NPCC 2015 New England Interim Review of Resource Adequacy

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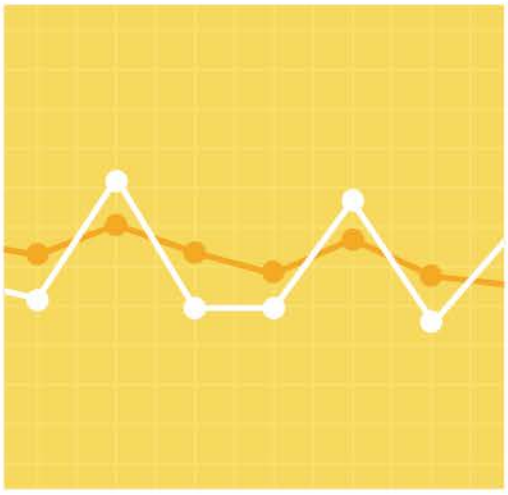
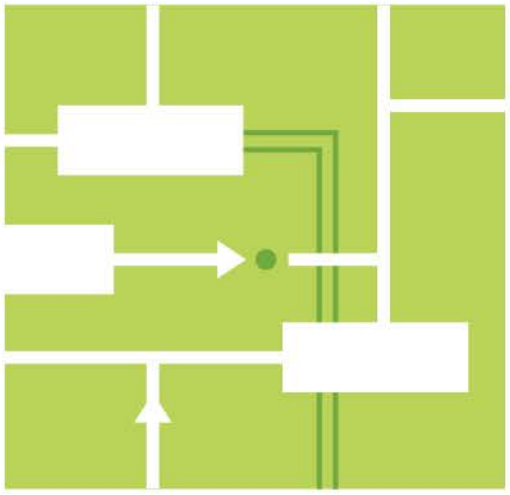


Section 1
Executive Summary

This report is ISO New England's 2015 annual assessment (Interim Review) of its 2014 Comprehensive Review of Resource Adequacy, and covers the time period of 2016 through 2019. This Interim Review is conducted to comply with the Reliability Assessment Program (RAP) as established by the Northeast Power Coordinating Council (NPCC). It follows the resource adequacy review guidelines as outlined in the *NPCC Regional Reliability Directory #1 Appendix D, Basic Criteria for Design and Operation of Bulk Power System*.

To ensure resource adequacy for the region, ISO New England identifies the amount and locations of resources the system needs and meets these needs in the short term through the Forward Capacity Market (FCM). Forward Capacity Auctions have been conducted to purchase needed resources for the years 2016/17[1] to 2018/19. The auction for 2019/20 will be conducted in February 2016. The resources procured by ISO New England through FCM assume a capacity supply obligation (CSO), and must be available to offer energy and reserve to the New England energy markets. Resources that do not have a capacity supply obligation can participate in the energy markets to serve New England load and provide reserve. For this Interim Review, resource adequacy is assessed under two sets of resource assumptions: 1) using the seasonal ratings of all the existing and planned resources; 2) using capacity supply obligations of resources purchased in the Forward Capacity Market.

Table 1-1 and Table 1-2 summarize the Loss of Load Expectation (LOLE) for the study years for the two demand forecast scenarios simulated under two sets of capacity resource conditions.

Table 1-1
LOLE under Reference Demand Forecast

Year	2014 Comprehensive Review (Days/Year)	2015 Interim Review (Days/Year)	
	Based on Existing and Planned Resource Seasonal Ratings	Based on Existing and Planned Resource Seasonal Ratings	Based on Capacity Supply Obligations
2016	0.016	0.029	0.095
2017	0.060	0.082	0.108
2018	0.068	0.045	0.072
2019	0.074	0.037	Auction to be conducted in February 2016

[1] A capacity commitment period of 20xx/yy refers to a period from June 1, 20xx through May 31, 20yy.

