NOVEMBER 15, 2018 | MARLBOROUGH, MA

Southeastern Massachusetts and Rhode Island (SEMA/RI) 2028 Needs Assessment Scope of Work

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Purpose

- Present the Southeastern Massachusetts and Rhode Island (SEMA/RI) 2028 Needs Assessment Scope of Work

Overview

- Background
- Objectives
- Study area description
- Steady-state modeling assumptions
- Peak load dispatches and transfer levels
- Summary of peak load dispatches
- Minimum load discussion
- Short circuit assumptions
- Study methodology
- Schedule/next steps

BACKGROUND

Background

- On June 29, 2017, the ISO posted a Notice of Initiation of the SEMA/RI Needs Assessment
  - https://www.iso-ne.com/static-assets/documents/2017/06/2027_sema_ri_needs_assessment_study_initiation_pac_notice.pdf
- The triggers for the Needs Assessment are:
  - (i): "*a need for additional transfer capability is identified by the ISO in its ongoing evaluation of the PTF's adequacy and performance*."
  - (v): "*as otherwise deemed appropriate by the ISO as warranting such an assessment.*"
- A SEMA/RI 2026 Needs Assessment report was finalized in May 2016, an addendum report to the SEMA/RI 2026 Needs Assessment report was finalized in October 2016, and a second addendum report was finalized in July 2018. A SEMA/RI 2026 Solutions Study report was finalized in March 2017 that developed solutions to time sensitive needs identified in the SEMA/RI 2026 Needs Assessment. This Needs Assessment will examine if any needs exist for the study area, and will identify the time-sensitivity of any identified needs
- The solutions identified in the 2026 Solutions Study are included in this Needs Assessment

OBJECTIVES

Objectives

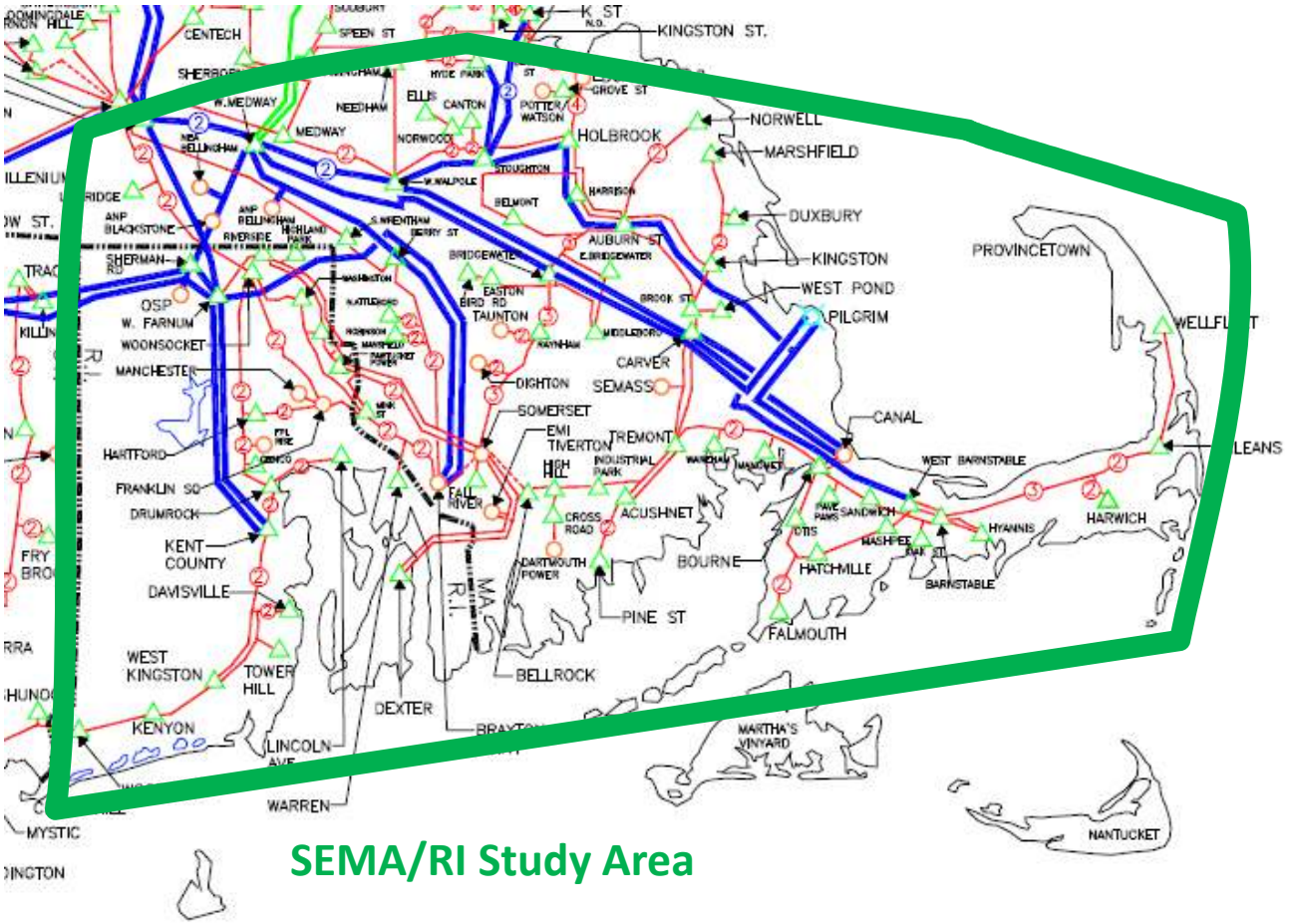
The objective of the SEMA/RI Needs Assessment study is to evaluate the reliability performance and identify reliability-based needs in the SEMA/RI study area for the year 2028 while considering the following:

- Future load distribution
- Resource changes in New England based on FCA 12 results, 2018 PV forecast and 2018 EE forecast
- Resource changes at Mystic Station beyond FCA 12*
  - Mystic 7, 8, 9, and Jet retired
- Additional scenario analysis with Vineyard Wind (QP 624) and the New England Clean Energy Connect (NECEC) projects in-service
- Reliability over a range of generation patterns and transfer levels
- All applicable North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Corporation (NPCC) and ISO New England transmission planning reliability standards

* https://www.iso-ne.com/static-assets/documents/2018/05/iso_petition_for_waiver_of_tariff_provisions.pdf

