Forward Capacity Auction 14 Transmission Transfer Capabilities & Capacity Zone Development

Planning Advisory Committee

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Topics

- Review of interface transfer capabilities
- Proposed Capacity Zone construct for the fourteenth Forward Capacity Auction (FCA 14, Capacity Commitment Period (CCP) 2023-2024)

REVIEW

Methodology for Modeling Capacity Zones in FCM

Developing Zonal Boundaries for the FCM

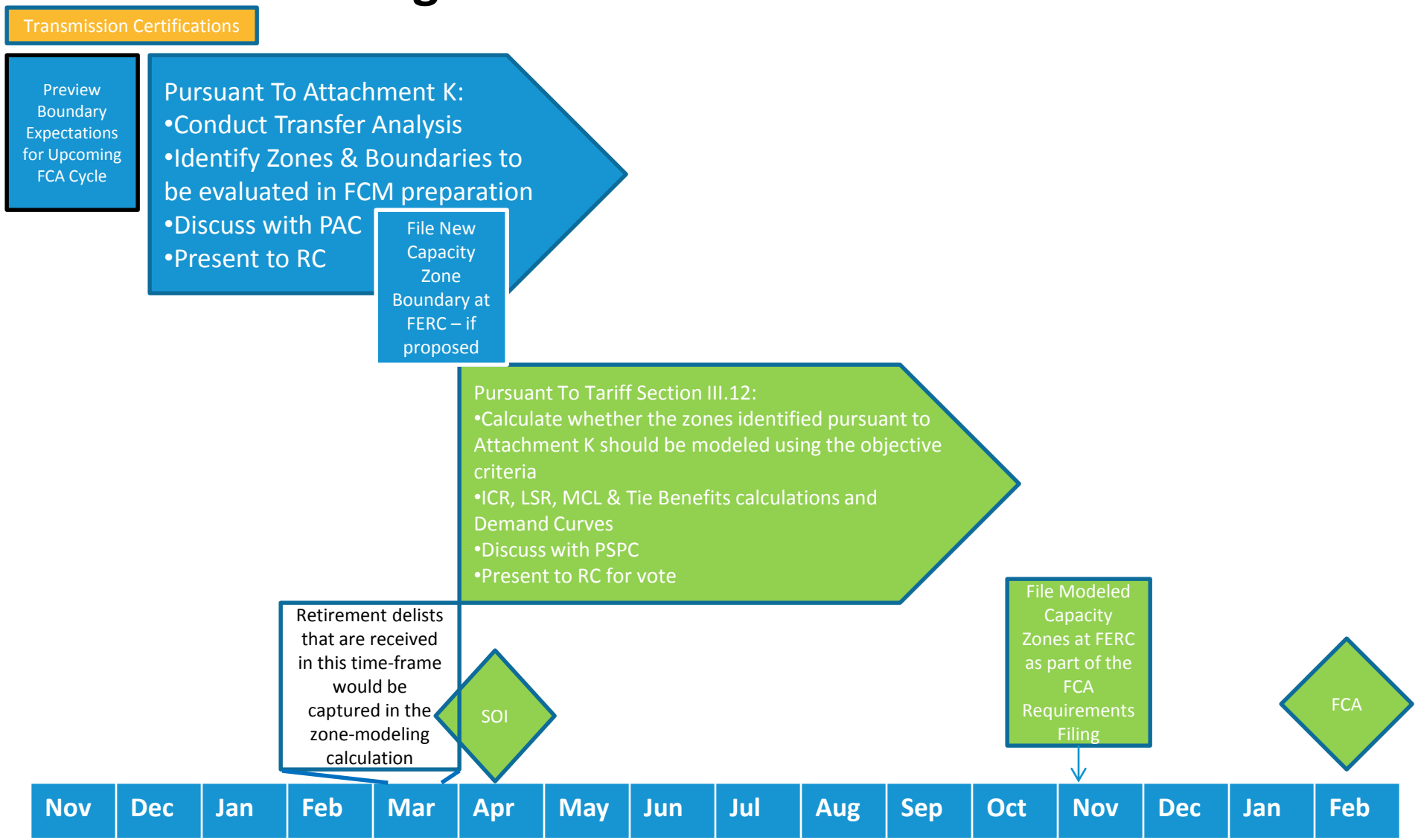
- Included in Attachment K of the Open Access Transmission Tariff:
  - Annual Assessment of Transmission Transfer Capability
    - Each year, the ISO shall issue the results of the annual assessment of transmission transfer capability, conducted pursuant to applicable NERC, NPCC and ISO New England standards and criteria and the identification of potential future transmission system weaknesses and limiting facilities that could impact the transmission system's ability to reliably transfer energy in the planning horizon.
    - Each annual assessment will identify those portions of the New England system, along with the associated interface boundaries, that should be considered in the assessment of Capacity Zones to be modeled in the Forward Capacity Market pursuant to ISO Tariff Section III.12.