Table 1-2
LOLE under High Demand Forecast

Year	2014 Comprehensive Review (Days/Year)	2015 Interim Review (Days/Year)	
	Based on Existing and Planned Resource Seasonal Ratings	Based on Existing and Planned Resource Seasonal Ratings	Based on Capacity Supply Obligations
2016	0.036	0.048	0.146
2017	0.109	0.134	0.177
2018	0.130	0.080	0.126
2019	0.150	0.070	Auction to be conducted in February 2016

Results of this Interim Review show that New England has adequate existing and planned resources to meet the NPCC Resource Adequacy Design Criteria under the reference forecast for the study period 2016 through 2019. Forward Capacity Market auctions have procured an adequate amount of resources for the years of 2016 and 2018. A small amount of needed resources (~150 MW) was deferred to the subsequent reconfiguration auctions for the year 2017 due to the administrative pricing mechanism[2] of the FCM. Adequate existing and planned resources are available to meet such resource need, and ISO New England expects to procure the resources needed to meet the Installed Capacity Requirement for 2017 in future annual reconfiguration auctions.

About 350 MW of additional new resources will be required for year 2017 to meet the high load growth scenario. Every year, ISO New England updates its Installed Capacity Requirements (ICRs) for the FCM to reflect the latest load forecast, resource availability and other system condition changes, and procures additional resources, if needed, through the forward capacity market in the reconfiguration auctions prior to these years. Should the high demand forecast materialize, or other conditions occur that would cause an increase in resource needs, ISO New England expects to procure the additional capacity to fulfill the needs in the Forward Capacity Market auctions.

[2] When the capacity clearing price is set administratively due to inadequate supply and insufficient competition, and as a result a permanent de-list bid, static de-list bid, or export bid clears that would not otherwise have cleared, then the de-listed or exported capacity will not be replaced in the current Forward Capacity Auction, and shall be included in subsequent annual reconfiguration auctions.

Section 2
Introduction

This is the first update of New England's 2014 Comprehensive Review of Resource Adequacy, which was approved by NPCC in November 2014. Since the approval of the 2014 Comprehensive Review, ISO New England has conducted additional comprehensive resource adequacy assessments as part of its Regional System Plan (RSP) process. The major assumptions of this Interim Review are consistent with those used for the most recent RSP, RSP15[3]. ISO New England continues to use the General Electric Multi-Area Reliability Simulation (MARS) model to simulate New England system resource adequacy.

[3] http://www.iso-ne.com/system-planning/system-plans-studies/rsp

Section 3
Assumptions Changes

3.1 Resources

Table 3-1 compares resource assumptions between the two reviews. The amount of existing and planned resources assumed for this Interim Review have decreased by about 700 MW and 360 MW for the years of 2016 and 2017, respectively, while increasing by about 600 MW for the years 2018 and 2019. The reason for these changes are 1) the in-service date of a new approximately 700 MW unit has been delayed from the original 2016 to 2017; 2) a new unit of about 300 MW that was assumed to be in-service in 2017 in the 2014 review is excluded in this review; and 3) about 1,000 MW of new resources have been procured in the Forward Capacity Market for 2018 since the 2014 review. The seasonal capability ratings of these resources are based on the ISO New England *2015–2024 Forecast Report of Capacity, Energy, Loads, and Transmission* (2015 CELT Report)[4]. The capacity supply obligation values are as of September 2015[5].

ISO New England received a Non-Price Retirement Request from the 677 MW Pilgrim generating unit in mid October 2015 to be retired starting on June 1, 2019. The ISO is reviewing the request to determine if the resource is needed for reliability. If the Non-Price Retirement Request is rejected for reliability reasons, the resource may elect to remain in operation to meet the reliability need, and will receive the cost-of-service compensation. Given that the outcome of this determination is not expected to be available prior to the publication of this interim review, the Pilgrim unit is assumed operational during the 2019 year in this assessment. A sensitivity simulation was conducted assuming the Pilgrim unit is no longer available in 2019, the results show no LOLE violation for 2019 under reference demand forecast.

