ISO new england

RSP15 Resource Adequacy and Related Studies

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Objective

- Introduce RSP15 Resource Adequacy Related Studies*
- Review Resource Adequacy Studies Conducted and their Results
- Identify Studies to be Conducted
- Obtain Comments

* General RSP15 scope of work was discussed with the PAC on January 21, 2015. A copy of that presentation is available at: http://www.iso-ne.com/static-assets/documents/2015/01/a6_rsp15_scope_of_work.pdf

Background – RSP15 Scope of Resource Adequacy Studies

- RSP15 will summarize established ICR values:
  - Actual Net Installed Capacity Requirement (ICR) approved by FERC
    - Regional and Subarea values for 2015/2016 through 2018/2019
    - Regional Demand Curve for 2018/2019 (FCA9)
- RSP15 will publish indicative Net ICR values based on the 2015 load forecast for 2020/2021 through 2024/2025
    - Calculated deterministically using a representative percent resulting reserve multiplier
- RSP15 will not include Actual or indicative Net ICR for 2019/2020 (FCA10):
  - ISO working with NEPOOL Committees to develop values to be filed with FERC in November 2015
- Net ICR, LSR, and MCL calculated probabilistically for 2021/2022 through 2024/2025 based on FCA10 assumptions will be presented to PAC in Dec 2015 or early 2016
  - Values to Include the parameters for the System-wide and Zonal Capacity Demand Curves

Background – RSP15 Scope of Resource Adequacy Studies (cont.)

- Other RSP15 resource adequacy studies:
  - Operable capacity analysis to demonstrate the extent to which load relief actions may be required to serve the projected system demands plus operating reserves based on Net ICR and representative Net ICR
  - Representative future operating reserve needs in the greater Southwest Connecticut (SWCT), Greater Connecticut and NEMA/Boston subareas.

NET INSTALLED CAPACITY REQUIREMENTS

Net ICR for 2015/2016 – 2018/2019

- RSP15 will publish FERC approved net ICR, LSR and MCL for:
  - 2015/2016 – based on values identified for its 3rd Annual Reconfiguration Auction (ARA)
    - http://www.iso-ne.com/static-assets/documents/2014/10/2015ara3_2016ara2_2017ara1_icr_values_pspc_1016_2014.pdf
  - 2016/2017 – based on values identified for its 2nd ARA
    - http://www.iso-ne.com/static-assets/documents/2014/10/2015ara3_2016ara2_2017ara1_icr_values_pspc_1016_2014.pdf2
  - 2017/2018 – based on values identified for its 1st ARA
    - http://www.iso-ne.com/static-assets/documents/2014/10/2015ara3_2016ara2_2017ara1_icr_values_pspc_1016_2014.pdf
  - 2018/2019 – based on values identified for its FCA
    - http://www.iso-ne.com/static-assets/documents/2014/10/a10_icr_related_values_for_aras.pdf

Indicative Net ICR for 2020/2021 through 2024/2025

- The 2015 RSP will publish indicative Net ICR values covering 2020/2021 through 2024/2025 using a 14.3% reserve margin multiplier and the 2015 CELT 50/50 peak load forecast (deterministic calculation).
  - This multiplier is developed by using the average % resulting reserves associated with the representative Net ICR values for 2019/2020 through 2023/2024 presented to the PAC in January 2015
    - Average % resulting reserves associated with the following net ICRs:
      - 2019/2020 (14.1%),
      - 2020/2021 (14.2%),
      - 2021/2022 (14.3%),
      - 2022/2023 (14.4%) and
      - 2023/2024 (14.6%).

