Gas Constraints Whitepaper Update

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Agenda

- Previous Discussions
- Updated Analysis
- Initial Recommendation
- Next Steps
- Appendix

Previous Discussions

Previous Discussions

- The goal of this project is to reflect the impact of gas constraints during varying winter load levels in Load Zones F – K
- Historical gas generation during recent winters has been analyzed in order to determine the magnitude of gas constraints at different load levels to be applied in the IRM model
- Derates are applied to the capacity of existing units to reflect the impact of the gas constraints based on the load level in the model
- The modeling also attempts to align with Capacity Accreditation Resource Class (CARC) assignments associated with proposed fuel characteristic elections made by generators every August (i.e., firm, partial firm, non-firm)
- The aim is to complete the whitepaper in Q1 2024 and incorporate gas constraints modeling in the 2025-2026 IRM Preliminary Base Case (PBC)

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Updated Analysis

Updated Analysis

- The NYISO previously presented analysis on gas generation during NYCA peak winter load hours for 2017-2022
  - This analysis examined the quantity of gas-fired production during the daily peak load hour from the past six winters to determine the trend for gas-fired production under different load conditions as a means to inform potential availability limitations
  - The ICS asked if a similar analysis could be done to review the oil-fired production during the same historical period
- The NYISO updated the analysis to include operational data for oil-fired production during peak winter load hours. A few notes on the oil-fired production data:
  - Historical production data should help identify fuel switching from gas to oil as load increases
  - The historical oil production data does not reflect the level of oil storage/production capability
  - It is expected that the availability of oil exceeds the observed oil-fired production

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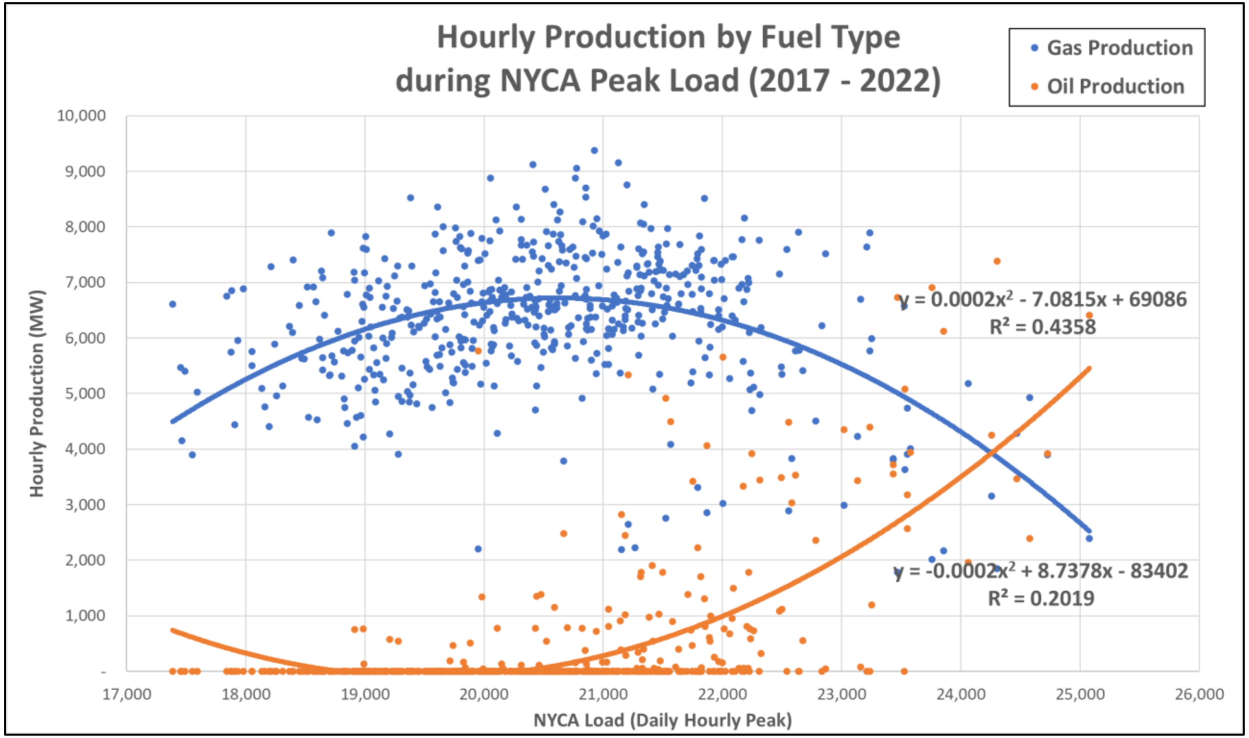
Historical Production By Fuel



