Winter Fuel Availability Constraints Modeling Whitepaper – Phase 2

Executive Summary:

As reliability risks during the winter season become more prominent across the New York Control Area (NYCA) system, the availability of gas and oil during winter conditions becomes a critical input to accurately reflect potential reliability risks in winter operations in the Installed Reserve Margin (IRM) study. The modeling of winter fuel availability constraints is an important step in properly reflecting operational reliability risks within the winter period in the IRM study.

The objective of winter fuel availability constraints modeling is to account for fuel availability constraints potentially impacting thermal generating units in Load Zones F-K during peak winter periods (December-February). In 2024, the New York State Reliability Council (NYSRC) published the findings from "Phase 1" of the fuel availability constraints modeling whitepaper.[1] In this whitepaper, the modeling techniques and preliminary assumptions for winter fuel availability constraints were outlined. Since publishing that whitepaper, additional refinement and discussion have continued with the NYSRC and stakeholders to finalize the initial implementation and assumptions for adoption of the winter fuel availability constraints modeling construct into the IRM study starting with the 2026-2027 Capability Year. This whitepaper addresses "Phase 2" of the Winter Fuel Availability Constraints Modeling project and summarizes updates to the assumptions, impact analysis from implementation of the modeling, and sets the stage for research/improvements that should continue in future IRM study cycles.

The implementation of winter fuel availability constraints into the IRM study helps to create incentives for thermal generators in Load Zones F-K to implement firm fuel arrangements that can improve winter resource availability and system reliability during peak winter periods (December-February). In connection with the implementation of winter fuel availability constraints in the IRM study model, the New York Independent System Operator, Inc. (NYISO) has implemented a new "firm fuel" resource class in the NYISO-administered capacity markets for purposes of capacity accreditation. Starting with the 2026-2027 Capability Year, thermal generators can make "firm fuel" characteristic elections. Thermal generators electing "firm fuel" quantities will be evaluated based on performance during the peak winter season. These market enhancements seek to incentivize thermal generators in Load Zones F-K to procure firm fuel supply and transportation arrangements to meet the "firm fuel" resource designation.

In 2025, the NYISO engaged an independent consultant to conduct a study to evaluate the quantity of dependable natural gas and oil supplies that are available to electric power generators during winter under various weather conditions and identify potential winter fuel availability constraints over a forward looking 10 year period. The NYISO and the independent consultant will be providing study results and key findings to the NYSRC and NYISO stakeholder groups at the end of 2025 and early 2026. These findings can be considered in developing the winter fuel availability assumptions in the IRM model in future study cycles.

[1] Gas Constraints Modeling Whitepaper: https://www.nysrc.org/wp-content/uploads/2024/06/Gas-Constraints-Modeling-Whitepaper-Final.pdf

As additional data and operational experience are gained, the winter fuel availability assumptions should be refined with the objective of accurately reflecting anticipated winter fuel availability and performance of thermal generators under peak winter conditions.

Modeling Approach Overview

"Modeling Concept 1," described in more detail in the first phase of the whitepaper, utilizes a "dummy profile" to trigger the winter fuel availability constraints based on winter load conditions. This construct was selected as the optimal modeling approach during the first phase of research and continues to be recommended as the optimal modeling option following the Phase 2 research effort.

Based on modeled winter load conditions that are forecasted for the upcoming year in the IRM study, the thermal generating units in Load Zones F-K identified as being impacted by winter fuel availability constraints are derated to a lower maximum capacity. Six load condition "tiers" (see Figure 1) were identified to trigger varying levels of winter fuel availability constraints. As the modeled winter load conditions increase, the amount of fuel available to the impacted generators decreases, resulting in larger derates.

