600 MW
Margin Before Potential Retirement of At-Risk Units	2,400 MW
Amount of At-Risk Generation	8,300 MW
Shortfall After Retirements	**- 5,900 MW**

Retirement of At-Risk Units without replacements or new resources will result in shortfall of ICR

Shortfall After Retirements	**- 5,900 MW**
April 2013 Generator Interconnection Queue*	5,200 MW
Shortfall plus queue	**-700 MW**

Adding existing queue still results in shortfall

* Generator Interconnection Queue includes nameplate capacity – note almost 40% of April 2013 queue is wind generation

Three Retirement Scenarios Evaluated

Scenario I

Existing generation with no new replacement resources

Scenario II

At-risk resources are replaced at the hub, and critical resources are retained at existing sites

Scenario III

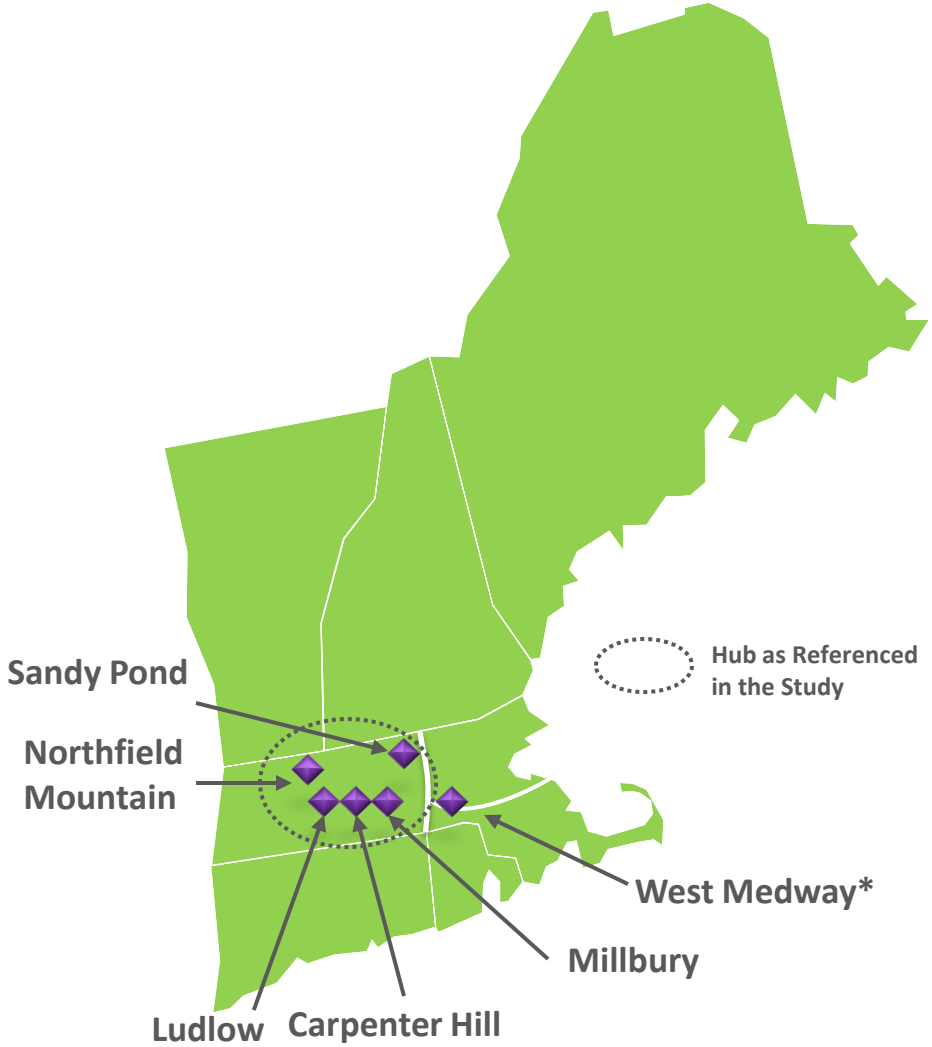
At-risk resources are replaced at the hub, and critical resources are repowered at existing sites

Each retirement analysis evaluates how much generation can be retired, recognizing:

- **Resource needs**
- **Existing capacity constraints**
- **Area transmission security**

Application of New England Trading "Hub"