Zone Formation: A Two Step Process

Step ONE	Step TWO
Identify the potential zonal boundaries and associated transfer limits to be tested for modeling in the FCM	Use objective criteria* to conduct the test determining whether or not the zone meets the trigger to be modeled for the Capacity Commitment Period
	Import-constrained zone Trigger to model the zone is based on the quantity of surplus resources in the zone above the zonal requirement Export-constrained zone: Trigger to model the zone is based on the quantity of existing and proposed new resources compared with the maximum capacity capability in the zone Adjacent load zones that aren't import- or export-constrained are modeled together in the rest-of-pool zone

*Objective criteria are contained in Section III.12.4 of the ISO Tariff

Zonal Modeling Timeline



External Import Capability Determinations For Use in FCM (Tariff Section III.12.9.2.4)

- The import capability of all external interconnections with New England will be determined using studies of system conditions expected during the Capacity Commitment Period:
  - Forecast 90/10 peak load
  - Existing Generating Capacity Resources at their CNR Capability
  - Existing Demand Resources reflecting their Capacity Supply Obligation
  - Stressed Transfers
- The system will be modeled in a manner that reflects the design of the interconnection
  - If an interconnection and its supporting system upgrades were designed to provide incremental capacity into the New England Control Area, simulations will assume imports up to the level that the interconnection was designed to support
  - If the interconnection was not designed to be comparably integrated, simulations will determine the amount of power that can be delivered into New England over the interconnection

FCA 14 – Capacity Zone Development: Steps So Far

- The *Forward Capacity Auction 14 (FCA 14) Capacity Zone Development Preview* was presented at the November 2018 Planning Advisory Committee (PAC) meeting
  - Relevant portions are included in this presentation also
- *2019 Forward Capacity Market Transmission Certifications* were presented at the January 2019 Reliability Committee

REVIEW OF NOVEMBER 2018 PLANNING ADVISORY COMMITTEE DISCUSSION

Forward Capacity Auction 14 (FCA 14) Capacity Zone Development Preview

Relevant System Changes

- The following system changes (since last year's Capacity Zone determination effort) are relevant to the formation of Capacity Zone boundaries
  - New transmission upgrades, including those expected to be in-service by the start of the 2023-2024 Capacity Commitment Period
  - Resource retirements
  - New Capacity Resources
- This presentation describes all of the currently known information regarding the relevant system changes

FCM Transmission Certification Timeline

- The certification process is initiated in October
  - The process is coordinated with the October Regional System Plan (RSP) Project List update to ensure consistency between the FCM and RSP updates
  - Performed pursuant to Section 12.6 of the Tariff
- The Transmission Owners are required to provide models and contingency definitions for all projects being certified
- The ISO's review of the information and determination to accept certifications are typically made by January
- The accepted certification will be used in FCM activities
  - Transfer Limits, qualification, ICR & Related Values development, and De-list/Retirement/Substitution Auction models
- The list of accepted certified projects is typically presented at the January Reliability Committee meeting

New Transmission Certifications

- Solutions have been identified for Southeast Massachusetts/Rhode Island (SEMA/RI)
  - Will result in upgrades within the SEMA/RI area
  - Will not change the boundaries of the SEMA/RI or Southeast New England Capacity Zones
- Most of the SEMA/RI Reliability Project upgrades have now been certified for use in the Forward Capacity Market