Figure 1 – NYCA Load Conditions Associated with Winter Fuel Availability Constraints Tiers

Tier	NYCA Load Conditions (MW)
1	>26,000
2	25,000 - 26,000
3	24,000 - 25,000
4	23,000 - 24,000
5	22,000 - 23,000
6	<22,000

These load conditions were developed during the first phase of the whitepaper and should be revisited and refined over the coming years as additional data becomes available, including but not limited to operational data, the NYISO's 2025 study of potential future winter fuel availability constraints, and "firm fuel" characteristic elections pursuant to the NYISO's capacity accreditation enhancements.

Available Gas and Available Oil Assumptions

The process for establishing the "available gas" and "available oil" assumptions is consistent with the process outlined in the first phase of the whitepaper.

For the "available gas" assumption, a historical hourly production regression analysis was utilized to inform the amount of gas anticipated to be available to the impacted units under varying winter load conditions. Since phase 1 of the whitepaper, the regression analysis has been updated to capture historical data from more recent winters and to reflect changes to the generation fleet (i.e., deactivations/additions). In addition, the historical hourly production data at load levels lower than

22,000 MW was removed from the regression analysis because the winter fuel availability constraints are not currently applied at load conditions lower than 22,000 MW.

For the "available oil" assumption, one major change has occurred since the first phase of the whitepaper. During the first phase of the whitepaper, the amount of "available oil" assumed was informed by an assumed firm fuel duration requirement for generators to run for 16 hours/day for 6 days (i.e., 96 hours). The NYISO subsequently revised the firm fuel duration requirement to 56 hours to be implemented in its capacity market starting with the 2026-2027 Capability Year.[2] Updating the analysis to utilize a 56-hour duration requirement led to an increase in the amount of "available oil" assumed for the 2026-2027 IRM study. New data from more recent winters and updates to the generation fleet have also been captured in recent updates to "available oil" assumptions for the 2026-2027 IRM study.

For the 2026-2027 IRM preliminary base case (PBC), the assumptions for "available gas" and "available oil" were as follows:

Figure 2: 2026-2027 IRM PBC Winter Fuel Availability Constraint Assumptions

Tier	NYCA Load Conditions (MW)	Available Gas (MW)	Available Oil (MW)	Total Available Fuel (MW) (Gas + Oil)
1	>26,000	300	11,525	11,825
2	25,000 - 26,000	600		12,125
3	24,000 - 25,000	2,550		14,075
4	23,000 - 24,000	4,200		15,725
5	22,000 - 23,000	5,575		17,100
6	<22,000	No Constraint		

Changes to the generation fleet will be captured in these assumptions as they are reflected in the IRM study. New data can also be incorporated into the data sets in future IRM cycles as it becomes available. The NYSRC and stakeholders should continue to work on refining the process and the assumptions to accurately reflect reasonable levels of winter fuel availability constraints.

Such improvements to the process and assumptions could include:

- Consideration of data from the "firm fuel" characteristic elections
- Consideration of finding and results from the NYISO's 2025 winter fuel constraints study
- Process improvements for adding/removing data from each of the data sets used to inform the assumptions for "available gas" and "available oil"

Annual "Firm Fuel" Characteristic Elections

The NYSRC, NYISO, and stakeholders weighed the option of directly incorporating the annual "firm fuel" characteristic elections made by thermal generators pursuant to the NYISO's capacity accreditation

[2] Modeling Improvements for Capacity Accreditation: Firm Fuel: https://www.nyiso.com/documents/20142/48151567/MICA%2011_21%20ICAPWG_v6.pdf

enhancements into modeling assumptions for the IRM study. The "firm fuel" characteristic elections are occurring for the first time in 2025 to be applicable for the 2026-2027 Capability Year and there is uncertainty with the amount of "firm fuel" characteristic elections that will be made as affected generators gain familiarity with the new market rules. It was decided that, at least for the time being, the elections will not be directly used to inform "available gas" and "available oil" assumptions for the IRM study.