Actual and Indicative New England Net ICR and Resulting Reserves

Status	Years	2015 CELT Forecast 50/50 Peak (MW)1	Actual (A) and Indicative Future Net ICR (MW)	Resulting Reserves (%)
A	**2015/2016**	28,251	33,391	18.2
A	**2016/2017**	28,673	33,764	17.8
A	**2017/2018**	29,066	34,061	17.2
A	**2018/2019**	29,483	34,189	16.0
	2019/2020	29,861	TBD	TBD
I	**2020/2021**	30,182	30,182 * 1.143 = 34,500	14.3
I	**2021/2022**	30,487	30,487 * 1.143 = 34,800	14.2
I	**2022/2023**	30,804	30,804 * 1.143 = 35,200	14.3
I	**2023/2024**	31,131	31,131 * 1.143 = 35,600	14.4
I	**2024/2025**	31,455	31,455 * 1.143 = 36,000	14.4

Status: A = Actual Values
I = Indicative Values
Values rounded to nearest 100

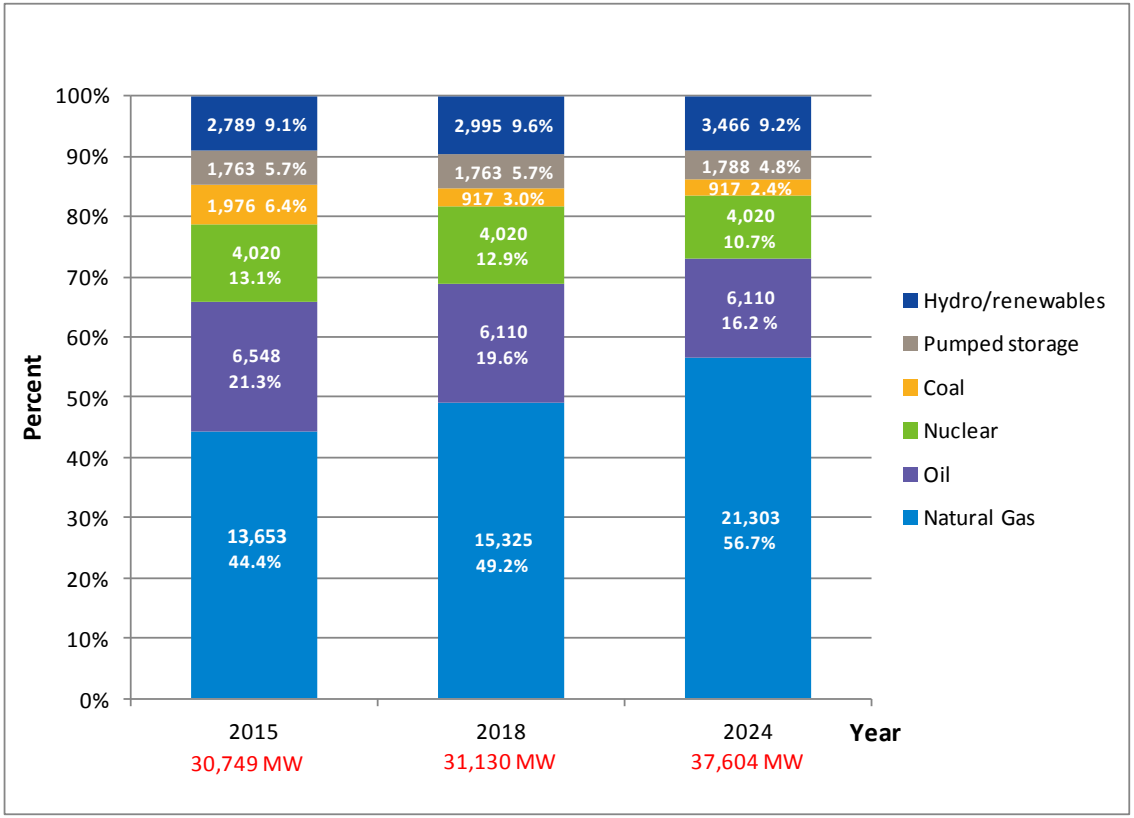
1) The 2015 CELT Forecast 50/50 peak loads reflect the behind the meter PV resources.