STUDY AREA DESCRIPTION

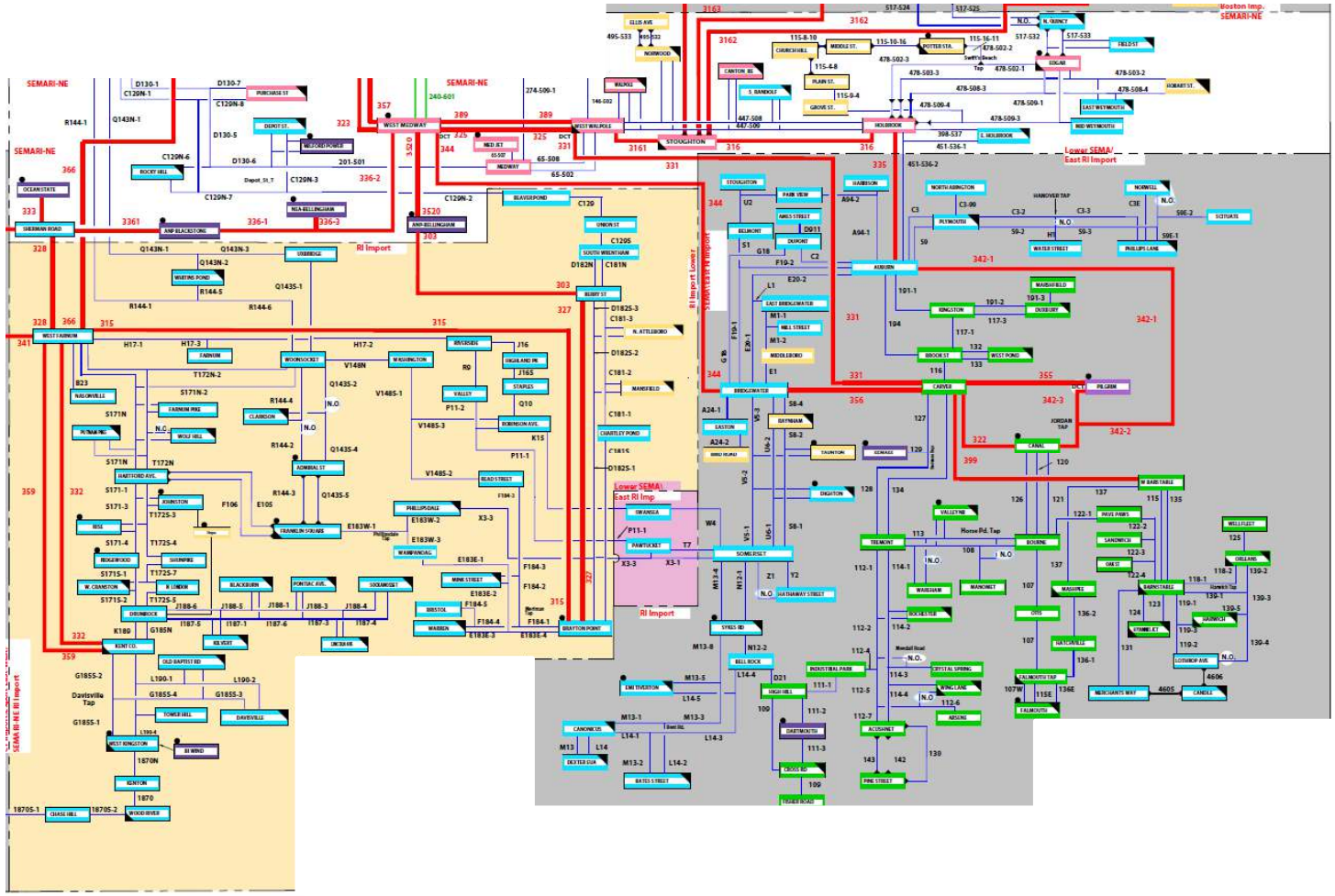
SEMA/RI Geographical Map



SEMA/RI Study Area

The map is shown for reference only and does not include all of the latest topology changes. This map shows the 115 kV system and above and does not depict the 69 kV system. For a high resolution version of the system diagram, please go to: https://www.iso-ne.com/about/key-stats/maps-and-diagrams

SEMA/RI One Line Diagram



The map is shown for reference only and does not include all of the latest topology changes such as the latest SEMA/RI projects. This map shows the 115 kV system and above and does not depict the 69 kV system. For a high resolution version of the system diagram, please go to: https://www.iso-ne.com/about/key-stats/maps-and-diagrams

STEADY-STATE MODELING ASSUMPTIONS

Initial Study Files

- The draft initial 2028 Needs Assessment cases and files and the draft Summary Document for 2018 Transmission Planning Base Case Library Review were posted on June 21, 2018 for stakeholder review and comment
- After the stakeholder comment period, the ISO posted:
  - the final initial 2028 Needs Assessment cases and study files, that will be used for the SEMA/RI Needs Assessment,
    - https://smd.iso-ne.com/operations-services/ceii/pac/2018/07/ceii_final_na_2018_tp_library_basecase.zip
    - Any other changes made to the initial study files since their posting on 7/13/2018 will be reflected in the scope of work report and will be included in the intermediate study files
  - the final Summary Document for 2018 Transmission Planning Base Case Library Review, and
    - https://smd.iso-ne.com/operations-services/ceii/pac/2018/07/ceii_summary_document_for_2018_transmission_planning_base_case_library.zip
  - the document responding to stakeholder comments
    - https://www.iso-ne.com/static-assets/documents/2018/07/iso_ne_response_to_stakeholder_comments_on_the_2018_transmission_planning_base_case_library_review.pdf

Modeling Assumptions

- Study Horizon
  - This study will be focused on 2028 for the ten-year horizon utilizing the 2018 Capacity, Energy, Loads, and Transmission (CELT) report
- Existing Topology
  - All transmission and generation facilities that are in-service as of June 1, 2018 are included in the base cases
- Load Levels
  - The 2018 Capacity, Energy, Loads, and Transmission (CELT) report was used to determine the forecasted loads for the peak load demand levels evaluated
    - **34,092 MW** - 90/10 summer peak load (includes T&D losses)

Modeling Assumptions, cont.

- Demand Resource Assumptions
  - New England Demand Resource Performance Assumptions

Load Level	Active-Demand Capacity Resource (ADCR)	Forecasted EE
Summer Peak (90/10 and 50/50)	75%	100%

  - **478 MW*** - 75% of ADCR that cleared in the Forward Capacity Market through FCA 12 (June 1, 2021 – May 31, 2022)
  - **5,259 MW*** - 100% of 2018 CELT Energy Efficiency (EE) forecast for the year 2028

- Future Generation Assumptions
  - All cleared generator additions through FCA 12 with the exception of QP 489 (Clear River)#
  - All submitted retirement delist bids through FCA 13 will be excluded from the base cases
  - Additional scenario analysis with Vineyard Wind and NECEC in-service

* Includes 5.5% distribution losses

Capacity Supply Obligation termination filing:
https://www.iso-ne.com/static-assets/documents/2018/09/clear_river_1_involuntary_res_term.pdf

Modeling Assumptions, cont.

- Photovoltaic (PV) Generation Modeled utilizing the 2018 CELT PV Generation Forecast

PV generation Modeled as Negative Load		Study Year
		2028 Summer Peak (MW)*
New England	A – PV generation (nameplate) in New England	5,853
	B – 5.5% Reduction in Distribution Losses	+322
	C – Unavailable PV generation (A+B)x(100%-26%)	-4,570
	PV generation Modeled in Case as Negative Loads (A+B)-C	**1,606**

* These values exclude explicitly modeled PV generators.

Modeling Assumptions, cont.

- New England New Load Levels (Excludes Transmission Losses)

Category	Summer Peak 2028 90/10 Load (MW)
CELT Forecast	33,304
Fixed New England load	N/A
Non-CELT Manufacturing load in New England	318
Available FCA-12 Active DR (modeled as negative load)	-478
Available 2018 CELT EE Forecast for study year (modeled as negative load)	-5,259
Available 2018 CELT PV Forecast for study year (modeled as negative load)	-1,606
Net load modeled in New England (Excludes Station Service)	**26,279**

Modeling Assumptions, cont.

- Transmission Upgrades Included in the Base Cases
  - RSP Project Tracking Sheet – All reliability upgrades in the Mach 2018 RSP Project List (Table 1a and 1b) that were Proposed, Planned and Under Construction were included in the base cases
  - Asset Condition Tracking Sheet – In general, all Asset Condition projects that are listed in the March 2018 Asset Condition listing that were Planned, Proposed, or Under Construction are included in the base cases
  - Local System Plan (LSP) Projects Tracking Sheet – Using the information from the 2017 TOPAC, all future LSP projects for which the ISO had modeling data available have been included in the base cases
  - Approved Proposed Plan Applications (PPA) Tracking Sheet – Transmission projects with an approved PPA as of May 16, 2018 that are not covered under the previously discussed tracking sheets and were not in-service as of May 16, 2018 have been included in the base cases
  - See Appendix E of the Summary Document for 2018 Transmission Planning Base Case Library Review to access all of the tracking sheets
    - https://smd.iso-ne.com/operations-services/ceii/pac/2018/07/ceii_summary_document_for_2018_transmission_planning_base_case_library.zip

Modeling Assumptions, cont.

