**NOTE: REVISIONS TO THE VERSION POSTED FOR THE APRIL 11, 2019 METTOMG ARE HIGHLIGHTED IN YELLOW**

# Appendix I – Fuel-Security Reliability Review for Forward Capacity Market (FCM)

1. **Purpose**

This appendix will establish the process and criteria for evaluating the reliability impacts of FCM (a) Retirement De-List Bids, (b) substitution auction demand bids, (c) bilateral transactions, and (d) all reconfiguration auction demand bids on system fuel security as required by Section III.13.2.5.2.5A of the Tariff. The process for this fuel-security reliability review is set out in this Appendix I to PP10.

**1.1 Term and Sunset of this Appendix I**

This appendix shall remain in use for the period described in Section III.13.2.5.2.5A.a of the Tariff.

1. **Timeline and Applicability**

The timeline for and applicability for fuel security reliability reviews is set out at Section III.13.2.5.2.5A.b of the Tariff.

**2.1 Input Review with Stakeholders**

Each year in February or March, prior to the commencement of the fuel-security reliability review for a FCA, the ISO will consult with the Reliability Committee regarding the inputs described in Section 3 below.

**2.2 ISO Notification of Fuel-Security Reliability Review Results to the Participant**

The results of the fuel-security reliability review will be quantified in an ISO issued determination notification that is issued pursuant to Section III.13.2.5.2.5A.f of the Tariff.

**2.3 ISO Notification and Review of Determination with Stakeholders**

The ISO determinations described in Section III.13.2.5.2.5A.f will be reviewed with stakeholders, at the Reliability Committee, in the same general timeframe that resources retained for transmission security are reviewed, as outlined in PP-10, Section 7.6.

**2.3.1 Informational Analysis Presentation**

An informational fuel-security reliability review with a 50/50 peak load forecast from the most recent CELT will also be performed in all scenarios analyzed for units retained utilizing the 90/10 peak load forecast, and included in with the materials described in this Section 2.3. This analysis is not used for unit retention determinations.

For the FCA 14 fuel-security reliability review cycle, an additional informational analysis will be performed to simulate the impact of approximately 500 MW of offshore wind that is being developed under a state procurement program with an in-service date for the winter under study, but which has not yet received all required state approvals.

**3.0 Fuel-Security Reliability Review**

The fuel-security review consists of an hour-by-hour chronological simulation of the New England electric supply systems for a winter period from the beginning of December through the end of February. One of the key assumptions driving the results of the review is the amount of natural gas available for electric generation.

**Natural Gas Assessment**

The fuel-security reliability review models natural-gas consumption on a daily basis. The primary, independent variable is average daily temperature converted to heating degree days (HDD). Given a daily temperature, the total gas demand for Residential, Commercial and Industrial (RCI) customers is established based on updated gas demand reports and the sources for serving this gas demand are based on the following:

* Gas from Pipelines – The first source utilized for natural gas comes from the pipeline supply encompassing Algonquin, Tennessee, Iroquois, and Portland Natural Gas Transmission System (PNGTS).
* Satellite Liquefied Natural Gas (LNG) – On cold days (HDD), the model assumes that injections from gas Local Distribution Company (LDC) satellite LNG storage facilities will be activated in order to support the LDC behind-the-meter operations by increasing pressures and limiting draws from pipelines in accordance with their contractual agreements and supply plans. An LNG injection curve shall be constructed from the implied satellite LNG injections calculated for the past five winters using forecast LDC gas demand for the modelled Capacity Commitment Period and actual non-power gas demand determined using publicly available bulletin board data.
* Pipeline Connected LNG – Any remaining needs of the LDCs are supplied by large pipeline-connected LNG facilities such as Canaport, Distrigas and the Excelerate buoy.

Once the gas LDC demand (i.e., New England and New Brunswick gas demand) is served, the remaining amount of natural gas for electric generation – and its supply source – can be determined. If the gas LDC demand was ‘low,’ then pipeline gas may be available for electric generators. After the pipeline gas is fully utilized, the next source of gas for electric generation would be from unused pipeline connected LNG facilities subject to the daily “cap” on LNG vaporization as addressed in Section B below. The maximum daily amount of gas available from both classes of supply to the electric sector is then passed to the Electric Sector Dispatch Model.

**Electric Sector Dispatch Model**

The maximum daily amount of natural gas available to the electric power sector is allocated to each hour using a heuristic algorithm to shape the available gas. The algorithm provides more gas during the higher load hours and less gas to lower load hours with the goal of ensuring that all of the available gas would be consumed each day before turning to other liquid fuel resources. Separate accounting is done for gas supply available from pipelines and gas supply available from pipeline connected LNG facilities.