Drivers Behind the Updates to the Transfer Capabilities

- The SEMA/RI Reliability Project upgrades are now planned:
  - Upgrades include a new 115 kV switching station, a 345/115 kV autotransformer, and various other 115 kV upgrades
  - Upgrades are expected to be completed by end of 2021
  - Additional details on the upgrades are located in the June 2018 RSP Project List
- Large generation retirements in the east (generation at Brayton Point, Pilgrim, Mystic)
- The transfer capabilities of the SEMA/RI Import and West-East interfaces were evaluated to examine the impact of the SEMA/RI Reliability Project upgrades and generation retirements:
  - Steady state thermal and voltage analyses were performed
  - Stability analysis was also performed for the West-East interface

Summary of Transfer Capabilities

- Today's transfer capabilities
  - SEMA/RI
    - N-1 = 1,280 MW
    - N-1-1 = 720 MW
  - West-East
    - N-1 = 2200 MW
- With the SEMA/RI Reliability Project in-service, the SEMA/RI Import interface transfer capabilities will be as follows, based on thermal limits with summer ratings:
    - N-1 = 1,800 MW
    - N-1-1 = 800 MW
- The West-East interface transfer capabilities will be as follows, based on thermal limits with summer ratings:
    - N-1 = 3,000 MW
- Steady state voltage analysis was performed for both interfaces:
    - No voltage based limitations were found to undercut the observed thermal limitations for both the SEMA/RI Import and West – East interfaces
- Stability analysis was performed for the West-East interface at a 5,200 MW West-East transfer level:
    - No stability based limitations related to this West-East transfer level were found

Resource Retirements

- Mystic 7 will be retiring with the commencement of Capacity Commitment Period 2022-2023
- The November 2015 Capacity Zone formation presentations (discussed further in this presentation) included scenario analysis of different potential future retirement scenarios (including Mystic 7 and additional retirement scenarios)
  - Analysis showed that retirements were not expected to drive the need to consider different Capacity Zone boundaries
- Any major retirements received for the FCA 14 Capacity Commitment Period will be considered in the Capacity Zone formation process

Interconnection Queue Activity (11/01/2018)*

- New Hampshire/Vermont
  - Over 4,100 MW (nameplate) of capacity interconnection requests
- Maine
  - Over 6,200 MW (nameplate) of capacity interconnection requests
- SEMA/RI
  - Over 7,700 MW (nameplate) of capacity interconnection requests
- Connecticut
  - Over 2,700 MW (nameplate) of capacity interconnection requests
- West/Central Massachusetts
  - Over 700 MW of capacity interconnection requests

*Since November 2018 the accumulation of Interconnection Requests in the various parts of New England has not changed significantly

Significant New Resource Activity in Maine

- There has been a significant backlog of requests in the ISO New England Interconnection Queue in Maine
- The November 1, 2017 FERC approval of the ISO's Clustering Proposal has enabled the queue to move forward in Maine
  - The first cluster is proceeding with over 600 MW through the system impact study process
  - An External ETU with 1,200 MW is also proceeding through the system impact study process
- Sufficient potential MW exists in the system impact study process for the Maine zone to become export-constrained