- 108-4 Line Reconductoring
  - Reconductoring the 108-4 Line (Horse Pond Tap to Bourne) is part of the reliability upgrades resulting from the SEMA/RI 2026 Solutions Study
  - While the PPA assumed that the work to cross the Cape Cod canal would be done, the scope of the project did not include this work
  - The additional work to reconductor the line over the canal would add additional expense and the reconductoring of the remainder of the line provides enough of a ratings increase to resolve the need in the Needs Assessment. Therefore the additional work over the canal will not be done as part of this upgrade.
  - A revised PPA for the project will be presented at the December RC
  - The revised ratings have been included in the cases for the 2028 SEMA/RI Needs Assessment

State Sponsored Request For Proposals (RFPs)

- Section 4.1(f) of Attachment K states:

  "Specifically, the ISO shall incorporate or update information regarding resources in Needs Assessments that have been proposed and (i) have cleared in a Forward Capacity Auction pursuant to Market Rule 1 of the ISO Tariff, (ii) have been selected in, and are contractually bound by, a state-sponsored Request For Proposals, or (iii) have a financially binding obligation pursuant to a contract." (*underlining added*)

  "With respect to (ii) or (iii) above, the proponent of the market response shall inform the ISO, in writing, of its selection or its assumption of financially binding obligations, respectively."

- If there are any resources that meet criteria (ii) and (iii) stated above that the ISO should consider for inclusion in the respective study area Needs Assessments, the proponents shall do the following no later than Sunday, December 2nd:
  - Notify the ISO in writing via pacmatters@iso-ne.com
  - Provide the contract as part of the notification to the ISO

State Sponsored Request For Proposals (RFPs), cont.

- As a result of two RFPs, Massachusetts has selected the following two projects:
  - Vineyard Wind (QP 624)
  - New England Clean Energy Connect (NECEC) project

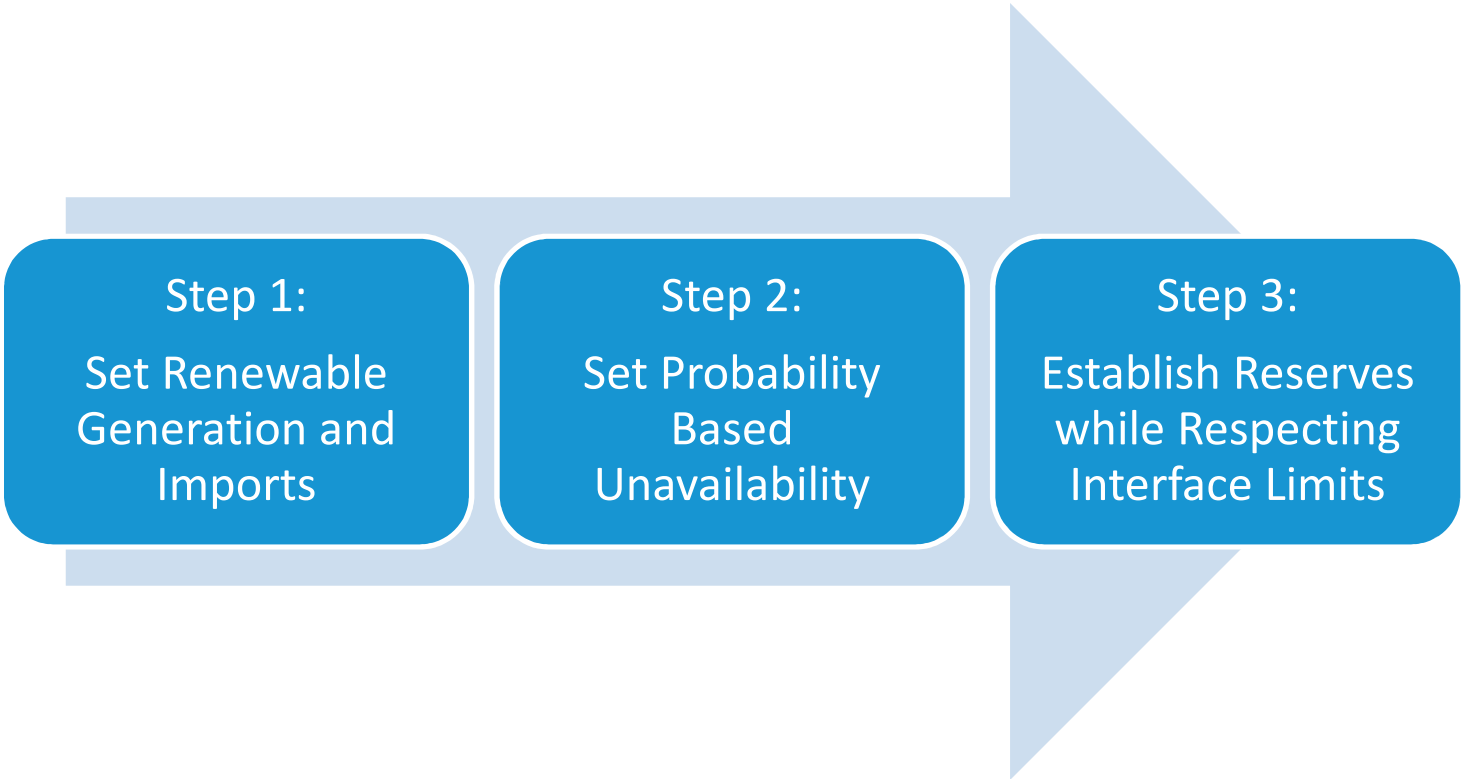
- Although the projects have yet to be approved by the Massachusetts Department of Public Utilities, it is highly probable that this will occur in the future. Therefore, additional scenario analysis will be conducted with each of the projects
- In summary, three sets of cases were created:
  - Scenario 1 - A set of base cases without QP 624 and NECEC
  - Scenario 2 - A set of base cases with QP 624 (dispatched at 160 MW*) included
  - Scenario 3 - A set of base cases with QP 624 (dispatched at 160 MW*) and NECEC (dispatched at 1,090 MW) included

* Vineyard Wind is a new 800 MW off-shore wind project. Based on the Transmission Planning Technical Guide, Vineyard Wind will be dispatched at 20% of its output, which is 160 MW.

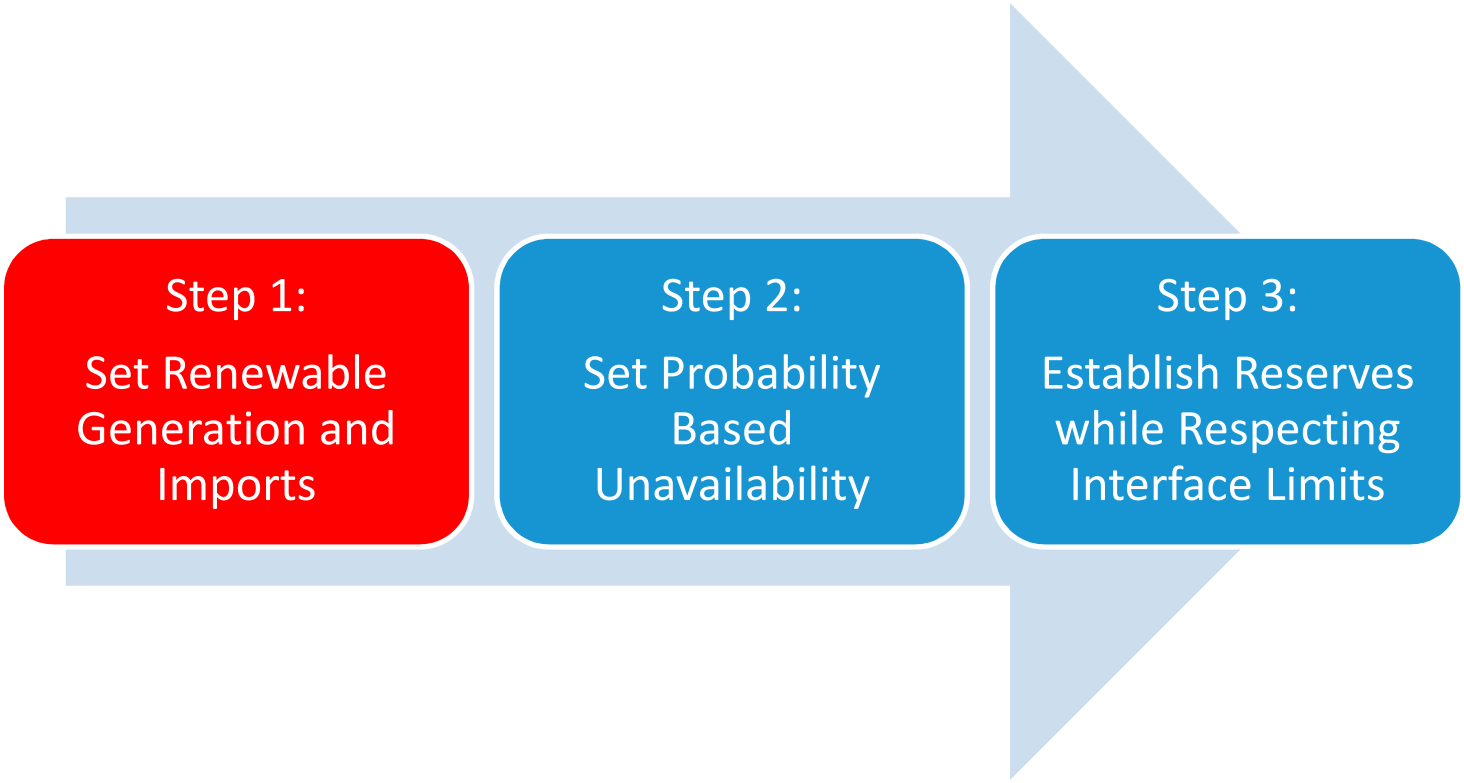
PEAK LOAD DISPATCHES AND TRANSFER LEVELS