The amount of gas available from both sources in each hour is converted to available electric MWh in each hour assuming an average conversion efficiency of 7,400 Btu/kWh. This amount of MWhs from available gas is used by the dispatch algorithm where pipeline gas is used first and then resources using gas from vaporized LNG facilities are dispatched subsequently.

***Electric Sector Load***

The New England electric loads used in the model are based on the loads and temperatures experienced during the winter of 2014/15. All winter hourly loads are then scaled using the ratio of the forecast 90/10 peak demand (net of Energy Efficiency) for the applicable future Capacity Commitment Period year to the observed peak in the historical benchmark year (2014/15).

***Reserves***

Thirty-Minute Operating Reserves and Ten-Minute Operating Reserves are being served by the distillate oil-only resources with the highest heat rates, which are the best suited to providing reserves.

***Resource Availability***

The fuel-security model does not assume any scheduled outages. Random unavailability due to forced outages and derates is treated by “derating” the capacity of a resource by an Equivalent Forced Outage Rate on Demand (EFORd) utilizing the ISO’s Generating Availability Data System (GADS) data as described below.

***Dispatch Order***

Energy to serve the load comes from dispatching the resources in an economic order reflecting winter conditions. Wind and Photovoltaics (PV) are dispatched first using profiles adjusted to reflect expected amounts of those resources as described in the Static Inputs below. Other renewables such as wood, biomass and municipal solid waste are then assumed to be dispatched next, followed by nuclear resources and then coal generators; the Seasonal Claimed Capability of these resource technologies is derived from the most recent CELT report as described in the Static Inputs below. Pumped storage and other electric storage resources are dispatched next using daily storage profiles used to reflect the characteristic operation of each resource type by storing energy during low load periods and generating energy during the higher load periods as described below in the Static Inputs.

Next, conventional hydro-electric generation is dispatched at an hourly profiled MW amount as described in the Static Inputs below. This is followed by the dispatch of imports as a constant MW resource in accordance with assumptions set forth in Section A below.

Next, the aggregate natural gas only resources are dispatched on pipeline gas in each hour, subject to the hourly availability of pipeline gas MWhs. If there is remaining pipeline gas, it is used by the gas-fired, dual-fueled, combined-cycle resources to serve remaining energy demands until the gas MWhs are exhausted.

Next in the dispatch order are the natural-gas only resources that would be dispatched on pipeline-connected-LNG gas, subject to the hourly availability of pipeline-connected-LNG gas MWhs. If there is remaining pipeline-connected-LNG gas, it is used by the gas-fired, dual-fueled, combined-cycle resources to serve remaining energy demands until the pipeline-connected-LNG gas MWhs are exhausted.

If more load still needs to be served, the dual-fueled combined cycle resources that have not been previously dispatched on pipeline or pipeline-connected-LNG are dispatched on distillate oil, subject to fuel in a specific generator’s associated oil tank as determined in Section A below.

Next in the dispatch order are the distillate only generators not held for reserve and residual oil generators, subject to fuel in a specific generator’s oil tank determined in Section A below.

Last, the dispatch of demand response resources will be applied to the unmet energy.

Any remaining energy not served is then converted to MWhs of Operating Procedure – 4 Actions, Ten-Minute Reserve Depletion and Operating Procedure – 7 Load Shed.

The following inputs will be used when performing the fuel-security reliability reviews.

1. **STATIC INPUTS**

A fuel-security reliability review will utilize the following static inputs:

1. **Peak Load:** This is calculated using the draft CELT Net 90/10 winter peak load values (including the effects of energy efficiency) presented to the Planning Advisory Committee (PAC) during the spring of the year when the fuel security reliability review is performed, which is prior to the annual issuance of the final values in the CELT report released on May 1.
2. **Winter Energy Profile:** The hourly system demand from the 2014/2015 winter will be used to create an hourly load shape by using the ratio of the CELT peak load for the relevant Capacity Commitment Period to the 2014/2015 winter peak load. The hourly temperature from the 2014/2015 winter will be used as the modeled hourly temperature.
3. **LDC Gas Demand:** The LDC winter peak demand for the modeled Capacity Commitment Period will be set annually based on vendor supplied information with growth for the modeled period adjusted to not exceed the addition of any new gas supply capacity.  The LDC winter peak demand shall be capped at the value utilized in the prior year’s fuel security reliability review (i.e., for the prior Capacity Commitment Period). Both New England and New Brunswick LDC gas demand shall be accounted for in the modelling.
4. **Pipeline Capacity:** Set for modeled Capacity Commitment Period based on vendor-supplied information annually.
5. **Satellite LNG facility vaporization:** Set for modeled year based on vendor-supplied information annually.
6. **Oil inventory levels:** Tank inventory levels for oil-only resources and dual-fuel resources that operate primarily on oil during the winter shall be set to levels determined using the 2017/2018 winter fuel surveys submitted to the ISO in December. Tank inventories then will be assumed to be replenished with 202 barrels per hour when the reorder level is reached. The reorder level is provided using the results of the 2017/2018 winter fuel survey.
7. **Resource Seasonal Claim Capability:**  The winter Seasonal Claimed Capability (MW) from the most recently published CELT report for all Existing Generating Capacity Resources qualified for the instant FCA and energy-only generators active in ISO New England markets. For non-commercial Existing Generating Capacity Resources that are not in the CELT report and energy-only generators that are in service but are not in the CELT report, the fuel-security reliability review will use the resource’s winter Qualified Capacity and the winter SCC value (as of the fifth business day in May), respectively.
8. **PV Forecast:** For photovoltaic resources accounted for in the PV forecast, the fuel-security reliability review will use draft CELT values as presented to the PAC during the spring of the year when the fuel security reliability review is performed, which is prior to the annual issuance of the final values in the CELT report released on May 1. For in-service photovoltaic resources not accounted for in the draft forecast values, the fuel-security reliability review will use the nameplate values. For non-commercial photovoltaic Existing Generating Capacity Resources that are not in the CELT report, the fuel-security reliability review will use the nameplate equivalent of the resource’s Capacity Supply Obligation received in the most recent Forward Capacity Auction.
9. **Wind Resource Nameplate:** For wind resources accounted for in the most recently available CELT report and in-service wind resources not accounted for in the most recently available CELT report, the fuel-security reliability review will use the nameplate values. For non-commercial wind Existing Generating Capacity Resources that are not in the CELT report, the fuel-security reliability review will use the nameplate equivalent of the resource’s Capacity Supply Obligation received in the most recent Forward Capacity Auction.
10. **Sun Profile:** The ISO will use the observed hourly profile from the winter of 2014/2015, adjusted to reflect the expected performance of the fleet assumed in service in the study year, and updated annually.
11. **Onshore Wind Profile:** The ISO will use the observed hourly profile from the winter of 2014/2015, adjusted to reflect the expected performance of the fleet assumed in service in the study year, and updated annually.
12. **Offshore Wind Profile:** The ISO will use an hourly profile reflecting the expected performance of the fleet assumed in service in the study year as though it had been in operation in the winter of 2014/2015, and updated annually.
13. **Demand Response Resources:** The winter Seasonal Claimed Capability (MW) reduction value from active Demand Response Resources.
14. **EFORd:** The ISO calculated Equivalent Forced Outage Rate on Demand (EFORd) utilizing the ISO’s Generating Availability Data System (GADS) data. EFORd will be applied to Seasonal Claimed Capability, vii above, in the same manner it is applied for ICR and related values calculations.
15. **OP-4 Action MW:** Estimated hourly MW relief for each action of OP-4.
16. **Export De-List Bids and Administrative Export Bids:** Resource capacity associated with Export De-List Bids and Administrative Export Bids qualified for the instant FCA will not be included as capacity available to ISO to meet internal New England load, and these bids will not be modeled.
17. **Pumped Storage and Other Electric Storage Devices:** Set to levels using a daily storage profile that reflects the characteristic operation of the resource by storing energy during low load periods and generating energy during the higher load periods.
18. **Conventional Hydro-Electric Generation:** This resource is dispatched at an hourly output based on the observed hourly profile from the winter of 2014/2015, adjusted to reflect the expected performance of the fleet assumed in service in the study year, and updated annually.
19. **VARIABLE INPUTS:**

The fuel-security reliability review will consider the following variable inputs:

1. **Imports:** Imports for this review will be defined as the total net flow across the NY-NE, NB-NE and HQ-NE interfaces. The values are set at 2,800 MW, 3,000 MW, and 3,500 MW and will be utilized in separate scenarios.
2. **LNG Injections:** LNG injections for this review will be defined as the total LNG injected into the pipeline transmission system by the region’s three available LNG facilities, Canaport, Distrigas and Buoy. The values are set at 0.8 Bcf, 1.0 Bcf and 1.2 Bcf and will be utilized in separate scenarios.
3. **Dual-Fuel resource tank inventory:** For dual-fuel resources that operate primarily on natural gas during the winter, tank inventory for this review will be defined as a multiplier for the onsite fuel-storage tank of the individual resource. The values are set at 1.25 and 2 and will be utilized in separate scenarios. When the value is set to 1.25, the onsite available fuel for the individual resources will be set to 125% capacity of the individual resources’ tanks at the start of the analysis. When the value is set to 2, the onsite available fuel for the individual resources will be set to 200% capacity of the individual resources’ tanks at the start of the analysis.