Future Systemwide Needs (MW)

Year	50/50 Peak Load (1)	Indicative Net ICR (Need)	FCA9 Resources* (Known Resources)	Cumulative EE Forecast** (New Resources)	Resource Surplus/Shortage
2020/2021	30,182	34,500	34,695	477	672
2021/2022	30,487	34,800	34,695	695	590
2022/2023	30,804	35,200	34,695	900	395
2023/2024	31,131	35,600	34,695	1,093	188
2024/2025	31,455	36,000	34,695	1,274	-31

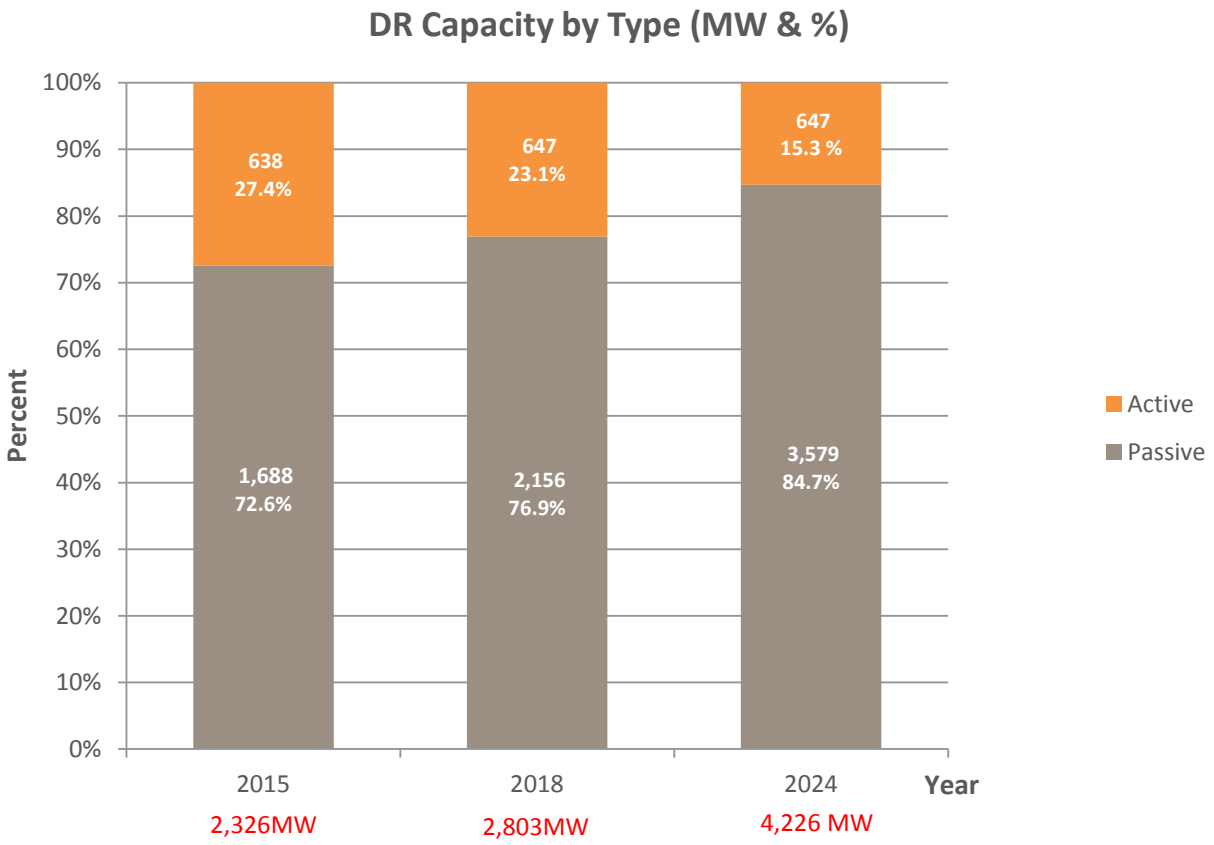
*FCA9 resource numbers are based on FCA9 auction results (CSO) and assuming no resource retirements. Details of FCA9 results are available at http://www.iso-ne.com/static-assets/documents/2015/02/er15- -000_2-27-15_fca_9_results_filing.pdf.
**EE Forecast values are based on the 2015 EE Forecast. Details are available at http://www.iso-ne.com/static-assets/documents/2015/04/iso_ne_final_2015_ee_forecast_2019_2024.pdf.
(1) The 50/50 peak loads reflect the behind the meter PV resources.