Steps to Create the Needs Assessment Dispatches

- The following process was used to create the SEMA/RI study area dispatches



Steps to Create the Needs Assessment Dispatches

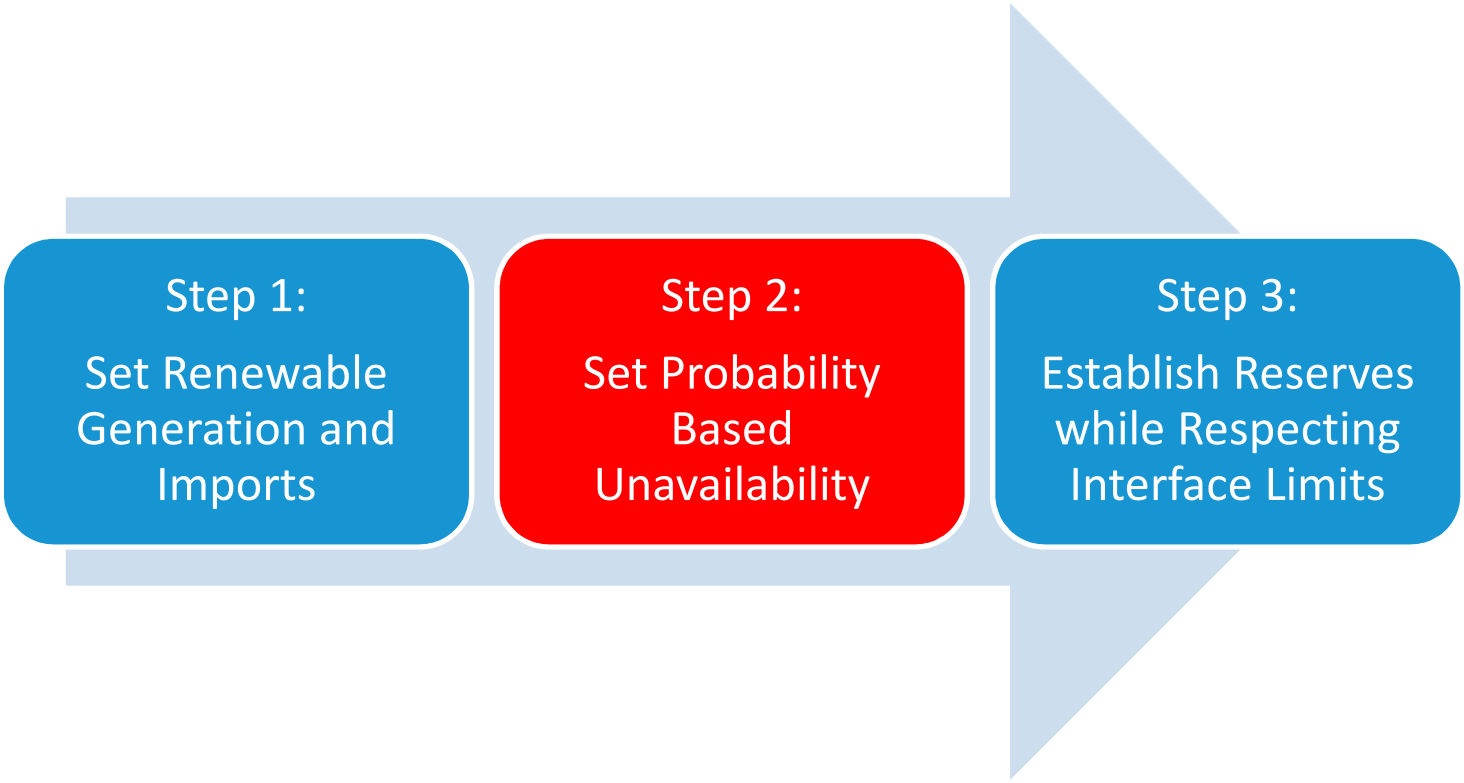


Step 1 – Set Renewable Generation and Imports

- Renewable generation in New England including the SEMA/RI study area is dispatched based on historical availability
- The table below specifies the ranges of imports from external areas that are proposed for the Needs Assessment

Inter-area Interface	Dispatch Range (MW)
New Brunswick to New England tie (NB-NE)	0 and 700
New York to New England AC ties (NY-NE)	0 to 1,400
Cross Sound Cable HVDC From Long Island to New England (CSC)	0
Phase II HVDC from Quebec to New England (Phase II)	950 and 1,400
Highgate HVDC From Quebec to New England (Highgate)	200

Steps to Setup the Needs Assessment Dispatches



Step 2 – Set Probability Based Unavailability

- The table below summarizes the maximum unavailable generation that will be considered in the SEMA/RI Needs Assessment

Type of Group	Group of Generators	Max MW Unavailable at 90/10 Peak Load
Study Area (Largest Generator – Edgar – 723 MW)	SEMA/RI Generators	973
Study Area + Adjacent Area	SEMA/RI + Boston Generators	1,052
	SEMA/RI + ECT Generators	1,219
Receiving End of System Stress	Eastern New England	1,351
	Western New England	1,499

Step 2 – Set Dispatches

- The non-renewable generators unavailable per dispatch are shown in the table below
  - Dispatches ending with A – East to West stress

1A	2A	3A	4A	5A	6A	7A
Pawtucket Power	Man 11/Frank 3	RISE	Cleary 9	Johnston	NEA Bellingham	RISE
Johnston	ANP Bellingham 1	Dighton	Dartmouth	RRIG	Canal 3	Ocean State Power 1, 2
Tiverton	Canal 3	West Medway 4	SEMASS	Dartmouth	Potter 2	West Medway 4
Canal 1	Milford Power	Montville 5	Oak Bluffs	Dighton	TA Watson 1	Montville 5
West Medway 3	Montville 5	Plainfield	West Tisbury	Oak Bluffs	West Medway 4	Plainfield
Montville 5	Plainfield	New Haven Harbor	Edgar	West Tisbury	Montville 5	New Haven Harbor
Plainfield	New Haven Harbor	South Meadow 5 and 6	Montville 5	ANP Blackstone 2	Plainfield	South Meadow 5 and 6
New Haven Harbor	South Meadow 5 and 6	Waterside	Plainfield	Milford Power	New Haven Harbor	Waterside
South Meadow 5 and 6	Waterside	Devon 13	New Haven Harbor	Montville 5	South Meadow 5 and 6	Devon 13
Waterside	Devon 13	Berkshire	South Meadow 5 and 6	Plainfield	Waterside	Berkshire
Devon 13	Berkshire	Monsanto	Waterside	New Haven Harbor	Devon 13	Monsanto
Berkshire	Monsanto	Stonybrook 2A	Devon 13	South Meadow 5 and 6	Berkshire	Stonybrook 2A
Monsanto	Stonybrook 2A		Berkshire	Waterside	Monsanto	
Stonybrook 2A			Monsanto	Devon 13	Stonybrook 2A	
			Stonybrook 2A	Berkshire		
				Monsanto		
				Stonybrook 2A		

Legend	
	Generators Unavailable in Study Area
	Generators Unavailable in Adjacent Areas
	Generators Unavailable in Receiving End

A 20 MW threshold for units unavailable in the Adjacent Area and Receiving End was used

Step 2 – Set Dispatches, cont.