REVIEW OF NOVEMBER 2015 PLANNING ADVISORY COMMITTEE DISCUSSION

Boundary Scenario analysis

Boundary Scenario Analysis

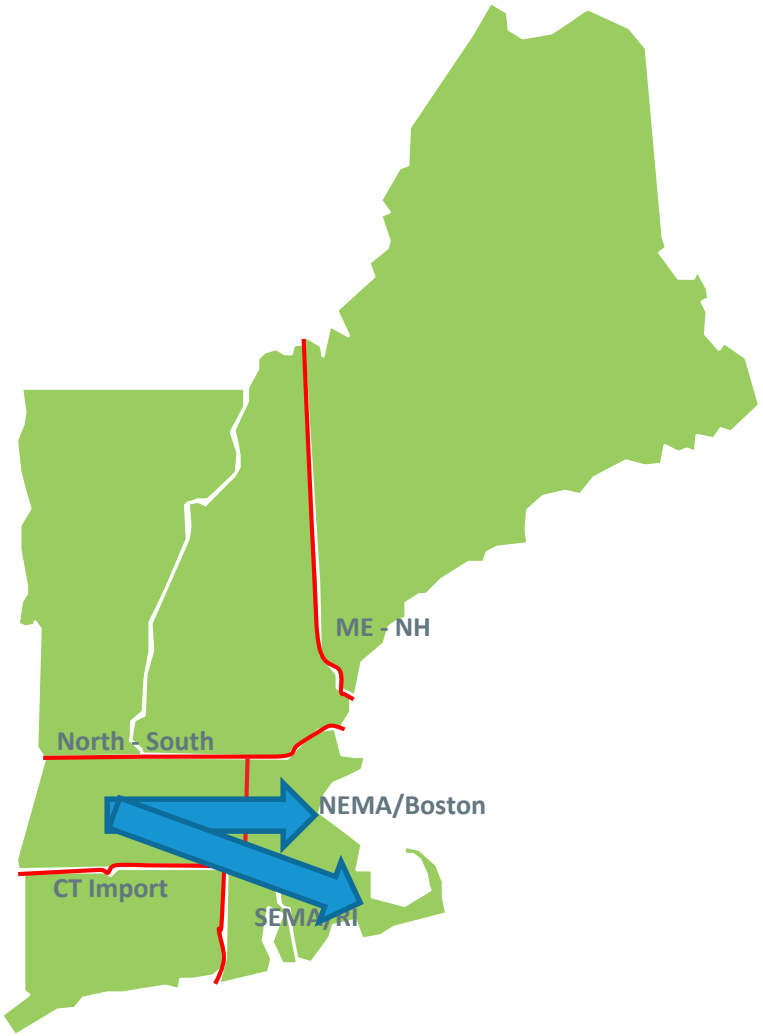
- To evaluate the potential durability of the Capacity Zone boundaries, in November 2015, the ISO discussed scenario analysis regarding the impact of potential future retirements

Analysis of Potential Further Retirements

- Analysis of potential further retirements was conducted to determine any potential impact on zonal boundaries of Southeast New England and Connecticut
  - Thermal transfer analysis, 2020 system
  - Focused on potential retirement of units older than thirty years

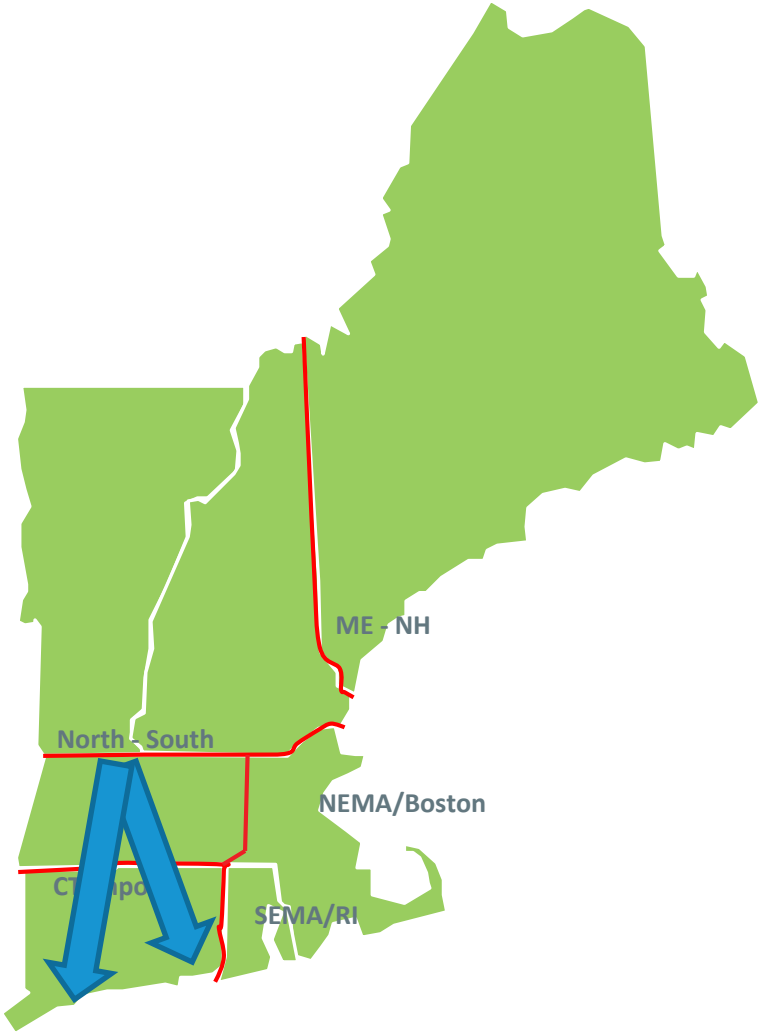
Results of Southeast New England – Further Retirement Scenarios