Capacity by Fuel Type (MW & %)



- Capacity in 2018 reflects the addition of queue projects designated as "green" in the April 2015 COO Report as well as those FCM Resources with CSOs, and a reduction for Non-Price Retirements through the 2018-2019 FCA.
- Capacity in 2024 assumes the commercial operation of all other ("yellow") projects reported in the April 2015 COO Report.
- The capacity additions in 2018 and 2024 were calculated as follows: For FCM Resources, capacity is based on Qualified Capacity (QC). For non-FCM resources, on-shore wind is derated to 5% of nameplate capacity and offshore wind is derated to 20% of nameplate, while all other projects reflect the Queue net capability.

Existing and Future Demand Resource Capacity*



* The DR for 2015 and 2018 reflect Capacity Supply Obligations. The passive DR shown for 2024, consists of Qualified Capacity of existing resources, CSO for new resources and an ISO-NE forecast of incremental EE beyond the FCM.

Summary and Observations

- Net ICR resulting reserves based on the 2015 CELT loads range between 16.0% to 18.2% for 2015/2016 through 2018/2019. The Capacity Supply Obligations obtained through the conducted FCAs will be adequate to meet the 1 day in 10 years LOLE for these years under the 2015 CELT loads.
- The system will need approximately 30 MW of new capacity in 2024/2025 to meet the indicative net ICR, assuming:
  - FCA9 cleared resources
  - No additional retirements
  - Forecast of behind the meter PV resources not embedded in load
  - Forecast of future new energy efficiency resources.

Summary and Observations (cont.)

- Retirements would exacerbate resource adequacy situation.
- Future requirements will be met by public policies, which are encouraging the development of both energy efficiency and photovoltaic resources; and new capacity resources, which have been responding to improvements made to the ISO's wholesale markets.
  - 11,300 MW of future generating resources are currently active in the interconnection queue.

OPERABLE CAPACITY ANALYSIS

Operable Capacity Analysis

- Operable Capacity Analysis is a deterministic approach to calculate the operable capacity margin at 50/50 and 90/10 peak demand, assuming New England will only have an amount of capacity equal to the net Installed Capacity Requirement to meet the assumed peak demand plus operating reserve requirement.
- A positive operable capacity margin indicates that there will be adequate operable capacity to meet the expected peak demand.
- A negative operable capacity margin indicates that mitigating actions would be required to maintain an orderly depletion of system operating reserve requirement or even shed load
  - The extent of the negative margin for a specific scenario indicates the extent of possible mitigating actions that would be required through predefined protocols, such as ISO Operating Procedure No. 4 (OP 4), Action During a Capacity Deficiency.

RSP15 Operable Capacity Analysis

- Operable Capacity Analysis will be conducted for 50/50 and 90/10 load levels for:
  - 2015 through 2018 using actual net ICR as total installed capacity
  - 2020 through 2024 using the indicative net ICR as the total installed capacity.

Operable Capacity Analysis for RSP15

Capacity Situation (Summer MW)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2023
Load (50/50 forecast)	28,251	28,673	29,066	29,483	29,861	30,182	30,487	30,804	31,131	31,455
Operating reserves	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375
Total Requirement	**30,626**	**31,048**	**31,441**	**31,858**	**32,236**	**32,557**	**32,862**	**33,179**	**33,506**	**33,830**
Installed Capacity (Net ICR)	33,391	33,764	34,061	34,189	N/A	34,500	34,800	35,200	35,600	36,000
Assumed unavailable capacity	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)
Total net capacity	**31,291**	**31,664**	**31,961**	**32,089**	**N/A**	**32,400**	**32,700**	**33,100**	**33,500**	**33,900**
Operable capacity margin	665	616	520	231	N/A	(157)	(162)	(79)	(6)	70