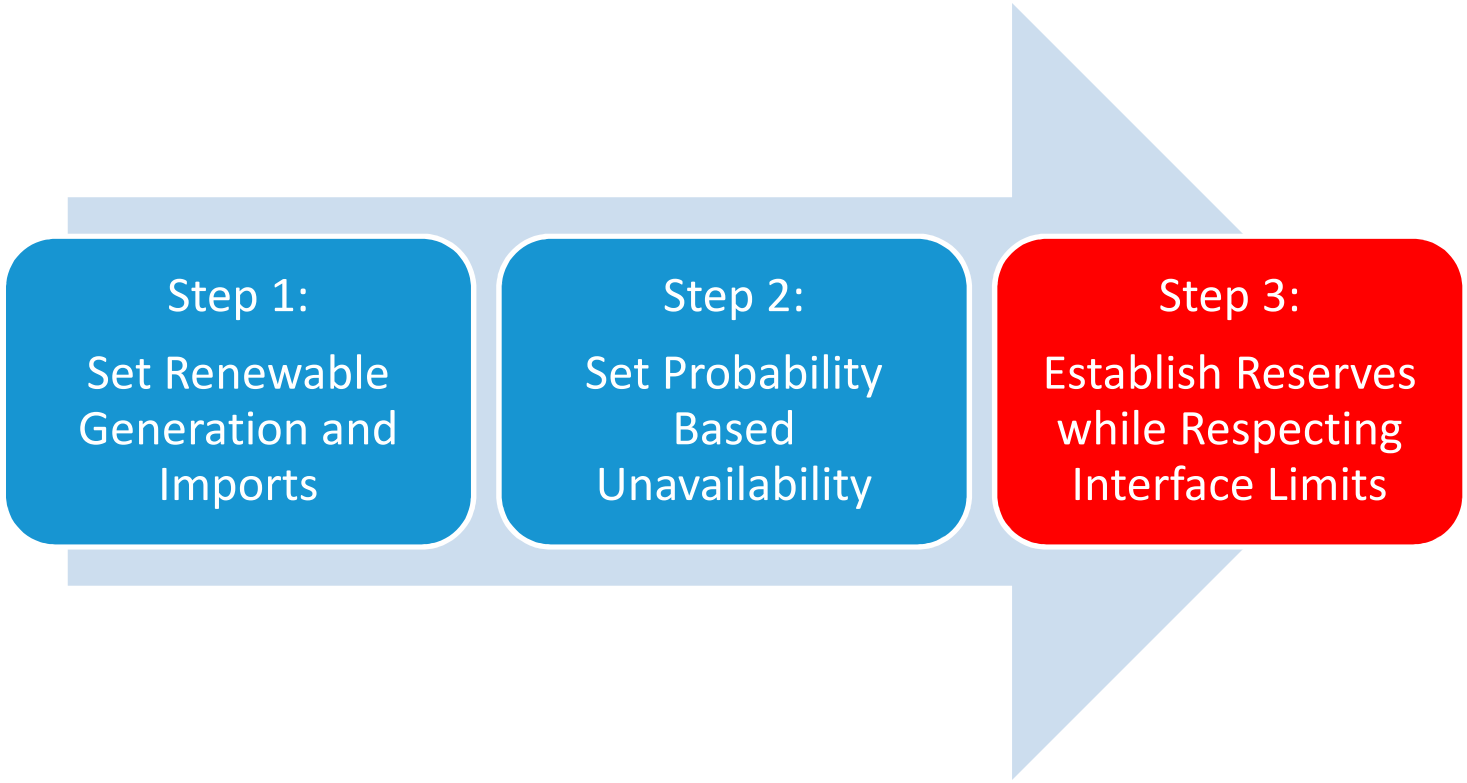
- The non-renewable generators unavailable per dispatch are shown in the table below
  - Dispatches ending with B – West to East stress

1B	2B	3B	4B	5B	6B	7B
Pawtucket Power	Man 11/Frank 3	RISE	Cleary 9	Johnston	NEA Bellingham	RISE
Johnston	ANP Bellingham 1	Dighton	Dartmouth	RRIG	Canal 3	Ocean State Power 1, 2
Tiverton	Canal 3	West Medway 4	SEMASS	Dartmouth	Potter 2	West Medway 4
Canal 1	Milford Power	OGDEN-MARTIN	Oak Bluffs	Dighton	TA Watson 1	OGDEN-MARTIN
West Medway 3	OGDEN-MARTIN	RESCO-SAUGUS	West Tisbury	Oak Bluffs	West Medway 4	RESCO-SAUGUS
OGDEN-MARTIN	RESCO-SAUGUS	MIS G2	Edgar	West Tisbury	OGDEN-MARTIN	MIS G2
RESCO-SAUGUS	MIS G2	MIS Steam (50%)	OGDEN-MARTIN	ANP Blackstone 2	RESCO-SAUGUS	MIS Steam (50%)
MIS G2	MIS Steam (50%)	SAPPI G2	RESCO-SAUGUS	Milford Power	MIS G2	SAPPI G2
MIS Steam (50%)	SAPPI G2		MIS G2	OGDEN-MARTIN	MIS Steam (50%)	
SAPPI G2			MIS Steam (50%)	RESCO-SAUGUS	SAPPI G2	
			SAPPI G2	MIS G2		
				MIS Steam (50%)		
				SAPPI G2		

Legend	
	Generators Unavailable in Study Area
	Generators Unavailable in Adjacent Areas
	Generators Unavailable in Receiving End

A 20 MW threshold for units unavailable in the Adjacent Area and Receiving End was used

Steps to Setup the Needs Assessment Dispatches



Step 3 - Establish Reserves

- In this step, the reserves are established while respecting the interface limits
- The priority order for reserve establishment is as follows:
  - Priority 1 – Study Area and Receiving End Weekly Hydro units
  - Priority 2 – Receiving End non-renewable generators and pumped hydro units
  - Priority 3 – Sending End generators
- The reserves will be established following the priority order noted above

Step 3 - Establish Reserves, Scenario 1 and 2 (East to West)

- For the reserves the total of 1200 MW of reserves are established as follows:
  - Priority 1 Reserves – There are 179 MW of weekly hydro units on the Western Receiving End and 0 MW in the study area
  - Priority 2 Reserves – There are 917 MW of pumped hydro units and 105 MW of non-renewable generators on the Western Receiving End
  - Priority 3 Reserves
    - East to West - Since Priority 1 and Priority 2 reserves cover the total 1200 MW reserve requirement there is no need to consider any Sending End non-renewable generators in the total reserves established

Step 3 - Establish Reserves, Scenario 1 and 2 (West to East)

- For the reserves the total of 1200 MW of reserves are established as follows:
  - Priority 1 Reserves – There are 511 MW of weekly hydro units on the Eastern Receiving End
  - Priority 2 Reserves – There are 498 MW non-renewable generators on the Eastern Receiving End
  - Priority 3 Reserves
    - West to East – An additional 194 MW of reserves is needed on the Sending End
      - 179 MW of Sending End weekly hydro units
      - 15 MW of Sending End non-renewable generators

Step 3 - Establish Reserves, Scenario 1 and 2

- The table below shows the amount of reserves available to be turned on after the first contingency in the N-1-1 analysis for Scenario 1 and 2