- For the analysis of further retirements in Southeast New England, the constraints remained on the outer boundary of the Southeast New England Zone
- No indication of the need to identify a different boundary
- Note that the previous (FCA-10) transfer analysis of Southeast New England focused the sinking of power at
  - Pilgrim
  - Canal
  - Mystic



Results of Connecticut – Retirement Scenarios

- For the analysis of retirements in Connecticut, the constraints remained on the outer boundary of the Connecticut Zone
- No indication of the need to identify a different boundary



Conclusions Regarding Relevant System Changes

- The following zonal boundaries have been used in the FCM in the past
  - Connecticut Import
  - Maine Export
  - NEMA/Boston Import
  - Northern New England Export (ME, NH, VT)
  - SEMA/RI Import
  - Southeast New England Import (NEMA/Boston, SEMA/RI)
- The following boundaries would address all of the potential limitations on transfers at a zonal level that are anticipated for FCA 14
  - Connecticut Import
  - Maine Export
  - Northern New England Export
  - Southeast New England Import

REVIEW OF INTERFACE TRANSFER CAPABILITIES

Internal Interfaces

FCA 14 Internal Interface Transfer Capability

Single-Value, Summer Peak,[a] Non-Firm, Transmission Interface Limits for Use in Subarea Transportation Models										
Interface	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Orrington South Export	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325
Surowiec South	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Maine-New Hampshire	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Northern New England-Scobie + 394	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
North-South	2725	2725	2725	2725	2725	2725	2725	2725	2725	2725
East-West	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
West-East	2200	2200	2200	2200	3000[f]	3000	3000	3000	3000	3000
Boston Import (N-1)	5400[b]	5400	5700[c]	5700	5700	5700	5700	5700	5700	5700
Boston Import (N-1-1)	4500[b]	4500	4600[c]	4600	4600	4600	4600	4600	4600	4600
SEMA/RI Export	3400	3400	3400	3400	3400	3400	3400	3400	3400	3400
SEMA/RI Import (N-1)	1280	1280	1280	1280	1800[f]	1800	1800	1800	1800	1800
SEMA/RI Import (N-1-1)	720	720	720	720	800[f]	800	800	800	800	800
Southeast New England Import (N-1)	5400[b]	5400	5700[c]	5700	5700	5700	5700	5700	5700	5700
Southeast New England Import (N-1-1)	4500[b]	4500	4600[c]	4600	4600	4600	4600	4600	4600	4600
Connecticut Import (N-1)	2950	3400[d]	3400	3400	3400	3400	3400	3400	3400	3400
Connecticut Import (N-1-1)	1750	2200[d]	2200	2200	2200	2200	2200	2200	2200	2200
SW Connecticut Import (N-1)	2500	2500	2800[e]	2800	2800	2800	2800	2800	2800	2800
SW Connecticut Import (N-1-1)	1750	1750	1900[e]	1900	1900	1900	1900	1900	1900	1900