Capacity Situation (Summer MW)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2023
Load (90/10 forecast)	30,600	31,053	31,481	31,933	32,341	32,697	33,037	33,389	33,746	34,104
Operating reserves	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375
Total Requirement	**32,975**	**33,428**	**33,856**	**34,308**	**34,716**	**35,072**	**35,412**	**35,764**	**36,121**	**36,479**
Installed Capacity (Net ICR)	33,391	33,764	34,061	34,189	N/A	34,500	34,800	35,200	35,600	36,000
Assumed unavailable capacity	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)	(2,100)
Total net capacity	**31,291**	**31,664**	**31,961**	**32,089**	**N/A**	**32,400**	**32,700**	**33,100**	**33,500**	**33,900**
Operable capacity margin	(1,684)	(1,764)	(1,895)	(2,219)	N/A	(2,672)	(2,712)	(2,664)	(2,621)	(2,579)

Observations – Operable Capacity Analysis

- If the 2015 CELT 50/50 loads and the assumed capacity conditions would occur during the 10-year study period (2015 - 2024), ISO system operations would need to manage the demand by:
  - Depleting the 30-minute reserve.
- If the 90/10 loads and assumed capacity conditions would occur during this period, ISO system operators would need to manage the demand by (not necessarily all these actions or in this order):
  - Depleting operating reserves,
  - Requesting emergency assistance from the neighboring balancing authorities,
  - Dispatching the emergency generators and
  - Implementing 5% voltage reductions.

LOCATIONAL FORWARD RESERVE REQUIREMENTS

Operating Reserve Requirements Background

- Operating Reserves are the amount of capacity resources needed by the system to respond quickly to system contingencies stemming from equipment outages and forecast errors.
- These capacity resources may also be called on
  - to provide regulation service for maintaining operational control or
  - to serve or reduce peak loads during high demand conditions.

Operating Reserve Requirements Background, cont.

- Real-time operating-reserve capacity must be available to respond to system contingencies. Typical contingencies considered are:
  - Loss of a supply source, such as a generator
  - Loss of a transmission element, such as a 345 kV transmission line
  - In certain circumstances, loss of multiple elements, such as two lines, a line and a generator, or several generators in a station vulnerable to a common-mode failure.

Operating Reserve Requirements Background, cont.

- Reliability standards, criteria, and procedures require the New England power system to be planned and operated to protect and recover from specific types of network disturbances
  - NERC Standard BAL-002-0 Disturbance Control Performance
    - http://www.nerc.com/files/BAL-002-0.pdf
  - NPCC Regional Reliability Reference Directory #5, Reserve
    - https://www.npcc.org/Standards/Directories/Directory_5-Full%20Member%20Approved%20clean%20-GJD%2020150330.pdf
  - ISO New England Operating Procedure 8, Operating Reserve and Regulation
    - http://www.iso-ne.com/static-assets/documents/rules_proceds/operating/isone/op19/op19_rto_final.pdf
  - ISO New England Operating Procedure No. 19, Transmission Operations
    - http://www.iso-ne.com/rules_proceds/operating/isone/op19/op19_rto_final.pdf
- Useful reference on operating reserve requirements
  - ISO New England Operating Reserves White Paper
    - http://www.iso-ne.com/pubs/whtpprs/operating_reserves_white_paper.pdf

Representative Future Locational Forward Reserve Requirements

Area/Improvement	Market Period	Range of Fast-Start Resources Offered into the Past Forward Reserve Auction (MW)*	Representative Future Locational Forward Reserve Market TMOR Requirements (MW)	
			Summer (Jun to Sep)	Winter (Oct to May)
Greater Southwest Connecticut	2015	199 - 515	138	
	2016			
	2017			
	2018			
	2019			
Greater Connecticut	2015	659 – 1,563**	714	
	2016			
	2017			
	2018			
	2019			
NEMA/BOSTON	2015	0 - 441	331	
	2016			
	2017			
	2018			
	2019			

* These values are the range of megawatts of resources offered into the past forward-reserve auctions through 2014.

** These values include resources in Greater Southwest Connecticut.

Summary and Observations

- Actual 2015 Summer locational Forward Reserve Requirements for greater SWCT, Connecticut (also referred to as Greater Connecticut), and NEMA/Boston are available now.
  - Forward Reserve Auction closed on April 23, 2015. Auction results expected by end of April
- Actual 2015/2016 Winter requirements will be available later this summer.
- Representative future locational forward reserve needs and assumed system conditions will be presented to the PAC at the June meeting.

Questions