ISO new england

memo

**To:** Power Supply Planning Committee

**From:** Fei Zeng, Technical Manager – Resource Studies and Assessments

**Date:** December 7, 2021

**Subject:** Operating Reserve Deficiency Information – Capacity Commitment Period 2025-2026

This transmittal summarizes the results of ISO New England's study to forecast the expected number of system-wide operating reserve deficiency hours for the 2025-2026 Capacity Commitment Period (CCP). The study simulated ISO New England's installed capacity at the net Installed Capacity Requirement (ICR) and at higher than and lower than net ICR levels for the 2025-2026 CCP. This study utilized the same load and resource assumptions used for developing the ICR for the 2025-2026 Forward Capacity Auction (FCA). The ISO conducted similar studies in 2013 for the 2016-2017 CCP, and in 2016 through 2020 for the 2020-2021 through 2024-2025 CCPs. Results of these studies are available by accessing the links listed in the Appendix.

This transmittal provides the following information for the 2025-2026 CCP, covering a New England system with installed capacity ranging from net ICR minus 1,600 MW (30,045 MW) to net ICR plus 3,200 MW (34,845 MW):

- The expected number of operating reserve deficiency hours;
- The frequency distribution (*i.e.* percentiles) of the expected operating reserve deficiency hours; and
- A comparison of this 2021 study (2025-2026 CCP) results with prior study results.

## Approach and Assumptions

To determine the ICR and Related Values for the Forward Capacity Market (FCM), the ISO employs the General Electric Multi-Area Reliability Simulation Program (GE MARS) probabilistic simulation model. This model provides estimates of the expected number of days per year in which supply would be insufficient to meet demand during the CCP (known as the Loss of Load Expectation, or LOLE). In addition to estimating LOLE, the same model provides estimates of the expected number of hours per year during which operating reserve requirements cannot be met.

Applying Monte Carlo simulation techniques, the GE MARS model, evaluates the annual (or a chosen period) bulk power system resource adequacy by simulating the availability of resources and the assumed

demand on an hourly basis. The program registers a shortage hour when the amount of available capacity in the system is not adequate to meet the system load and operating reserve requirement for the hour of interest. The simulation results in the total number of shortage hours for the year (or a chosen period). Here, we want to emphasize that while GE MARS provides the number of hours of operating reserve shortage, it does not provide the number of events that resulted in these shortage hours. For example, 20 hours of annual operating reserve shortage could represent 20 discrete (non-continuous) shortage hours, or one shortage lasting 20-hours, or shortages of different durations totaling 20 hours. The "expected hours" of operating reserve shortage are calculated, after thousands of Monte Carlo iterations, as the average number of shortage hours during a year.

As a reliability tool mainly used for assessing the resource adequacy of the system, GE MARS captures the randomness of the resources' outages. It doesnot, however, consider the operational parameters associated with the resources such as ramp rate, minimum up/down times, maximum number of starts per day, etc. In addition, operational requirements associated with unit commitment/economic dispatch; or transmission constraints associated with transmission maintenance, system upgrades or unforeseen loss of transmission elements are also not considered. Therefore, the shortage hours reported in this study do not reflect any shortage hours that could arise relating to operational risks such as under-commitment due to load forecast error in operations, loss of critical transmission elements, loss of fuel supply facilities; or lack of fuel supply, etc.

The ISO derived all of results in this transmittal from the GE MARS probabilistic simulations. As noted above, this year's study relied on the same load and resource assumptions used to develop the net ICR for the 2025-2026 CCP. These assumptions are detailed in the ISO's FERC filing of "Installed Capacity Requirement, Hydro Quebec Interconnection Capability Credits and Related Values for the Sixteenth Forward Capacity Auction (Associated with the 2025-2026 Capacity Commitment Period)", and an ISO presentation to the Power Supply Planning Committee on October 5, 2021 entitled "Estimated Hours of System Operating Reserve Deficiency for Capacity Commitment Period 2025-2026 (FCA 16)".