Notes are discussed on the following pages

FCA 14 Internal Interface Transfer Capability (Notes)

a) Limits are for the summer period, except where noted to be winter
   - The limits may not include possible simultaneous impacts, and should not be considered as “firm”
   - For the years within the FCM horizon (CCP 2023-24 and sooner), only accepted certified transmission projects are included when identifying transfer limits
   - For the years beyond the FCM horizon (CCP 2024-25 and later), proposed plan approved transmission upgrades are included according to their expected in-service dates

b) Increase associated with the Greater Boston upgrades, without the Wakefield – Woburn 345 kV line (CCPs 2019-2020 and 2020-2021)

c) Increase associated with the Greater Boston upgrades, with the Wakefield – Woburn 345 kV line in service (CCP 2021-2022 and later)

d) Increase associated with the Greater Hartford/Central Connecticut upgrades

e) Increase associated with the Southwest Connecticut upgrades

f) Increase associated with the SEMA/RI Reliability project upgrades

EXTERNAL INTERFACES

FCA 14 External Interface Import Capability

Single-Value, Summer Peak,[1] Non-Firm, Transmission Interface Limits for Use in Subarea Transportation Models

Interface	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
New Brunswick-New England (energy import capability)[2]	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
New Brunswick-New England (capacity import capability)	700	700	700	700	700	700	700	700	700	700
HQ-New England (Highgate) (energy import capability)[3]	217	217	217	217	217	217	217	217	217	217
HQ-New England (Highgate) (capacity import capability)	200	200	200	200	200	200	200	200	200	200
HQ-New England (Phase II) (energy import capability)[4]	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
HQ-New England (Phase II) (capacity import capability)	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
Cross-Sound Cable (CSC) (energy import capability)[5]	330	330	330	330	330	330	330	330	330	330
Cross-Sound Cable (CSC) (capacity import capability)	0	0	0	0	0	0	0	0	0	0
New York-New England (energy transfer capability)[6]	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
New York-New England (capacity transfer capability)	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400

Notes are discussed on the following pages

External Interface Import Capability (Notes)

1. Limits are for the summer period
   - The limits may not include possible simultaneous impacts, and should not be considered as “firm” (the bases for these limits are subject to more detailed review in the future)
2. The electrical limit of the New Brunswick-New England (NB-NE) Tie is 1,000 MW
   - When adjusted for the ability to deliver capacity to the greater New England Control area, the NB-NE transfer capability is 700 MW
     - This is because of downstream constraints; in particular Orrington South
3. The capability for the Highgate facility is listed at the New England AC side of the Highgate terminal