The variable inputs in this section can be changed based upon historical trends, new infrastructure, fuel surveys and as the ISO deems necessary, and the information will be provided to the Reliability Committee in accordance with section 2 above.

1. **SYSTEM MODEL STARTING POINT**

With the exception noted below, the model will include all new resources that have a binding and enforceable contract under a state procurement to be in-service by January 1 of the associated Capacity Commitment Period that, by the time the fuel-security reliability review is conducted, have (i) submitted the certification described in Section 8.1.2 of PP10, pursuant to Section 4.1(f) of Attachment K to Part II of the Tariff, or (ii) demonstrated the contractual requirements through submittal of an order or other similar authorization from the appropriate state regulatory agency, along with a copy of the contract, by five business days prior to the Existing Capacity Retirement Deadline. The model will take into consideration any obligation(s) to operate under these contracts, or lack thereof, regarding energy deliveries specific to winter stress conditions being reviewed for fuel security. With respect to (ii) above, the demonstration can be made by the state regulatory agency authorizing the contract, by a transmission company or electric distribution companies that is a counterparty to the contract, or by a third-party organization representing the interests of the New England states regarding energy-related issues (e.g., NESCOE). For FCA 14, offshore wind resources shall have until April 23, 2019 to demonstrate the contractual requirements stated above. If demonstration of the contractual requirements is received after April 23, 2019, the ISO will make reasonable efforts to account for the resource in the model (e.g., scenario analysis), to the extent that doing so will not interfere with the ability of the ISO to complete the analysis and issue its determination by 90 days after the Existing Capacity Retirement Deadline.

**Table 1**

**Timetable for ISO Notification to Include Resources in the Fuel Security Reliability Review**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **CCP13**  **2022-2023** | **CCP14**  **2023-2024** | **CCP15**  **2024-2025** | **Submission of Certification of Contractual Commitment from Resources Being Built in Accordance with Attachment K to the ISO\*** |
|
| Receipt of FERC order for FCA 13 |  |  |  | Sep-15-18 |
| Feb-19 | FCA |  |  | Jan-15-19 |
| Feb-20 |  | FCA |  | Apr-23-19 |
| Jun-20 | ARA1 |  |  | Apr-15-20 |
| Feb-21 |  |  | FCA | Jan-15-20 |
| Jun-21 |  | ARA1 |  | Apr-15-21 |
| Aug-21 | ARA2 |  |  | Jun-15-21 |
| Mar-22 | ARA3 |  |  | Jan-15-22 |
| Jun-22 |  |  | ARA1 | Apr-15-22 |
| Aug-22 |  | ARA2 |  | Jun-15-22 |
| Mar-23 |  | ARA3 |  | Jan-15-23 |
| Aug-23 |  |  | ARA2 | Apr-15-23 |
| Mar-24 |  |  | ARA3 | Jan-15-24 |

\* If the notification to ISO indicates the contract for the resource is pending regulatory approval of the state’s review, the ISO will require an update 5 business days prior to the auction or prior to the retirement de-list bid deadline that the pending contracts have been approved. If the notification timeline is not met, the resources will be removed from the model for the given auction for fuel-security reliability review.

1. **ORDER OF REVIEW**

Bids reviewed for fuel-security will be reviewed in the order prescribed by Section III.13.2.5.2.5A.d of the Tariff.

1. **RESULTS OF THE FUEL-SECURITY RELIABILITY REVIEW**

The fuel-security reliability review results will document the following metrics per scenario:

* OP-4 Action 1 MWh
* OP-4 Action 1 Hours
* OP-4 Actions 2-5 MWh
* OP-4 Actions 6-11 MWh
* 10 - Minute Reserve Depletion MWh
* 10 - Minute Reserve Depletion Hours
* 10 - Minute Reserve Depletion less than 700 MW in Hours
* OP-7 Action: Load Shedding MWh
* OP-7 Action: Load Shedding Hours
* OP-7 Action: Load Shedding Individual Days

Hourly curves profiling the MWh of OP-4 Actions and OP-7 Actions across the applicable analyzed winter period will also be documented.

1. **Reliability Need for a Generator Based on Fuel-Security Reliability Review Results**

The ISO New England fuel-security reliability review standard is set out at Appendix L of Section III of the Tariff. Results from the testing described in this Planning Procedure 10, Appendix I will be measured against the trigger set out in that Appendix L.