## Summary of Results

Table 1 provides summary information regarding: (a) the expected number of hours of operating reserve deficiency annually, and (b) the estimated relative frequency of hours of operating reserve deficiency conditions annually. Table 1 values in columns labeled '5/95', '50/50', '95/5' represent the 5$^{th}$ percentile, median and 95$^{th}$ percentile, respectively, of the simulation results for the number of hours with system operating reserve deficiency conditions.

For example, the value 0.4 in the first row and column labeled '5/95' means that, based on the simulation, there is a 1-in-20 (or 5%) chance that the annual number of hours with operating reserve deficiency conditions would equal *0.4 hours or less* when the amount of installed capacity equals net ICR plus 3,200 MW. Similarly, the value of 2.2 in the far-right column labeled '95/5' means that, based on the simulation, there is a 19-in-20 (or 95%) chance that the number of hours with operating reserve deficiency conditions would be *2.2 hours or less* annually. The values listed in the column labeled "*Expected*" are calculated as

the average of all outcomes for a particular capacity level while the column labeled "50/50" is the median value[1].

**Table 1: Estimated Hours of System Operating Reserve Deficiencies Annually for 2025-2026 CCP**

| Capacity Level | Expected | 5/95 | 50/50 | 95/5 |
|---|---|---|---|---|
| Net ICR + 3,200 MW | 1.0 | 0.4 | 0.8 | 2.2 |
| Net ICR + 2,800 MW | 1.3 | 0.6 | 1.1 | 2.9 |
| Net ICR + 2,400 MW | 1.8 | 0.7 | 1.5 | 3.7 |
| Net ICR + 2,000 MW | 2.4 | 0.9 | 2.1 | 4.9 |
| Net ICR + 1,600 MW | 3.2 | 1.2 | 2.8 | 6.1 |
| Net ICR + 1,200 MW | 4.2 | 1.8 | 3.8 | 7.7 |
| Net ICR + 800 MW | 5.5 | 2.6 | 5.0 | 10.0 |
| Net ICR + 400 MW | 7.1 | 3.6 | 6.6 | 12.2 |
| Net ICR | 9.0 | 4.9 | 8.2 | 15.5 |
| Net ICR – 400 MW | 11.4 | 6.5 | 10.3 | 19.4 |
| Net ICR – 800 MW | 14.5 | 8.3 | 13.2 | 24.3 |
| Net ICR – 1,200 MW | 18.5 | 10.4 | 17.2 | 30.8 |
| Net ICR – 1,600 MW | 23.8 | 13.4 | 22.5 | 38.3 |

[1] The median value represents the middle value of the shortage hours in a year in which one half of the numbers are above the median and the other half are below. The expected value is the average value of the shortage hours in a year.