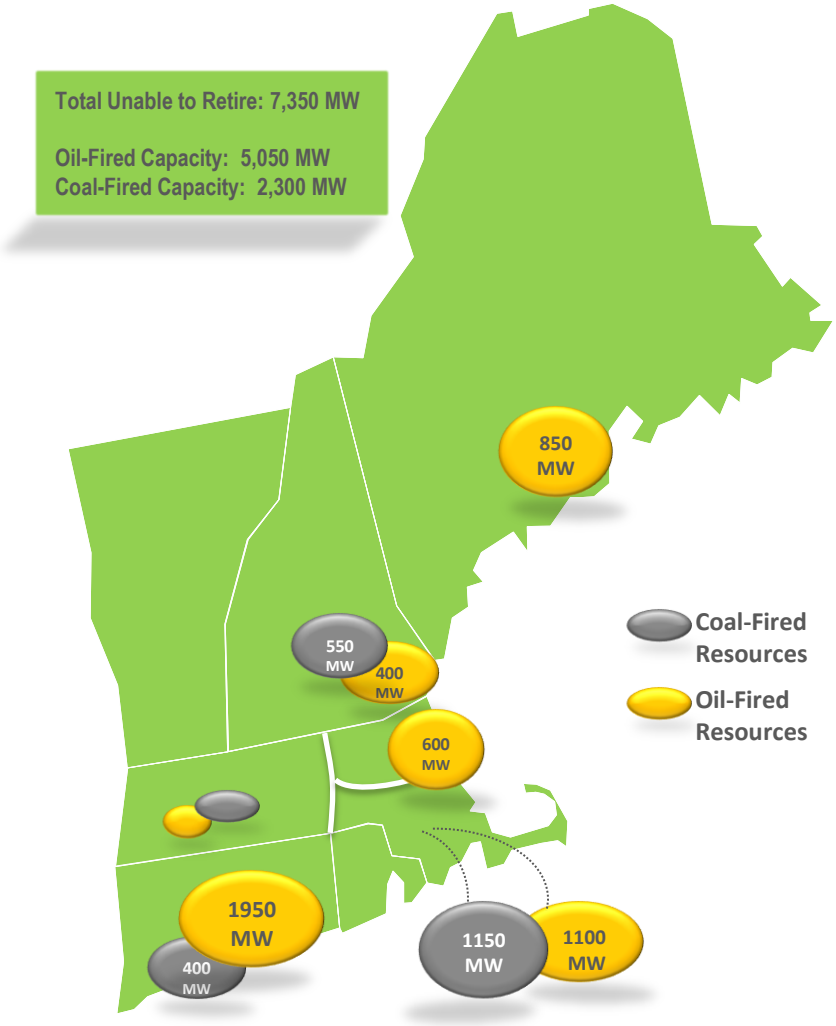
- New England Trading Hub (Hub) is a central trading location in energy market where no significant energy congestion is expected
  - 32 electrical buses/nodes in West-Central Massachusetts make up the Hub
  - Interconnection of new proxy generation at the Hub was represented by six 345 kV buses/nodes*
- Replacement resources needed were envisioned to be integrated at the Hub



** W. Medway 345 kV is electrically close to, but not in the defined Trading Hub*

Scenario I

With assumed resources and transmission in 2020, no more than 950 MW may be retired without causing reliability problems