Table 3-1
Resource[6] Assumptions Comparison (Summer Ratings)

Year	2014 Comprehensive Review (MW) Existing and Planned Resources Summer Ratings	2015 Interim Review (MW)		
		Existing and Planned Resource Summer Ratings	Existing and Planned Resource Difference	Capacity Supply Obligations
2016	35,834	35,138	-696	33,408
2017	34,611	34,248	-363	33,817
2018	34,851	35,449	598	34,694
2019	35,075	35,714	639	N/A

3.2 Load

This Interim Review uses the RSP15 load forecast, which updates the data for the region's historical annual use of electric energy and peak loads by adding another year of historical data to the sample, incorporating the most recent economic and demographic forecasts, and making adjustments for resettlement that include meter corrections. This year's forecast also reflects the impacts of the

[4] http://www.iso-ne.com/static-assets/documents/2015/05/2015_celt_report.pdf

[5] http://www.iso-ne.com/static-assets/documents/2015/09/september-2015-coo-report.pdf

[6] Resources include generating units, demand-side resources and capacity imports.

behind-the-meter photovoltaics (PV)[7] load reductions not already considered as part of the gross forecast. Table 3-2 compares the reference summer peak demand forecasts between these two reviews. This year's forecast is lower than last year's by about 500 MW on average for every year of the study period, which is mainly driven by the incorporation of the behind-the-meter embedded PV and a slightly slower growth in gross demand. Table 3-3 compares the high demand forecasts, which shows a similar trend.

Table 3-2
Reference Demand Forecast Comparison

Year	2014 Comprehensive Review (MW)	2015 Interim Review (MW)	Difference (MW)
2016	29,130	28,673	-457
2017	29,610	29,066	-544
2018	30,005	29,483	-522
2019	30,335	29,861	-474

Table 3-3
High Demand Forecast Comparison

Year	2014 Comprehensive Review (MW)	2015 Interim Review (MW)	Difference (MW)
2016	29,830	29,168	-662
2017	30,420	29,676	-744
2018	30,915	30,193	-722
2019	31,330	30,656	-674

3.3 Interface Limits

The same sub-area configuration (bubble transportation model) is used in these two reviews. The transmission interfaces and their limits used in this Interim Review are based on the RSP15 transfer capability analysis of the New England system, which incorporated the results of several recent studies. Changes from the 2014 Comprehensive Review include: 1) the advancement of the expected in-service date of the interstate portions of the New England East-West solution transmission upgrade; 2) the inclusion of the Greater Boston Project, which is certified to be in-service in 2019; 3) an updated transfer capability for the North-South interface reflecting the expected resource retirements; 4) a new defined Southeast New England interface to reflect expected system limitations in the NEMA/Boston and SEMA/RI areas in 2019. Table 3-4 shows the transmission transfer limits used for both reviews.

[7] The amount of behind-the-meter PV assumed in the study is 237 MW for 2016, 309 MW for 2017, 342 MW for 2018, and 369 MW for 2019. These values reflect a 40% discount factor from their name plate ratings, and are assumed available only from Hour 14:00 to 18:00 during the months from May to September.

Table 3-4
Major Transmission Interfaces and Limits Assumed in the 2014 & 2015 Reviews (MW)

Interface	Limit assumed in 2014 Comprehensive Review (MW)	Limit assumed in 2015 Interim Review (MW)
New England Internal Interfaces		
Orrington South	1,325	1,325
Surowiec South	1,500	1,500
Maine – NH	1,900	1,900
North to South	2,700	2,100 2,675[8] (year 2019)
Boston Import	4,850	4,850 5,700[9] (year 2019)
SEMA / RI Export	3,000 3,400 (year 2018)	3,000 3,400[10] (year 2016)
SEMA / RI Import	786 (year 2018)	1,280[11] (year 2018)
East to West	2,800 3,500 (year 2018)	2,800 3,500[9] (year 2016)
West to East	1,000 2,200 (year 2018)	1,000 2,200[9] (year 2016)
Connecticut Import	2,800 (year 2016) 2,950 (year 2018)	2,950[9] (year 2016)
Southwestern CT Import	3,200	3,200
Norwalk / Stamford Import	1,650	No Limit
Southeast New England	Interface Not Defined	5,700[8] (year 2019)
New England External Interfaces		
New Brunswick to New England[12]	700	700
New York/New England (Summer/Winter)[13]	1,400/1,875	1,400
HQII Import[14]	1,400	1,400
Highgate Import[15]	200	200
Cross Sound Cable[16]	0	0

[8] The North–South transfer capabilities reflect the retirements of Brayton Point and Vermont Yankee.