**Figure 1: Plot of Estimated Hours of System Operating Reserve Deficiencies Annually for 2025-2026 CCP**

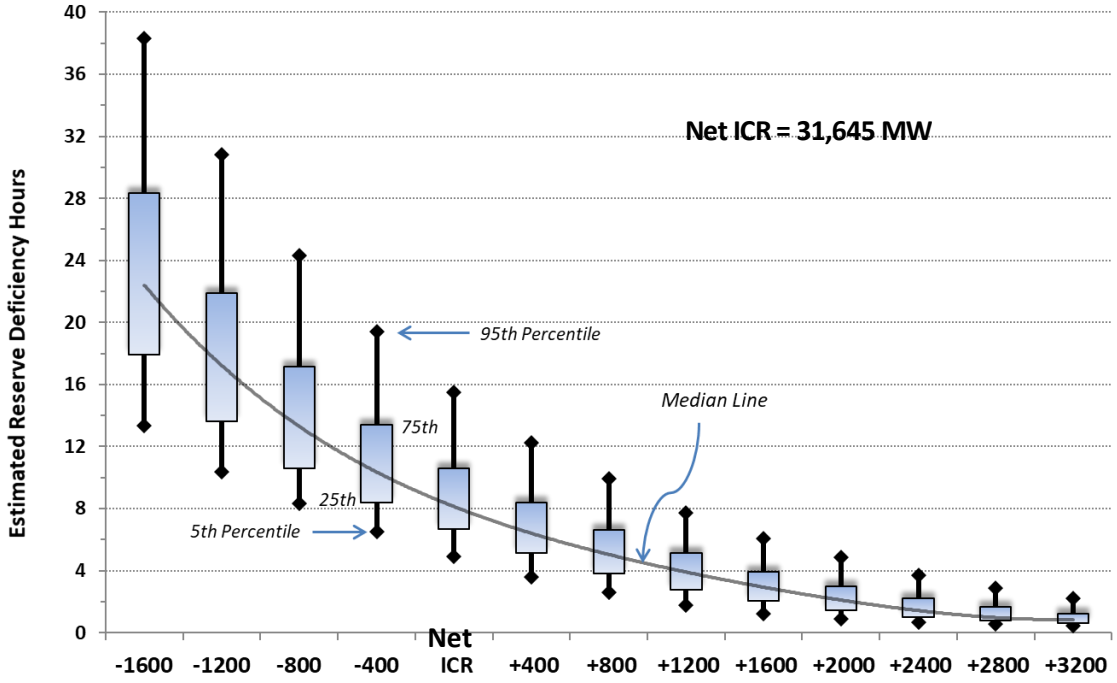



Figure 1 is a '*box-and-whisker*' plot of the data in Table 1 with the values for the 25th and 75th percentiles included in addition to the 5th, 50th and 95th percentiles shown in Table 1. In Figure 1, each shaded '*box*' indicates the upper and lower quartiles (25th and 75th percentiles) for the distribution of the total number of hours of operating reserve deficiency conditions annually, at each level of installed capacity. The extended '*whiskers*' show the 5th and 95th percentile values from Table 1, and the smooth line interpolates the median ('50/50') hours data from Table 1.