Directly incorporating these elections could produce unwarranted volatility to the IRM study model. It was agreed that, for purposes of initial implementation, the historical data currently being used provides a reasonable assumption for winter fuel availability assumptions used in the IRM study. As more operational experience during peak winter conditions is gained along with further analysis of "firm fuel" characteristic elections by impacted units, refinements to assumptions to consider such election data can be considered to help inform future winter fuel availability assumptions for the IRM study.

Interaction Between Winter Fuel Availability Constraints Modeling and Champlain Hudson Power Express (CHPE)

Following the adoption of the winter fuel availability constraints modeling and the addition of the CHPE project into the 2026-2027 IRM study, it was observed that the combined impact of these two modeling assumptions leads to higher IRM and winter LOLE impacts than observed when these two assumptions are modeled separately. Prior testing of the winter fuel availability constraints without inclusion of the CHPE project showed the potential for an increase of approximately 0.5% to the IRM and 3% loss of load expectation (LOLE) risk in the winter.[3] Following the inclusion of both modeling assumptions, the impact observed for the 2026-2027 IRM PBC was an increase of approximately 1.8% to the IRM and 14% LOLE risk in the winter.

This observation was investigated further through certain NYSRC-requested special sensitivities on the 2026-2027 IRM PBC. This additional analysis identified that winter risk is exacerbated in the case that includes both winter fuel availability constraints and CHPE. This result is due to the combination of increased winter risk introduced by the winter fuel availability constraints and the modeling of CHPE as a summer-only resource. Since capacity is removed on an annual basis to achieve the 0.1 loss of load event-days annual LOLE criteria, there is the potential for a resource with material seasonal differences in capacity availability to exacerbate the risk in the season in which it is unavailable/less available (i.e., winter in the case of the CHPE modeling assumptions for the 2026-2027 IRM PBC). This occurs when CHPE is included in the model in tandem with the winter fuel availability constraints.[4]

Phase 2 Recommendations

[3] Fuel Availability Constraints Modeling Phase 2: https://www.nysrc.org/wp-content/uploads/2025/04/4.1.2-Fuel-Availability-Constraints-Modeling-Phase-2-r1-04112025-EC-Attachment-4.1.2.pdf

[4] 2026-2027 IRM Study Special Sensitivities: https://www.nysrc.org/wp-content/uploads/2025/08/2026-2027-IRM-Special-Sensitivities-09032025-ICS.pdf

Based on the research conducted in both Phase 1 and Phase 2 of the winter fuel availability constraints modeling effort, it is recommended that the assumptions and modeling continue to be refined over time. Including the winter fuel availability constraints modeling in the 2026-2027 IRM study is an important step in beginning to properly capture winter risk in the IRM study. This effort should continue, and as new data and research becomes available, future improvements should be incorporated into the model. Some areas of focus for ongoing research and refinement include, but are not limited to:

- Monitoring changing market behavior of firm fuel procurements and reassessing the methodology using the historical data trends
- Assessing the need to and, if warranted, adjust to account for the impact of potential additional factors (i.e., impact of liquefied natural gas, economic considerations for fuel switching by dual fuel generators, retail gas demand, oil replenishment capability, and generator emissions restrictions) that may affect historical production data currently used to inform the modeled fuel availability constraint assumptions
- Potential need for reflecting additional winter-related modeling assumptions (e.g., winter transmission limits) in the IRM study model
- Monitoring load growth during winter and adjusting load levels "tiers" accordingly to represent changing winter conditions over time
- Assessment of "firm fuel" characteristic elections as part of the NYISO's capacity accreditation rules and reported fuel inventories by impacted units
- Need for research to potentially extend the modeling of fuel availability constraints to resources statewide (i.e., extend to thermal units in Load Zones A-E)
- Potential changes to the supply of natural gas available (e.g., natural gas pipeline expansion from the Northeast Supply Enhancement Pipeline Project)
- Enhancements to the modeling of fuel availability constraints as future GE MARS improvements are implemented

Consideration of these factors will be reviewed and analyzed through efforts in 2026 and future years to help inform assumptions for capturing the impacts of winter fuel availability constraints in the IRM study.