[9] These values reflect the Greater Boston upgrades project that is certified to be in service by June 2019.

[10] The ISO has accepted the certification of the New England East–West Solution (NEEWS) Interstate Reliability Program (IRP) to be in service by December 2015

[11] In response to the Brayton Point retirement, the following Rhode Island area facilities are now planned to be upgraded (and are certified to be in service by the start of the tenth capacity commitment period (i.e., by June 1, 2017): The V148N 115 kV line between Woonsocket and Washington, the West Farnum 345/115 kV autotransformer upgrade (already in service), and the Kent County 345/115 kV autotransformer.

[12] 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 ISO New England Area, the NB–NE transfer capability is 700 MW because of downstream constraints, in particular, Orrington South.

[13] The New York interface limits are without the CSC and with the Northport–Norwalk Cable at 0 MW flow. Simultaneously importing into New England and SWCT or CT can lower the NY–NE capability (very rough decrease = 200 MW). Conversely, simultaneously exporting to NY and importing to SWCT or CT can lower the NE–NY capability (very rough decrease = 700 MW).

[14] The HQICC interconnection is a DC tie with equipment ratings of 2,000 MW. The PJM and NYISO systems may be constrained by the loss of this line. As a result, ISO New England has assumed that its transfer capability is 1,400 MW for capacity and reliability calculations. This assumption is based on the results of loss-of-source analyses conducted by PJM and NYISO.

[15] The capability for the Highgate facility is listed at the New England AC side of the Highgate terminal.

[16] The import capability on the CSC is dependent on the level of local generation.

3.4 Unit Availability

Table 3-5 compares the weighted average EFORd assumptions used in the 2014 Comprehensive Review and this Interim Review. Overall, the system weighted average EFORd for generating capacity assumed in this review has increased about 0.5% as compared to the 2014 review assumptions. The change is the result of the update of the rolling 5-year average of generator submitted Generation Availability Data System (GADS) data.

Table 3-5
Change In EFORd Assumptions – Weighted Averages

Unit Type	2014 Comprehensive Review EFORd (%)	2015 Interim Review EFORd (%)
Fossil	14.9	14.8
Combined Cycle	3.6	4.0
Diesel	6.5	7.6
Combustion Turbine	9.5	9.6
Nuclear	3.1	2.5
Hydro	4.6	4.9
Others	14.2	16.1
System	6.7	**7.2**

3.5 Fuel Flexibility and Certainty

The regional dependence on natural-gas-fired generation, coupled with natural gas pipeline constraints, pose reliability issues. Environmental and economic considerations continue to influence the retirement of oil and coal generating resources and the addition of natural-gas-fired generation, further exposing the region to dependence on a single type of fuel.

Capital improvements to the natural gas delivery system are under development to access Marcellus shale gas production. Additional pipeline projects, however, would improve electric power system reliability and reduce prices for the wholesale electricity markets. The New England states are considering additional means of funding new pipeline capacity into the region and are examining possible electric transmission infrastructure upgrades for improving the access to Canadian hydropower as an alternate source of generation. The winter peak load is flat as the result of energy-efficiency programs; these programs, coupled with the more efficient use of natural gas, would allow generators the greater use of available pipeline capacity.

A fuel-reliability program and improved coordination of electric power and natural gas system operations resulted in more reliable resource performance during winter 2014/15. Increased flexibility of scheduling natural gas also allows generators to more reliably respond to system conditions. Recently implemented improvements to the day-ahead and real-time markets have helped achieve shorter-term system reliability, and they supplement improvements to the FCM that are part of the longer-term reliability solution.