Dispatch	Adjecent Area	Stress	Receiving End (MW)	Priority 1 Reserves		Priority 2 Reserves		Priority 3 Reserves		Total Reserves
				Weekly Hydro Receiving End (MW)	Weekly Hydro Sending End (MW)	Pumped Hydro WMA (MW)	Non-Renewable Generators Receiving End (MW)	Weekly Hydro Sending End (MW)	Non-Renewable Generators Sending End (MW)	
1A	ECT	E/W	Western	179	0	917	105	0	0	1,200
2A	ECT	E/W	Western	179	0	917	105	0	0	1,200
3A	ECT	E/W	Western	179	0	917	105	0	0	1,200
4A	ECT	E/W	Western	179	0	917	105	0	0	1,200
5A	ECT	E/W	Western	179	0	917	105	0	0	1,200
6A	ECT	E/W	Western	179	0	917	105	0	0	1,200
7A	ECT	E/W	Western	179	0	917	105	0	0	1,200
1B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
2B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
3B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
4B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
5B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
6B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200
7B	Boston	W/E	Eastern	511	0	0	498	179	15	1,200

Step 3 - Establish Reserves, Scenario 1 and 2

- List of non-renewable generators greater than 20 MW for Eastern New England as the Receiving End:
  - Tamworth – 22 MW
  - West Medway 1 – 42 MW
  - West Medway 2 – 40 MW
  - Hemphill Power – 20 MW
  - MMWEC – 61 MW
  - Waters River 2 – 30 MW

- List of non-renewable and pumped storage generators greater than 20 MW for Western New England as the Receiving End:
  - Bear Swamp 1 – 333 MW
  - West Springfield 1 – 40 MW
  - West Springfield 2 – 41 MW
  - Northfield 1 – 292 MW
  - Northfield 2 – 292 MW

Step 3 - Establish Reserves, Scenario 3 (East to West)

- For the reserves the total of 1200 MW of reserves are established as follows:
  - Priority 1 Reserves – There are 179 MW of weekly hydro units on the Western Receiving End
  - Priority 2 Reserves – There are 917 MW of pumped hydro units and 105 MW of non-renewable generators on the Western Receiving End
  - Priority 3 Reserves
    - East to West - Since Priority 1 and Priority 2 reserves cover the total 1200 MW reserve requirement there is no need to consider any Sending End non-renewable generators in the total reserves established

Step 3 - Establish Reserves, Scenario 3 (West to East)

- For the reserves the total of 1200 MW of reserves are established as follows:
  - Priority 1 Reserves – There are no weekly hydro units on the Eastern Receiving End available to be used
    - Weekly hydro units are located in north of the North-South interface, which is at it's limit with the addition of NECEC
  - Priority 2 Reserves – There are 313 MW non-renewable generators on the Eastern Receiving End
  - Priority 3 Reserves
    - West to East – An additional 891 MW of reserves is needed on the Sending End
      - 179 MW of Sending End weekly hydro units
      - 712 MW of Sending End non-renewable generators

Step 3 – Establish Reserves, Scenario 3

- The table below shows the amount of reserves available to be turned on after the first contingency in the N-1-1 analysis

Dispatch	Adjecent Area	Stress	Receiving End (MW)	Priority 1 Reserves		Priority 2 Reserves		Priority 3 Reserves		Total Reserves
				Weekly Hydro Receiving End (MW)	Weekly Hydro Sending End (MW)	Pumped Hydro WMA (MW)	Non-Renewable Generators Receiving End (MW)	Weekly Hydro Sending End (MW)	Non-Renewable Generators Sending End (MW)	
1A	ECT	E/W	Western	179	0	917	105	0	0	1,200
2A	ECT	E/W	Western	179	0	917	105	0	0	1,200
3A	ECT	E/W	Western	179	0	917	105	0	0	1,200
4A	ECT	E/W	Western	179	0	917	105	0	0	1,200
5A	ECT	E/W	Western	179	0	917	105	0	0	1,200
6A	ECT	E/W	Western	179	0	917	105	0	0	1,200
7A	ECT	E/W	Western	179	0	917	105	0	0	1,200
1B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
2B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
3B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
4B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
5B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
6B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200
7B	Boston	W/E	Eastern	0	0	0	313	179	712	1,200

Step 3 – Establish Reserves, Scenario 3

- List of non-renewable generators greater than 20 MW for Eastern New England as the Receiving End:
  - Tamworth – 22 MW
  - West Medway 1 – 42 MW
  - Waters River 2 – 30 MW
  - Wallingford 2 – 44 MW
  - Wallingford 4 – 44 MW
  - Wallingford 6 – 46 MW
  - Devon 15 – 48 MW
  - Devon 17 – 48 MW
  - NHHP 2 – 45 MW
  - NHHP 3 – 45 MW
  - Hemphill Power – 20 MW
  - West Medway 2 – 40 MW
  - MMWEC – 61 MW
  - Wallingford 3 – 45 MW
  - Wallingford 5 – 45 MW
  - Wallingford 7 – 46 MW
  - Devon 16 – 48 MW
  - Devon 18 – 48 MW
  - Waterbury – 98 MW
  - NHHP 4 – 45 MW

- List of non-renewable and pumped storage generators greater than 20 MW for Western New England as the Receiving End:
  - Bear Swamp 1 – 333 MW
  - West Springfield 1 – 40 MW
  - West Springfield 2 – 41 MW
  - Northfield 1 – 292 MW
  - Northfield 2 – 292 MW

Step 3 – Respect Interface Limits

- The final step is to check if the establishment of reserves on the receiving end results in the violation of any key interfaces in the vicinity of the study area or the receiving end of the stress
- All interfaces are within their limits and the reserves are considered acceptable

Interface Name	Limit (MW)	90/10 Range (MW)
East-West	3,500	-2,937 to -723
West-East	3,000	724 to 2,950
North-South	2,725	1,514 to 2,648
SEMA/RI Export	3,400	228 to 625
Boston Import	5,700	4,338 to 4,698

SUMMARY OF PEAK LOAD DISPATCHES

Summary of Peak Load Dispatches – MWs Unavailable and Transfer Levels Scenario 1

Dispatch	Load Level	Adjacent Area	MW Unavailable in Study Area and Adjacent Area (Maximum MW^)			MW Unavailable in Receiving End (Maximum MW^)		External Interfaces Targets# (Maximum Transfer Capability in MW)			Additional Interfaces (Maximum Transfer Capability in MW)				
			SEMA/RI (973)	SEMA/RI + ECT (1219)	SEMA/RI + Boston (1052)	Western (1499)	Eastern (1351)	NY-NE (1400)	NB-NE (700)	Phase II (1400)	E-W (3500)	W-E (3000)	N-S (2725)	Boston Import (5700)	SEMA/RI Export (3400)
1A	90/10	ECT	961	1156	N/A	1364	N/A	706	700	1400	-1107	1109	2623	4340	236
2A	90/10	ECT	965	1160	N/A	1364	N/A	706	700	1400	-1106	1108	2623	4339	235
3A	90/10	ECT	829	1024	N/A	1364	N/A	567	700	1400	-976	978	2623	4339	371
4A	90/10	ECT	960	1155	N/A	1364	N/A	704	700	1400	-1104	1106	2623	4339	238
5A	90/10	ECT	738	933	N/A	1364	N/A	476	700	1400	-889	890	2623	4338	461
6A	90/10	ECT	856	1051	N/A	1364	N/A	592	700	1400	-1000	1002	2623	4335	347
7A	90/10	ECT	847	1142	N/A	1364	N/A	686	700	1400	-1090	1092	2623	4339	254
1B	90/10	Boston	961	N/A	1039	N/A	1336	1070	0	950	-2937	2950	1514	4693	228
2B	90/10	Boston	965	N/A	1043	N/A	1339	1070	0	950	-2936	2949	1514	4692	228
3B	90/10	Boston	829	N/A	907	N/A	1204	924	0	950	-2805	2817	1514	4692	365
4B	90/10	Boston	960	N/A	1038	N/A	1334	1069	0	950	-2935	2948	1514	4692	229
5B	90/10	Boston	738	N/A	816	N/A	1112	931	0	950	-2717	2729	1514	4692	455
6B	90/10	Boston	856	N/A	934	N/A	1230	953	0	950	-2830	2842	1514	4692	339
7B	90/10	Boston	947	N/A	1025	N/A	1322	1046	0	950	-2918	2931	1514	4692	248