- As gas-fired production starts to decline, oil-fired production starts to increase
- While the gas-fired production can provide information regarding availability, oil-fired production reflects only usage, not availability
  - Alternative data is needed to review oil availability
- In addition, availability of oil can change significantly based on fuel procurement decisions

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Availability By Fuel

- The NYISO used the historical analysis to estimate the availability of gas at different load levels
  - The historical data provides information regarding gas availability/utilization from the aggregated output perspective, regardless of the fuel purchase arrangement from individual units
  - Changes in fuel procurement arrangements over time may impact the production trends
    - For example, if more units enter into firm purchase arrangements, this could produce an upward trend of gas-fired production over time, indicating reduced availability constraints
  - Regularly repeating the historical analysis on the production data will capture the changing trend of fuel purchase arrangements (e.g., 5-year rolling average)
- To estimate potential oil-fired capability/availability, the NYISO analyzed recent winter fuel survey data submitted by generators
  - The historical weekly fuel surveys showed a production capability range of 9,500 – 12,000 MW for dual fuel units in Load Zones F – K, with an average production capability of ~11,000 MW
- As units with oil storage may change fuel purchase arrangements regularly, the proposed fuel availability elections associated with capacity accreditation may improve the accuracy of the information regarding stored oil inventory due to the proposal's establishment of minimum requirements for oil storage to qualify as a firm fuel election

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Initial Recommendation

Initial Fuel Constraint Recommendation

- Based on the analysis of the historical gas production and weekly fuel surveys, the NYISO has developed the following initial recommendation of fuel constraints to model in the IRM study

Tier	NYCA Load Conditions	Available Gas	Available Oil	Total Available Fuel (Gas + Oil)
1	>26,000	0 MW	11,000 MW	11,000 MW
2	25,000 - 26,000	750 MW		11,750 MW
3	24,000 - 25,000	2,750 MW		13,750 MW
4	23,000 - 24,000	4,500 MW		15,500 MW
5	22,000 - 23,000	5,500 MW		16,500 MW
6	<22,000	No Constraint		No Constraint

- The available gas will be reevaluated on an annual basis as new winter data is added to the analysis
- The available oil will be updated each August once fuel availability elections are finalized
  - The elections should provide a reasonable estimate of the amount of reliable oil-fired production anticipated to be available each winter

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Implementation Example: Year 1

- **The fuel constraints will be modeled for the first time during the IRM study for the 2025-2026 Capability Year, with the following schedule:**
  - The assumptions for the PBC will be finalized in July 2024, and the PBC will be completed early August 2024
  - The assumptions for the Final Base Case (FBC) will be finalized in October 2024, and the FBC will be completed November 2024
- **For the PBC, the study will include the initial fuel constraint recommendations (outlined on slide 10) applied to gas-only and dual fuel generators**
  - Oil-only units will be modeled with their full capability until the first fuel availability elections occur
- **For the FBC, the fuel constraint model will be updated to reflect the firm oil elections for the 2025-2026 Capability Year, which under the NYISO's current fuel availability proposal are expected in August 2024**
  - Available gas portion remains unchanged
  - Available oil portion will be updated with the total firm MW from oil-only units and the oil portion of the dual-fuel units

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Implementation Example: Future Years

- **After the initial year of implementation (i.e., the 2025-2026 IRM study), during the PBC, the inputs to the fuel constraint model will be based on the following information:**
  - Refresh historical analysis of gas production by adding most recent historical winter data to update the available gas portion
  - The available oil portion will remain the same as the assumption modeled in the prior FBC
- **During the FBC, the fuel constraint model will be updated to reflect the firm oil election expected each August**
  - