NPCC 2021 New England Interim Review of Resource Adequacy

APPROVED BY THE RCC **(NOVEMBER 30, 2021)**

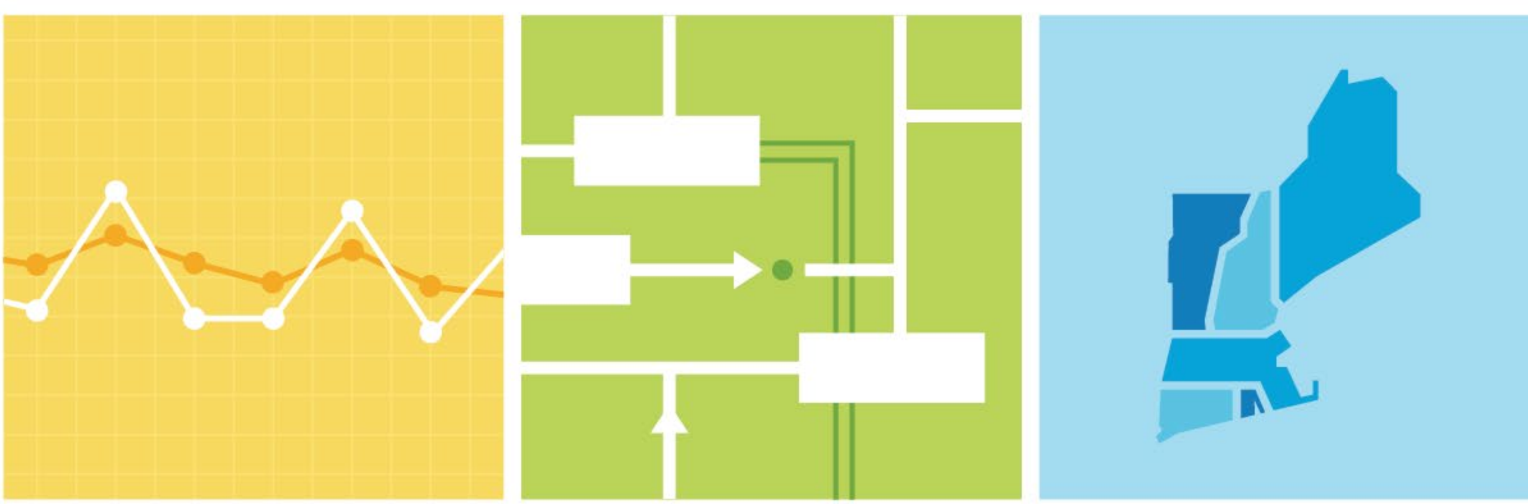

Table of Contents

List of Tables

Section 1 - Executive Summary

This report is ISO New England's (ISO-NE) annual resource adequacy reliability assessment entitled *NPCC 2021 New England Interim Review of Resource Adequacy* (aka, *Interim Review*) covering the study period of 2022 through 2025. Results of this *Interim Review* show that New England meets the Northeast Power Coordinating Council's (NPCC) Full Member Resource Adequacy Criteria (Requirements 4 & 4.1) of disconnecting firm load customers no more than once in ten years (loss of load expectation (LOLE) of 0.1 days/year) during each year of the study period. ISO-NE conducts this *Interim Review* to comply with the Reliability Assessment Program (RAP) as established by the NPCC. This *Interim Review* follows the guidelines outlined in *Appendix D-Guideline for Area Review of Resource Adequacy of the NPCC Regional Reliability Directory #1, Design and Operation of the Bulk Power System*.

To ensure resource adequacy of New England's bulk power system (BPS), ISO-NE identifies the amount of Installed Capacity Requirement (ICR)[1] needed to meet the LOLE of disconnecting firm customer load due to resource deficiencies, on average, no more than 0.1 days per year. In addition, ISO-NE identifies the locations of where the BPS needs resources and meets these needs through capacity procurement via the Forward Capacity Market (FCM). ISO-NE conducts Forward Capacity Auctions (FCA) and has purchased capacity resources to meet the regional resource adequacy needs for the Capacity Commitment Periods (CCP)[2] 2022-2023 to 2024-2025. ISO-NE's upcoming February 2022 FCA will procure capacity resources needed to satisfy BPS resource adequacy requirements during 2025-2026. The procurement of resources by ISO-NE through the FCM/FCA process is done (contractually) through a capacity supply obligation (CSO), and those resources must be available (during the respective CCP) to offer both energy and reserves into the New England day-ahead and real-time energy markets. Resources that do not have a CSO can still participate in these energy markets on a voluntary basis.

ISO-NE calculates the ICR values using demand and resource data from ISO-NE's annual report entitled *2021-2030 Forecast Report of Capacity, Energy, Loads and Transmission* (*2021 CELT Report*) dated May 1, 2021. ISO-NE's development of the ICR values involves an extensive stakeholder process participated by various New England Power Pool (NEPOOL) committees and interested parties. The ICR development process includes the simulations' input assumptions, review of the results and findings, and voting on the ICR values by the NEPOOL Reliability Committee (RC) and Participants Committee (PC). ISO-NE will file the ICR values presented in this *Interim Review* with the Federal Regulatory Commission (FERC) by November 30, 2021.

[1] The Installed Capacity Requirement (ICR) is a projection of the amount of installed capacity needed to meet New England's and the Northeast Power Coordinating Council's resource adequacy planning standards for satisfying the region's peak demand forecast while maintaining required operating reserves.

[2] A capacity commitment period entitled "20xx-20yy," refers to the time period from June 1, 20xx through May 31, 20yy.

Table 1-1 summarizes the required installed capacity covering the study period, the amount of capacity purchased in the FCM/FCA to meet the ICR, and the expected available capacity.

Table 1-1 - New England's Capacity Conditions During 2022 through 2025

Year (CCP)	**50/50 Peak Demand (Net of BTM PV[3])**	**Required Installed Capacity (I)**		**Capacity Procured in FCM (CSO) (II)**			**Expected Available Capacity (III)**		
		Amount (MW)	**Resulting LOLE (days/yr)**	**Amount (MW)**	**Surplus MW (II-I)**	**Resulting LOLE (days/yr)**	**Amount (MW)**	**Surplus MW (III-I)**	**Resulting LOLE (days/yr)**
2022 (2022-2023)	27,645	31,590	0.1	34,135	2,545	< 0.1	35,170	3,580	< 0.1
2023 (2023-2024)	27,747	31,480	0.1	33,930	2,450	< 0.1	34,988	3,508	< 0.1
2024 (2024-2025)	27,885	31,775	0.1	34,619	2,844	< 0.1	35,066	3,291	< 0.1
2025 (2025-2026)	28,025	31,645	0.1	***TBD***	***TBD***	***TBD***	33,893	2,248	< 0.1

Results of this *Interim Review* show that ISO-NE has purchased more than the required amounts of capacity resources through its FCM/FCA process to meet the NPCC Full Member Resource Adequacy Criteria for 2022 through 2024 (CCPs 2022-2023 through 2024-2025). ISO-NE anticipates purchasing adequate amounts of capacity to meet its resource adequacy criterion for 2025 (CCP 2025-2026) in the February 2022 FCA. According to the *2021 CELT Report*, at least 33,000 MW[4] of the regional installed capacity resources could participate in the FCA for the CCP 2025-2026.

Please note that on November 4, 2021, ISO-NE submitted , to FERC, a resource termination filing for the Killingly Energy Center ("Killingly") - Resource No. 38663/ Project 12280 (rated at approximately 630 MW). Although the capacity of this resource was reflected in this Interim Review, the removal of this resource from the New England bulk power system will not modify the result that New England meets the NPCC Full Member Resource Adequacy Criteria of 0.1 days/year LOLE during each year of the study period. This conclusion is based on the observation that New England has purchased more capacity than is needed to meet the 0.1 days/year LOLE, and removing 630 MW from the surplus would still result in over 1,800 MW of surplus above the requirement through 2024, and over 1,600 MW of expected surplus available capacity for 2025.

[3] BTM PV = behind-the-meter photovoltaic

[4] Please see Section 1.3 of the 2021 CELT at: https://www.iso-ne.com/static-assets/documents/2021/04/2021_celt_report.xlsx

Section 2 - Introduction

This is the first update of *New England's 2020 Comprehensive Review of Resource Adequacy*, which the NPCC Reliability Coordinating Committee (RCC) approved in December 2020. ISO-NE used the *2021 CELT Report*'s peak demand forecast and regional resource capacity values to calculate the ICR values used for this *Interim Review*. In mid-2021, ISO-NE updated all the other LOLE simulation assumptions covering resource performance, transmission interface transfer capability, load and capacity relief assumed obtainable through emergency operating procedures (EOPs), etc. ISO-NE continues to use the General Electric Multi-Area Reliability Simulation (MARS) model to simulate New England BPS resource adequacy requirements.

Section 3 - Assumptions Changes

3.1 Resources

Table 3-1 compares resource assumptions between the two reviews *(2021 Interim vs 2020 Comprehensive)*. As shown in Table 3-1, except for 2024, the total amount of capacity assumed for this *Interim Review* are lower than the amount assumed for the four common years of the *Comprehensive* Reviews. The total amount of capacity for 2022 and 2023 is approximately 740 MW and 850 MW lower, respectively, mainly due to lower passive demand resources. For 2024, the amount of capacity assumed in this *Interim Review* is approximately 1,300 MW higher than the amount assumed in the *Comprehensive Review*. The increase in capacity is due to generating resource uprates, additions and an increase in capacity imports procured in the FCA for 2024. By the end of the study period, the *Interim Review* shows the amount of capacity assumed are approximately 130 MW lower than the amount assumed in the *Comprehensive Review*.

Table 3-1 – A Comparison of New England's Resource Assumptions

YEAR (CCP)	Comparisons Based on Resources' Summer Claimed Capabilities (MW)			
	2020 Comprehensive Review	***2021 Interim Review***	**Difference (2021 – 2020)**	**Major Reasons for Changes**
2022 (2022-2023)	35,912	35,170	-742	• ~ 300 MW increase due to rating updates • ~ 100 MW increase in imports • ~ 1,100 MW decrease in passive demand resources due to new reconstitution methodology
2023 (2023-2024)	35,838	34,988	-850	• ~ 300 MW increase due to rating updates • ~ 100 MW increase due to generation resource additions • ~ 1,300 MW decrease in passive demand resources due to new reconstitution methodology
2024 (2024-2025)	33,741	35,066	1,325	• ~ 300 MW increase due to rating updates • ~ 1,000 MW increase due to generating resource additions • ~ 1,400 MW increase in capacity imports (procured through FCA) • ~ 1,400 MW decrease in passive demand resources due to new reconstitution methodology
2025 (2025-2026)	34,020	33,893	-127	• ~ 300 MW increase due to rating updates • ~ 1,000 MW increase due to generating resource additions • ~ 100 MW increase in active demand resources • ~ 1,400 MW decrease in passive demand resources due to new reconstitution methodology • ~ 100 MW decrease in capacity imports assumed

Please note that the Mystic Units 8 & 9 are scheduled to retired on June 1, 2024 within the modeling of both the *Interim* and *Comprehensive Reviews*. Therefore, their retirement impacts are not reflected in the above table.

3.2 Demand

This *Interim Review* uses the *2021 CELT Report's* demand forecast. The forecast is updated by adding another year of data to the region's historical model of annual use of electric energy and peak loads, incorporating the most recent economic and demographic forecasts, and by making adjustments for re-settlement that includes revenue-quality meter corrections. This year, ISO-NE updated its methodology for reconstitution of passive demand resources used in the development of historical gross loads[5]. This change in reconstitution methodology more accurately captures the EE impact on the gross load forecast. Table 3-2 shows the difference in the 50/50 summer peak demand forecast assumed in the two reviews. As shown, the *Interim Review's* 50/50 peak demand forecast is lower than the *Comprehensive Review's* peak demand forecast, ranging from approximately 1,200 MW to 1,500 MW during the 2022 through the 2025 study period.

Table 3-2 – A Comparison of New England's Reference (50/50) Summer Peak Demand Forecasts

YEAR (CCP)	*2020 Comprehensive Review (MW)*			*2021 Interim Review (MW)*			Delta of Net Peak Forecasts (2020-2021)
	Gross Peak Forecast	BTM PV Peak Reduction[6]	Net Peak Forecast	Gross Peak Forecast	BTM PV Peak Reduction	Net Peak Forecast	
2022 (2022- 2023)	29,717	874	28,844	28,493	849	27,645	-1,199
2023 (2023-2024)	29,977	894	29,083	28,651	905	27,747	-1,336
2024 (2024-2025)	30,241	938	29,303	28,818	933	27,885	-1,418
2025 (2025-2026)	30,504	970	29,534	29,000	975	28,025	-1,509

Note: Values shown may not sum correctly due to rounding.

3.3 Transmission Interface Transfer Limits

With the exception of Boston Import and Southeast New England Import transfer limits, which increased by 100 MW starting in 2024, the assumptions relating to the transmission interface limits remained the same between the *Comprehensive Review* and the *Interim Review*.

Please note that ISO-NE relied on resource adequacy reliability simulations to perform the ICR calculations to demonstrate its compliance with the NPCC resource adequacy criterion. The ICR calculation methodology only models the internal transmission interfaces that are associated with possible export- or import-constrained load zones to determine local resource needs to meet the system LOLE. Even though ISO-NE did not simulate the transfer capability between the 13 sub-areas as has done in the *Comprehensive Review*, ISO-NE expects the same reliability results for the 2022 through 2025 study period, if the transmission interfaces were modeled the same way within the *Interim Review*. ISO-NE based this expectation on the observation that the system load forecast

[5] For details of the revised EE reconstitution method and its estimated impact, please see: https://www.iso-ne.com/static-assets/documents/2020/10/eef2021_eeinitiative.pdf

[6] These values are the estimated peak-load-reduction impacts from the BTM PV. ISO-NE used hourly profiles in the simulation model.

has decreased more than the decrease in system capacity while the transmission system stayed approximately unchanged.

3.4 Unit Availability

Table 3-3 compares the resource availability (by technology type), weighted average, EFORd assumptions used in the *Comprehensive Review* and this *Interim Review*. Overall, the BPS weighted average EFORd for the overall system (generating capacity) remained the same, although the ISO's annual update of the rolling 5-year average of generator-submitted Generation Availability Data System (GADS) data resulted in EFORd changes for most of the different unit types/technologies.

Table 3-3 – A Comparison of the Changes in New Englands BPS EFORd Assumptions (Weighted Averages)

Unit Type/Technology	*2020* *Comprehensive Review* EFORd (%)	*2021* *Interim Review* EFORd (%)[7]	Delta (2021-2020) EFORd (%)[8]
Fossil	15.4	16.4	1.0
Combined Cycle	4.1	4.1	0.0
Diesel	8.3	10.6	2.3
Combustion Turbine	10.2	9.7	-0.5
Nuclear	1.2	1.6	0.4
Hydro	2.1	2.3	0.2
Others	13.1	12.6	-0.5
System	**6.4**	**6.4**	**0.0**

3.5 Energy Security

ISO-NE has identified that energy security problems are a result of misaligned incentives for energy supply arrangements for individual generators in today's market construct. Generating resources that do not receive a commitment in the day-ahead market may not have sufficient energy to operate the following day because they do not expect to run the next day, unless they made costly fuel supply arrangements in advance.

Building upon the region's competitive wholesale electricity structure and in anticipation of the evolving generation fleet and power system, ISO-NE will work toward developing day-ahead ancillary service markets to procure the reserve capabilities needed to support a reliable next-day operating plan. These services will help ensure that the system is prepared for, and has the capabilities to manage, a range of uncertainties in a power system increasingly reliant on just-in-time technologies.

In 2022, ISO-NE will revisit efforts to co-optimize reserves in the day-ahead energy markets. ISO-NE anticipates it will take until mid to late 2023 to complete (e.g., design, impact assessment, stakeholder process, and regulatory process) this day-ahead energy and reserve co-optimization effort.

[7] https://www.iso-ne.com/static-assets/documents/2018/08/a3_pspc_prpsd_icr_values_08302018.pdf

[8] https://www.iso-ne.com/static-assets/documents/2018/08/a3_pspc_prpsd_icr_values_08302018.pdf

3.6 Environmental Regulations and Initiatives

Federal, regional, and state environmental standards may require generators with various technologies to add pollution control devices; modify or reduce water use and wastewater discharges; and, in some cases, limit operations. These standards are frequently complex and involve multi-year rulemakings, susceptible to delays, due to litigation, or changes in federal and state political and/or environmental priorities. The increased uncertainty regarding the overall scope and final compliance costs of environmental regulations and site-specific circumstances of the electric generating facilities can easily lead to the retirement of commercial resources. Some generator owners may determine it uneconomical invest in environmental compliance measures, and retire their resources earlier than expected.

All New England states have Renewable Portfolio Standard (RPS) targets for the amount of energy that electric load-serving entities (LSEs) must provide by renewable resources; or pay alternative compliance payments (ACPs). Individual state targets range from requiring LSEs to provide anywhere between 11% to 59% of the total electric energy they procure, and it must be from renewable resources, which has subsequently driven the influx of new proposals for regional renewable energy projects. Some of the states have also issued requests-for-proposals (RFPs) for specifying/procuring offshore wind development, and adopted clean energy production, or clean peak standards for their LSEs. The increased use of various types and amounts of renewable resources may require operational modifications or retrofits at existing fossil-fueled generators, resulting in higher environmental compliance costs. As capacity factors decline for various types of fossil-based resources, units are incurring higher operations and maintenance costs.

3.7 Integration of Variable Energy Resources, Demand Response, and Storage

New England has witnessed significant growth in the development of solar photovoltaic resources over the past few years, and anticipates continued growth of these resources. Most recently, there has been an abundance of Distributed Energy Resources (DERs) interconnecting to the electric distribution systems. Many of these DERs are solar PV or a combination of solar PV and battery (storage) facilities. On September 17, 2020, *FERC Order No. 2222* required removing barriers to entry for DER aggregations in the wholesale electric markets.[9]

In addition to future market enhancements, ISO-NE has recently adopted a number of planning and operational practices to ensure the reliable integration of new inverter-based resources (IBRs), including the use of advanced simulation models. These new models more accurately simulate IBR performance during post-contingency recovery and confirm the appropriate voltage and frequency ride-through of both VERs and DERs.

ISO-NE actively participates in developing industry standards, including *IEEE 1547—Standard for the Interconnection of Distributed Resources with Electric Power Systems,* which ensures that increased amounts of VERs and DERs can be reliably and economically interconnected to the

[9] FERC Order 2222 describes DERs as: "Any resource located on the distribution system, any subsystem thereof or behind a customer meter. These resources may include, but are not limited to, electric storage resources, distributed generation, demand response, EE, thermal storage, and electric vehicles and their supply equipment." The ISO does not currently have participation models to allow DERs to participate in the markets using heterogeneous aggregations of DER asset types. ISO-NE is also addressing a number of directives in the Order, including the size and location requirements, metering the telemetry requirements, registration requirements, and coordination among the ISOs, distribution utilities, DER Aggregators and retail regulatory entities.

distribution system. Looking to the future, ISO-NE has begun a multi-year project (2021-2023) referred to as the "*Inverter-Based Resource Integration and Modeling Assessment.*" The purpose of this project is to evaluate and adopt advanced, innovative analysis techniques that capture the unique performance and characteristics of IBRs, which is critical to transmission studies beyond the 10-year planning horizon. By the end of 2021, ISO-NE expects to deliver a report that evaluates options for and recommends deployment of *Electromagnetic Transient* power system software that will enable efficient and reliable modeling and integration of these rapidly-evolving, IBRs.

The continued development of VERs and DERs, may ultimately require a potentially significant bulk transmission (and distribution-level) buildout to interconnect these resources in a successively reliable manner. ISO-NE is currently leading or supporting a number of Transmission Planning study efforts to examine the continued evolution of the BPS.

3.8 Transmission Tie-Line Benefits

ISO-NE considered the interconnection benefits from neighboring Control Areas in both NPCC reliability reviews. Since the *Comprehensive Review*, ISO-NE has conducted additional tie benefit studies to identify the amount of tie reliability assistance New England can rely on from its neighbors for inclusion in resource adequacy studies. Table 3-4 summarizes the tie benefit assumptions for the 2020 and 2021 NPCC resource adequacy reviews.

Table 3-4 – A Comparison of New England's Tie Benefits from Neighboring Areas (MW)

YEAR (CCP)	*2020 Comprehensive Review*	*2021 Interim Review*
2022 (2022-2023)	2,000	1,820[10]
2023 (2023-2024)	1.940	1,940[11]
2024 (2024-2025)	1,735	1,735[12]
2025 (2025-2026)	1,735	1,830[13]

Other assumptions for these two reviews are consistent with each other.

[10] https://www.iso-ne.com/static-assets/documents/2019/08/2019_08_29_a04_tie_benefits_analysis.pptx

[11] https://www.iso-ne.com/static-assets/documents/2019/07/pspc_a05_tiebenefitswithandwithoutmystic89.pptx

[12] https://www.iso-ne.com/static-assets/documents/2020/08/a02_pspc_2020_08_14_.results_tie_benefits.pptx

[13] https://www.iso-ne.com/static-assets/documents/2021/07/a02_pspc_2021_07_27_fca_tie_benefits.pptx

Section 4 – Results and Findings

Tables 4-1 summarizes New England's expected system conditions for the 2022 through 2025 study period for the two resource adequacy reviews. As shown, the *Interim Review* has lower installed capacity and lower peak demand during the study period.

Table 4-1 also shows that the amount of capacity purchased in ISO-NE's FCA is more than the amount needed to meet the 0.1 days/year LOLE for 2022 (CCP 2022-2023) through 2024 (CCP 2024-2025). While ISO-NE has not yet conducted a capacity auction for 2025 (CCP 2025-2026), data show that there are 33,523 MW of commercial capacity in service that can be purchased in the February 2022 FCA to meet the capacity needs of 2025 (CCP 2025-2026).

Table 4-1 – A Comparison of New England's LOLE using Reference Demand Forecast (MW)

	2020 Comprehensive Review			***2021 Interim Review***			
YEAR (CCP)	**Assumed Capacity**	**Peak Demand (Net of BTM PV)**	**LOLE (days/year)**	**Assumed Capacity**	**Peak Demand (Net of BTM PV)**	**Capacity Needed to meet 0.1 days/year LOLE**	**Capacity Purchased to meet 0.1 days/year LOLE**
2022 (2022-2023)	35,912	28,844	0.003	35,170	27,645	31,590	34,135
2023 (2023-2024)	35,838	29,083	0.005	34,988	27,747	31,480	33,930
2024 (2024-2025)	33,741	29,303	0.100	35,066	27,885	31,775	34,619
2025 (2025-2026)	34,020	29,534	0.098	33,893	28,025	31,645	TBD

Section 5 – Conclusions

Results of this *2021 Interim Review* show that ISO-NE has already purchased adequate amounts of capacity to meet the NPCC Resource Adequacy Design Criteria for year 2022 through 2024. In addition, there are enough capacity resources in-service to meet the capacity needs in 2025, which ISO-NE plans to purchase in the February 2022 FCA.

To address energy security concerns, ISO-NE will work toward developing day-ahead ancillary service markets to procure the reserve capabilities needed to support a reliable next-day operating plan. These services will help ensure that the system is prepared for, and has the capabilities to manage, a range of uncertainties in a power system increasingly reliant on just-in-time technologies.