Regarding the fuel-reliability program, during the 2013/14 and 2014/15 winters, the ISO has implemented special programs outside its markets to mitigate winter reliability risks associated with the retirements of key non-gas-fired generators, gas pipeline constraints, and generators' difficulties in replenishing on-site oil supplies. As part of the 2014/2015 program, oil-fired and

dual-fuel generators, generators contracting for LNG, and demand resources selected to participate were paid to secure fuel inventory and fuel-switching capability. They were compensated for any unused end-of-season fuel inventory and were subject to nonperformance charges. As a result, the high availability of fuel oil and LNG supported winter 2014/2015 operations despite of the cold weather.

The 2014/2015 program included two permanent improvements, as well. To help dual-fuel resources more effectively manage fuel supply on days when the price of oil and natural gas approach convergence, the market monitoring rules eliminated the administrative requirement to prove that the higher-priced fuel was burned. The ISO also gained the ability to test resources' fuel-switching capability and to compensate them for running these tests.

The FERC recently approved a similar program to the 2014/15 winter reliability program to be implemented as a bridge between now and 2018 when FCM design changes that include resource performance incentives go into effect. Due to the existence of these winter reliability programs, no additional outages are assumed from the gas-fired units in this review.

3.6 Environmental Regulations and Initiatives

Compliance obligations for generators from existing and pending state, regional, and federal environmental requirements are not expected to pose reliability concerns during the study period, but are likely to impose operational limits on new and existing generators. These requirements pose less risk on unit retirements and system reliability compared with earlier assessments. Federal air, water, endangered species, and carbon standards could affect the economic performance of nuclear, renewable, and fossil-fired generators by imposing operational constraints and additional capital costs for pollution control retrofits. Other state and regional air, water, and carbon standards could require certain generators to further reduce emissions and other adverse environmental impacts through the extended operation of pollution control devices or curtailment in operation.

Clean Water Act final rules on cooling water 316(b) and waste water discharges from power plants may have impacts on the relicensing of some existing units during the study periods. The ISO is monitoring such proceedings to assess the impacts of operational restrictions, including the maintenance of minimum flows, on the ability of hydroelectric generators to offer regulation and reserve services.

The 2015 ozone standard, existing other National Ambient Air Quality Standards, Mercury and Air Toxics Standards, and the future Transported Air Pollution Rule may also affect some of the fossil-fueled power generators in New England. Most coal- and oil-fired fossil steam generators greater than 25 MW in capacity in New England are already complying with the standard's emissions limits for acid gases, toxic metals, and mercury based on maximum achievable control technologies (MACTs) or are exempted due to individual unit capacity factors.

3.7 Integration of Variable Energy Resources

The region has significant potential for developing renewable resources and energy efficiency, encouraged by Renewable Portfolio Standards, the Regional Greenhouse Gas Initiative, and other environmental regulations and public policy objectives. While variable energy resources can provide additional fuel diversity, integrating wind or solar resources could place additional stresses

on the transmission system. Generators could be stressed as well if system operators call on them to change output on short notice to provide system balancing and reserves.

Wind resources have requested interconnection in remote portions of the system, which can require significant transmission upgrades. In response, the ISO improved the process for reviewing elective transmission upgrades in the interconnection queue. To further facilitate wind integration, the ISO has incorporated wind forecasting into ISO processes, scheduling, and dispatch services.

The ISO continues engaging stakeholders on the issues challenging the wind-interconnection process and the performance of the system with wind resources in locally constrained areas. The wind-integration component of the Strategic Transmission Analysis developed conceptual additions to the transmission system that would enable onshore wind resources to reliably serve load.

Photovoltaic resources are rapidly developing in New England and are predominately situated in southern New England. The large-scale development of photovoltaic and other distributed resources poses some potential issues that the ISO is beginning to address with stakeholders. The ISO cannot directly observe or control most of these resources, which may respond differently to grid disturbances compared with larger, conventional generators.

Additional work remains on incorporating the effects of PV in improved short-term load forecasting tools for use by system operators and fully addressing the potential reliability risks, which are not expected to be significant during the study period of this review.

3.8 Others

The interconnection benefits from neighboring Areas are considered in both assessments. Since the 2014 Comprehensive Review, ISO New England has conducted additional tie benefit studies to identify the amount of tie reliability assistance New England can rely on from its neighbors for resource adequacy studies. Table 3-6 summarizes the tie benefit assumptions for these two reviews.