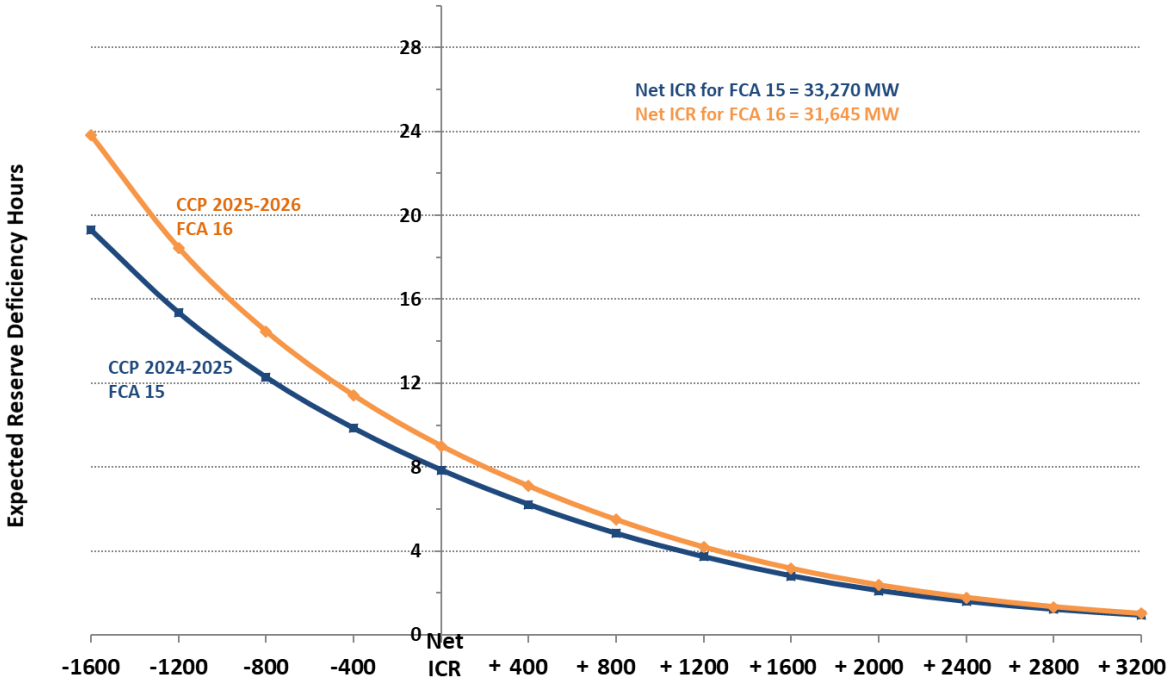
## Observations

Similar to prior studies, the results of the 2021 study demonstrate that as the level of installed capacity in the New England system decreases from the most surplus condition studied (Net ICR + 3200 MW) to the most deficient condition studied (Net ICR – 1600 MW), the estimated number of hours with operating reserve deficiency conditions increases gradually at first, then more quickly as the system becomes close to or below its criteria capacity requirement.

Figure 2 compares the expected number of hours of operating reserve deficiency between the study for the 2024-2025 CCP (FCA 15) and this 2021 study for the 2025-2026 CCP (FCA 16). The estimated annual hours of operating reserve deficiencies for the 2025-2026 CCP are slightly higher. This is attributed to the higher tie benefits assumed for FCA 16. The total amount of tie benefits assumed for FCA 16 is 95 MW higher than FCA 15 values. As the system increases its reliance on load or capacity relief from implementing operating procedures as resources (a ratio of net ICR) to meet the system LOLE, the frequency of entering reserve shortage condition at the same system operating reserve requirement will also

increase. In addition, the net ICR for FCA 16 is 1,625 MW lower than the value for FCA 15 mainly due to the lower load forecast associated with the new Passive Demand Resource reconstitution methodology applied in forecasting the load. Given similar resource outage assumptions, a lower amount of installed capacity (i.e. fewer capacity resources in the system) while maintaining the same operating reserve requirement, results in higher frequency of reserve shortage conditions.

**Figure 2: Comparison of the 2024-2025 (FCA 15) and 2025-2026 (FCA 16) Study Results of Estimated Hours of Reserve Deficiency**

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## Appendix – Past Studies

- The 2013 studies for the 2016-2017 CCP are available at:

  https://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/mrkts_comm/mrkts/mtrls/2013/jul10112013/a12a_iso_memo_07_05_13.pdf

  https://www.iso-ne.com/committees/comm_wkgrps/mrkts_comm/mrkts/mtrls/2013/jun452013/a07b_iso_memo_05_29_13.pdf

- The 2016 study for the 2020-2021 CCP is available at:

  https://www.iso-ne.com/static-assets/documents/2016/12/iso_memo_operating_reserve_deficiency_dec_19_2016.pdf

- The 2017 study for the 2021-2022 CCP is available at:

  https://www.iso-ne.com/static-assets/documents/2017/12/pspc_oprting_resrve_deficiency_memo_12072017.pdf

- The 2018 study for the 2022-2023 CCP is available at:

  https://www.iso-ne.com/static-assets/documents/2018/12/pspc_oprting_resrve_deficiency_memo_12072018.pdf

- The 2019 study for the 2023-2024 CCP is available at:

  https://www.iso-ne.com/static-assets/documents/2020/02/2020_05_28_pspc_iso_memo_fca_14_operating_reserve_deficiency_info.pdf

- The 2020 study for the 2024-2025 CCP is available at:

  https://www.iso-ne.com/static-assets/documents/2020/12/a00_pspc_2020_12_iso_memo_or_def_fca_15.pdf

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