External Interface Import Capability, continued …

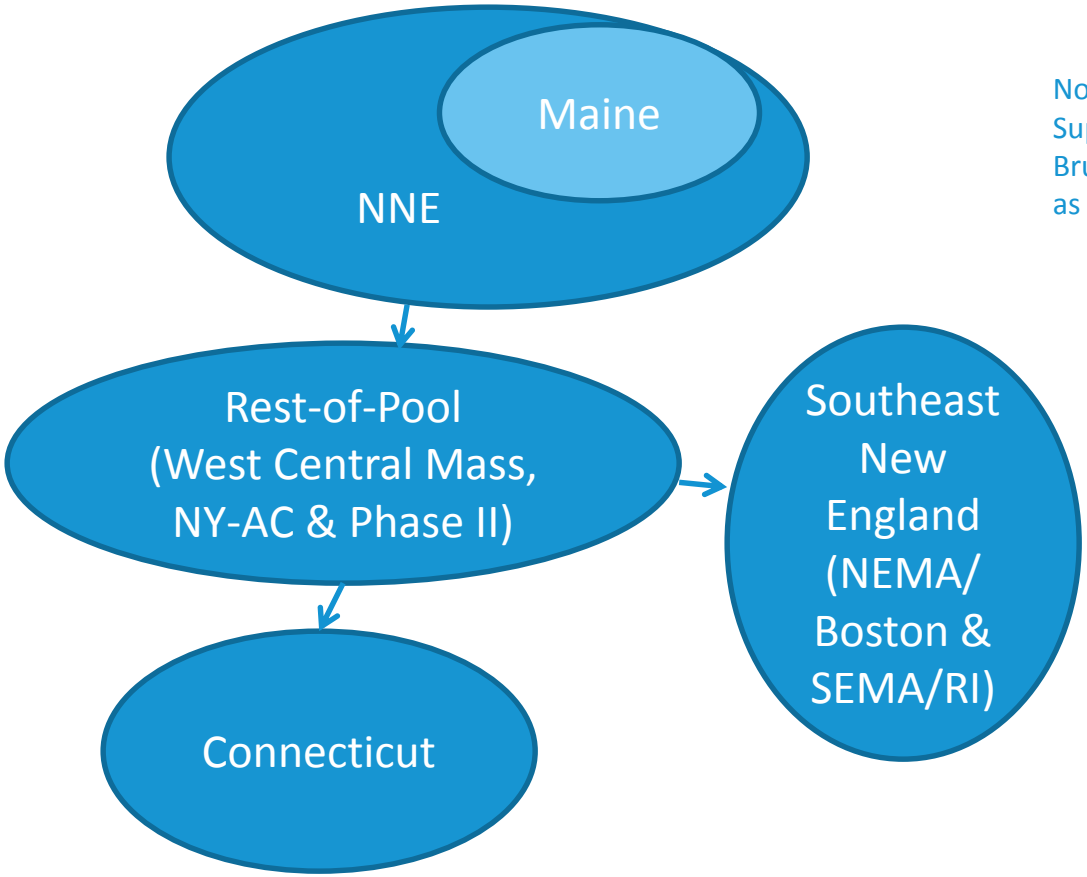
4. The Hydro-Quebec Phase II interconnection is a DC tie with equipment ratings of 2,000 MW. Due to the need to protect for the loss of this line at full import level in the PJM and New York (NY) Control Areas' systems, ISO-NE has assumed its transfer capability for capacity and reliability calculation purposes to be 1,400 MW
   - This assumption is based on the results of loss-of-source analyses conducted by PJM and NY
5. Import capability on the Cross Sound Cable is dependent on the level of local generation
6. New York interface limits
   - These are without CSC and with the Northport Norwalk Cable at 0 MW flow
   - Simultaneously importing into NE and SWCT or CT can lower the NY-NE capability (very rough decrease = 200 MW)

PROPOSED POTENTIAL ZONAL CONSTRUCT FOR FCA 14

Proposed Potential Zonal Construct for FCA 14

- For FCA 14, the following will be evaluated using the Capacity Zone modeling objective criteria triggers in Section III.12.4 of the Tariff
  - Potential export-constrained zone
    - Northern New England ("NNE" - Vermont, New Hampshire & Maine)
    - Maine (nested within NNE)
  - Potential import constrained zones
    - Southern New England ("SENE" - Northeast Massachusetts/Boston & Southeast Massachusetts/Rhode Island)
    - Connecticut

Potential Capacity Zone Construct for FCA 14



Note:
Supply from New Brunswick is modeled as connected to Maine

Note that zones are modeled in the FCA only if the objective criteria in Market Rule 1, Section 12 is triggered

Interface Transfer Capabilities for Potential Capacity Zone Boundaries

FCA 13 Transfer Capabilities (MW)		FCA 14 Transfer Capabilities (MW)	
SENE Import N-1	5,700	SENE Import N-1	5,700
SENE Import N-1-1	4,600	SENE Import N-1-1	4,600
Connecticut Import N-1	3,400	Connecticut Import N-1	3,400
Connecticut Import N-1-1	2,200	Connecticut Import N-1-1	2,200
North-South (NNE Boundary) N-1	2,725	North-South (NNE Boundary) N-1	2,725
Maine-New Hampshire (Maine Boundary) N-1	1,900	Maine-New Hampshire (Maine Boundary) N-1	1,900

Next Steps

- The potential Capacity Zone boundaries will be tested using the Step 2 objective criteria trigger calculations
  - Scheduled for the May 2019 Power Supply Planning Committee
- Certain targeted clarifying changes will be proposed to the Forward Capacity Market rules in ISO Tariff Section III.13 to ensure the correct handling of a nested export-constrained Capacity Zone
- Zones that trigger the objective criteria will be modeled in the FCA and associated reconfiguration auctions
- The FCA will determine whether any of the modeled zones bind in the auction and experience price-separation

Questions