Table 3-6
Assumed Tie Benefits from Neighboring Areas (MW)

Year	2014 Comprehensive Review	2015 Interim Review
2016	1,870	1,847[17]
2017	1,870	1,870[18]
2018	1,970	1,970[19]
2019	1,970	1,990[20]

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

[17] http://www.iso-ne.com/static-assets/documents/2015/08/pspc_082715_a2.1_tie_benefits_assumptions_2016_17ara3_2017_18ara2_2018_19ara1.pdf

[18] See presentation to Reliability Committee on 9/16/2013 http://www.iso-ne.com/committees/reliability/reliability-committee

[19] http://www.iso-ne.com/static-assets/documents/2014/09/a6_fca9_tie_benefits_study.pdf

[20] http://www.iso-ne.com/static-assets/documents/2015/09/a9_tie_benefits_results.pdf

Section 4
Results

Tables 4-1 and 4-2 summarize the New England system LOLE results for the scenarios investigated within this Interim Review and those from the 2014 Comprehensive Review. The increase in the LOLEs of 2016 and 2017 is attributed to the expected delay of the in-service date of two future resources. About 1,000 MW of new resources that have procured in the Forward Capacity Market for 2018 helps lower the LOLEs for 2018 and 2019.

The LOLE results indicate that New England has adequate existing and planned resources to meet the NPCC Resource Adequacy Design Criteria under the reference forecast for the study period 2016 through 2019. About 350 MW of additional new resources will be required for year 2017 to meet the high load growth scenario. Every year, ISO New England updates its Installed Capacity Requirements (ICRs) for the FCM to reflect the latest load forecast, resource availability and other system condition changes, and procures additional resources, if needed, through the market in the reconfiguration auctions prior to these years. Should the high demand forecast materialize, or other conditions occur that would cause an increase in resource needs, ISO New England expects to procure the additional capacity to fulfill the needs in the Forward Capacity Market auctions.

Table 4-1
LOLE under Reference Demand Forecast

Year	2014 Comprehensive Review (Days/Year)	2015 Interim Review (Days/Year)	
	Based on Existing and Planned Resource Seasonal Ratings	Based on Existing and Planned Resource Seasonal Ratings	Based on Capacity Supply Obligations
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Table 4-2
LOLE under High Demand Forecast

Year	2014 Comprehensive Review (Days/Year)	2015 Interim Review (Days/Year)	
	Based on Existing and Planned Resource Seasonal Ratings	Based on Existing and Planned Resource Seasonal Ratings	Based on Capacity Supply Obligations
2016	0.036	0.048	0.146
2017	0.109	0.134	0.177
2018	0.130	0.080	0.126
2019	0.150	0.070	Auction to be conducted in February 2016

Section 5
Conclusions

Results of this Interim Review show that New England has adequate existing and planned resources to meet the NPCC Resource Adequacy Design Criteria under the reference demand forecast for the study period 2016 through 2019. The ISO New England is expected to procure an adequate amount of resources to meet system reliability through the Forward Capacity Market.

ISO New England does not expect that upcoming environmental regulations will impact resource adequacy during the period covered by this Interim Review.

The regional dependence on natural-gas-fired generation, coupled with natural gas pipeline constraints, pose reliability issues. ISO New England expects the potential for various amounts of single fuel, gas-only power plants to be temporarily unavailable during extreme winter weather conditions or during force majeure conditions. This reliability risk is expected to be mitigated through the Pay-for-Performance mechanism of the FCM design, which is go into be effect in 2018. Winter reliability programs, similar to the two successful programs ISO New England has implemented for the 2013/14 and 2014/15 winters, have recently been approved by FERC to be implemented as a bridge between now and 2018. Improved coordination of electric power and natural gas system operations, increased flexibility of scheduling natural gas allowing generators to more reliably respond to system conditions, and recently implemented improvements to the day-ahead and real-time markets, will also help achieve shorter-term system reliability.