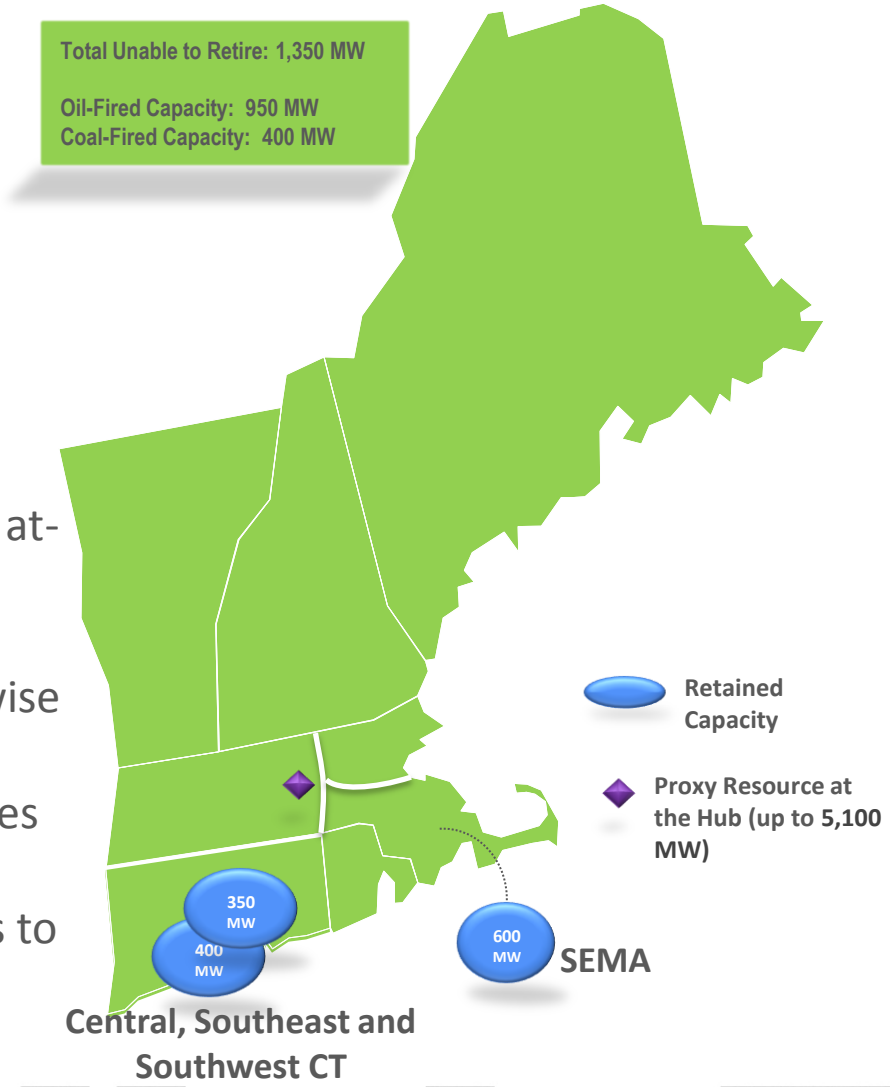


- Issues caused by retirements:
  - Resource deficiency
  - Area and local transmission constraints
- Observations:
  - Maximum amount of retirement capacity that can be achieved is 950 MW
  - More resources can retire if replaced by new resources to meet capacity needs
  - Approximately 1,400 MW of existing capacity will be limited in effectiveness due to deliverability constraints

Scenario II

Assumes all units retired, except at critical resource sites; remaining resource needs met by new resources at the Hub

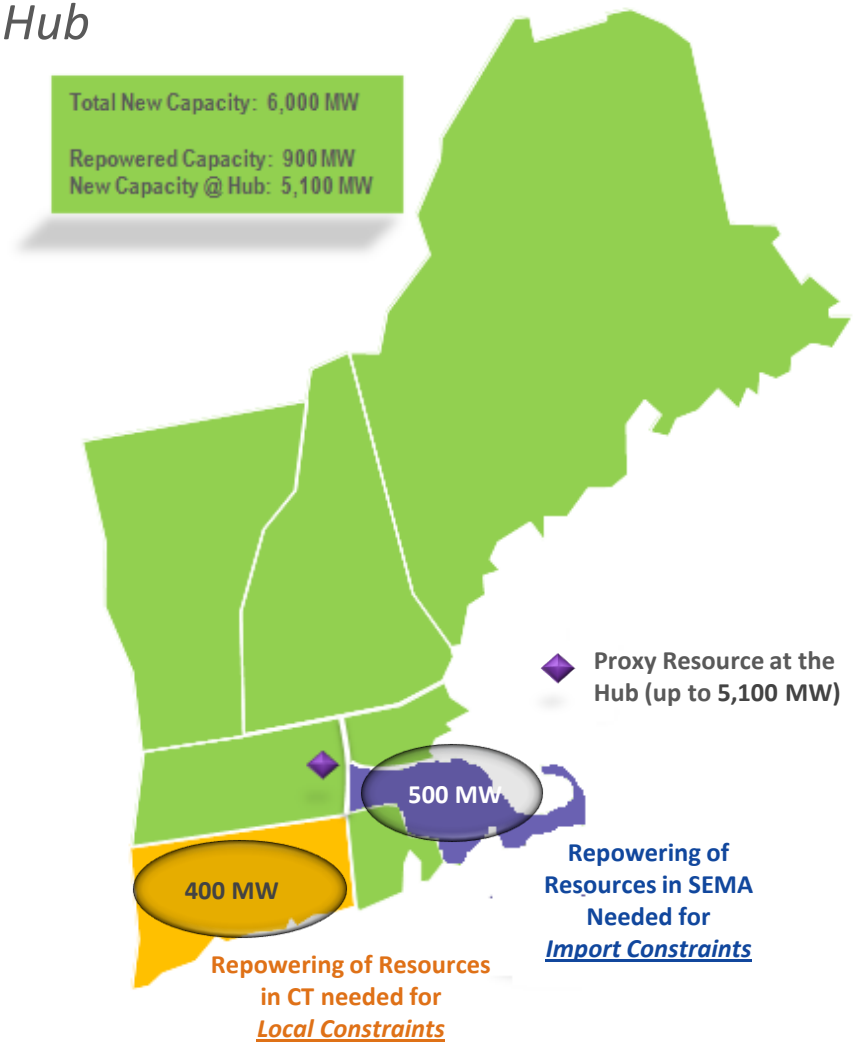
- Issues caused by retirements:
  - Area and local transmission constraints
- Observations
  - SEMA import transmission constraints would require continued operation of assumed at-risk resources in SEMA
  - Local transmission constraints would require continued operation of assumed at-risk resources in Connecticut
  - Some existing resources will need to be retained, repowered or replaced; otherwise transmission upgrades will be necessary
  - Up to 5,100 MW of replacement resources at the Hub needed
  - Integrating resources to the Hub appears to be more deliverable than some existing resource sites