^ Maximum MW is the Maximum unavailable MW of non-renewable generators based on probabilistic methods

Actual interface transfers may vary slightly from the targets due to power flow mismatches

Summary of Peak Load Dispatches – MWs Unavailable and Transfer Levels Scenario 2

Dispatch	Load Level	Adjacent Area	MW Unavailable in Study Area and Adjacent Area (Maximum MW^)			MW Unavailable in Receiving End (Maximum MW^)		External Interfaces Targets# (Maximum Transfer Capability in MW)			Additional Interfaces (Maximum Transfer Capability in MW)				
			SEMA/RI (973)	SEMA/RI + ECT (1219)	SEMA/RI + Boston (1052)	Western (1499)	Eastern (1351)	NY-NE (1400)	NB-NE (700)	Phase II (1400)	E-W (3500)	W-E (3000)	N-S (2725)	Boston Import (5700)	SEMA/RI Export (3400)
1A	90/10	ECT	961	1156	N/A	1364	N/A	538	700	1400	-948	950	2623	4340	400
2A	90/10	ECT	965	1160	N/A	1364	N/A	539	700	1400	-948	950	2622	4339	399
3A	90/10	ECT	829	1024	N/A	1364	N/A	401	700	1400	-819	821	2622	4339	535
4A	90/10	ECT	960	1155	N/A	1364	N/A	536	700	1400	-945	947	2623	4339	402
5A	90/10	ECT	738	933	N/A	1364	N/A	310	700	1400	-731	733	2622	4339	625
6A	90/10	ECT	856	1051	N/A	1364	N/A	426	700	1400	-842	943	2622	4339	511
7A	90/10	ECT	947	1142	N/A	1364	N/A	520	700	1400	-933	935	2622	4339	417
1B	90/10	Boston	961	N/A	1039	N/A	1336	896	0	950	-2778	2790	1514	4693	393
2B	90/10	Boston	965	N/A	1043	N/A	1339	897	0	950	-2777	2790	1514	4692	392
3B	90/10	Boston	829	N/A	907	N/A	1204	753	0	950	-2647	2658	1514	4692	529
4B	90/10	Boston	960	N/A	1038	N/A	1334	896	0	950	-2776	2788	1514	4692	394
5B	90/10	Boston	738	N/A	816	N/A	1112	660	0	950	-2560	2570	1514	4692	619
6B	90/10	Boston	856	N/A	934	N/A	1230	781	0	950	-2671	2683	1514	4692	504
7B	90/10	Boston	947	N/A	1025	N/A	1322	874	0	950	-2761	2772	1514	4692	412

^ Maximum MW is the Maximum unavailable MW of non-renewable generators based on probabilistic methods

Actual interface transfers may vary slightly from the targets due to power flow mismatches

Summary of Peak Load Dispatches – MWs Unavailable and Transfer Levels Scenario 3

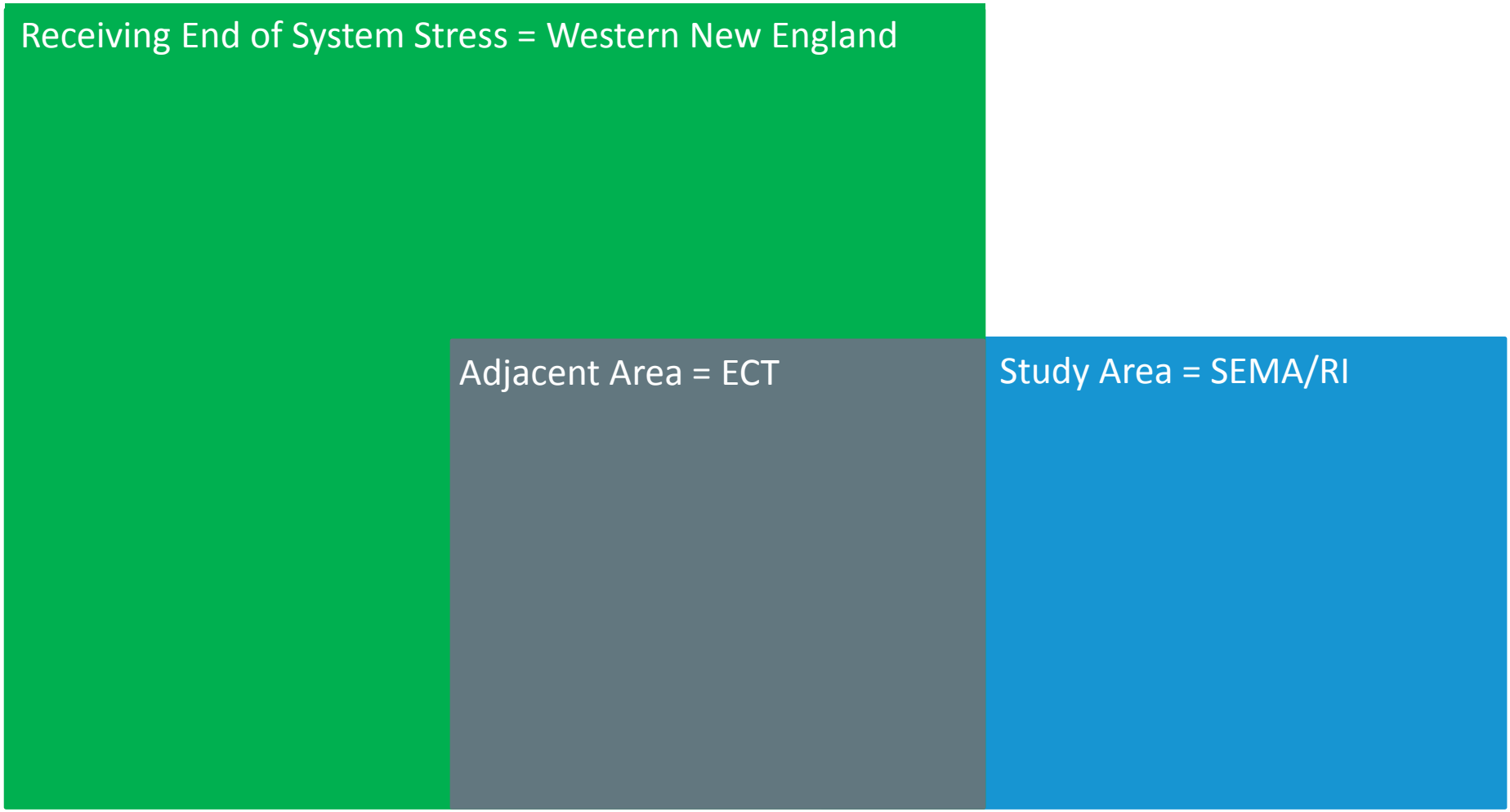
Dispatch	Load Level	Adjacent Area	MW Unavailable in Study Area and Adjacent Area (Maximum MW^)			MW Unavailable in Receiving End (Maximum MW^)		External Interfaces Targets# (Maximum Transfer Capability in MW)			Additional Interfaces (Maximum Transfer Capability in MW)				
			SEMA/RI (973)	SEMA/RI + ECT (1219)	SEMA/RI + Boston (1052)	Western (1499)	Eastern (1351)	NY-NE (1400)	NB-NE (700)	Phase II (1400)	E-W (3500)	W-E (3000)	N-S (2725)	Boston Import (5700)	SEMA/RI Export (3400)
1A	90/10	ECT	961	1156	N/A	1364	N/A	528	55	1400	-940	942	2632	4339	400
2A	90/10	ECT	965	1160	N/A	1364	N/A	530	55	1400	-939	941	2632	4338	399
3A	90/10	ECT	829	1024	N/A	1364	N/A	392	55	1400	-811	812	2631	4338	535
4A	90/10	ECT	960	1155	N/A	1364	N/A	527	55	1400	-937	938	2632	4338	402
5A	90/10	ECT	738	933	N/A	1364	N/A	301	55	1400	-723	724	2631	4338	625
6A	90/10	ECT	856	1051	N/A	1364	N/A	416	55	1400	-833	835	2632	4338	511
7A	90/10	ECT	947	1142	N/A	1364	N/A	510	55	1400	-925	927	2631	4338	417
1B	90/10	Boston	961	N/A	1039	N/A	1336	42	0	950	-1617	1622	2758	4698	399
2B	90/10	Boston	965	N/A	1043	N/A	1339	43	0	950	-1617	1622	2758	4697	398
3B	90/10	Boston	829	N/A	1016	N/A	1204	4	0	950	-1488	1492	2758	4697	534
4B	90/10	Boston	960	N/A	1038	N/A	1334	40	0	950	-1615	1620	2758	4697	400
5B	90/10	Boston	738	N/A	1023	N/A	1112	11	0	950	-1400	1404	2758	4697	624
6B	90/10	Boston	856	N/A	1040	N/A	1230	29	0	950	-1511	1515	2758	4697	509
7B	90/10	Boston	947	N/A	1025	N/A	1322	22	0	950	-1602	1606	2758	4697	416

^ Maximum MW is the Maximum unavailable MW of non-renewable generators based on probabilistic methods

Actual interface transfers may vary slightly from the targets due to power flow mismatches

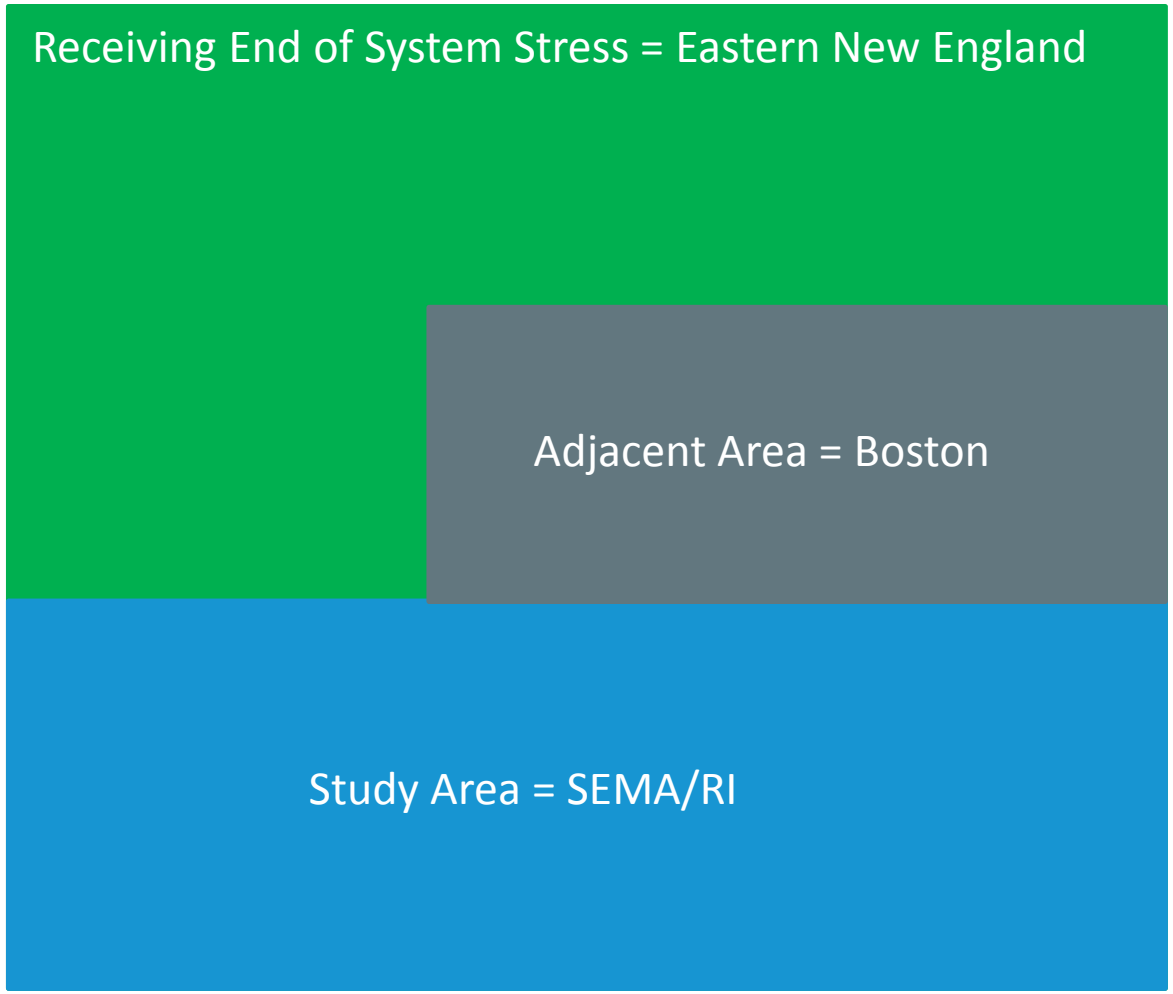
Study Areas for East to West Stress

The diagram below shows the rough geographical relationship between the study area, adjacent area, and receiving end of system stress



Study Areas for West to East Stress

The diagram below shows the rough geographical relationship between the study area, adjacent area, and receiving end of system stress



MINIMUM LOAD DISCUSSION

Minimum Load Discussion

- A 2026 minimum load Needs Assessment for SEMA/RI was completed in August 2017*
- Solutions are being developed in the on-going Solutions Study** and therefore minimum load analysis will not be conducted as part of this Needs Assessment

* https://smd.iso-ne.com/operations-services/ceii/pac/2017/08/ceii_final_sema_ri_min_load_needs_assessment_report.pdf

** https://www.iso-ne.com/static-assets/documents/2017/09/2026_sema_ri_minimum_load_solutions_study_initiation_pac_notice.docx

SHORT CIRCUIT ASSUMPTIONS

Short Circuit Basecase Assumptions

- The short circuit basecase used for the SEMA/RI Needs Assessment is based on the expected topology in the 2023 compliance steady state base case. No significant project is expected in the 2023-2028 timeframe, and hence the 2023 case was considered acceptable
- The 2023 case includes the impact of all PPA approved generators and ETUs (including resources without an obligation through the FCM)
  - The resources with an approved PPA that do not have an obligation through the FCM cannot be relied upon to resolve a reliability need (and are therefore not considered in steady state),
  - However, they do contribute to the available short circuit current as they may be in service as part of the energy dispatch of the system
- All generators in the short circuit model will be considered online for this study
- Two scenarios with differing assumptions around Mystic station will be evaluated:
  - Scenario 1: Mystic 7, 8, 9, and Jet retired
  - Scenario 2: Mystic 7 and Jet retired

STUDY METHODOLOGY

Study Methodology

- Steady state thermal and voltage analysis will be performed, for N-0 (all-facilities-in), N-1 (all-facilities-in, first contingency), and N-1-1 (facility-out, first contingency) for the described set of generation dispatches and inter-regional stresses
  - Up to 1,200 MW generation re-dispatch will be allowed between the first and second contingency
- Short circuit analysis will be performed with representation of the latest generation additions and retirements in the study area
- If any needs are identified in the Needs Assessment, a determination will be made on whether the needs are time sensitive or not

SCHEDULE/NEXT STEPS

Schedule/Next Steps

- Please submit comments on the materials in this presentation to pacmatters@iso-ne.com by Sunday, December 2nd
- Post the draft study area 2028 Needs Assessment Scope of Work report and intermediate study files – Q1 2019
- Complete the study area 2028 Needs Assessment and present to PAC and post report – Q1 or Q2 2019

Questions