Scenario III

Assumes all units retired; repowering of critical resource sites; remaining resource needs met by new resources at the Hub

- Issues caused by retirements:
  - Area import and local transmission constraints
- Observations:
  - 900 MW are needed to address SEMA import constraints and CT local constraints
  - SEMA import constraint can be addressed by adding generation at multiple sites
  - Local constraints within CT must be addressed electrically close to existing generation sites
  - Approximately 5,100 MW of replacement capacity at the Hub is required to replace lost capacity due to retirement of all the other at-risk resources



Overall Observations

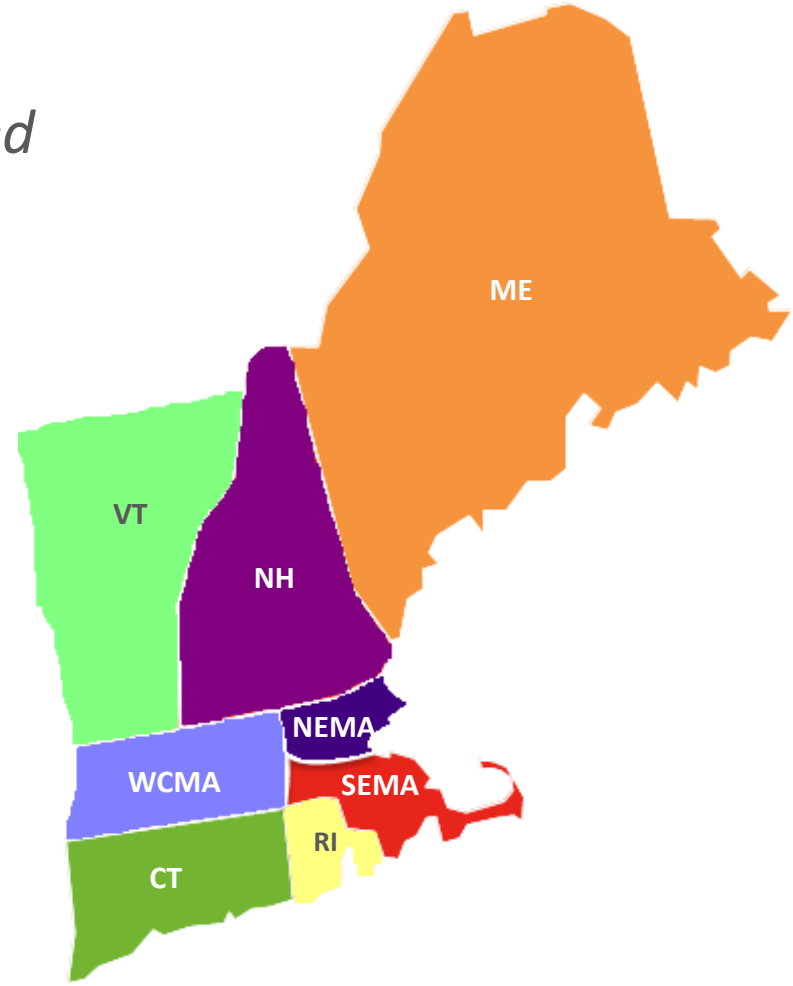
- If 8,300 MW retire by 2020, resource adequacy needs dictate replacement capacity of at least 5,900 MW plus almost 800 MW of new energy efficiency reflected in EE forecast
- With the currently planned system configuration at least 900 MW of the 5,900 MW replacement capacity must be in specific locations due to transmission constraints
  - 500 MW must be in SEMA
  - 400 MW must be in Connecticut
- Approximately 5,000 MW may need to be integrated into Hub
  - Transmission may be needed to make resources deliverable to the Hub
  - From Hub power can be delivered to the load

Overall Observations, *continued*

- If substitute resources are not available, only 950 MW of the existing 8,300 MW of older oil and coal resources will be able to retire without causing reliability problems
- Major transmission projects significantly improve deliverability of most existing resources, and greatly facilitate retirement of assumed at risk resources
- Repowering all existing sites would likely result in congested capacity, thereby increasing the amount of capacity that needs to be replaced, compared to a scenario where the replacement capacity is deliverable to the Hub

Overall Observations, *continued*

- New zonal definitions may need to be considered
  - Zones may not resemble current definitions (*i.e.,* state boundaries)



- Actual retirement requests will be evaluated as submitted based on prevailing system conditions

- This study focused on the year 2020, assuming all major transmission projects were already in service
  - Individual retirements may trigger local transmission reliability issues that were not captured in this study

Questions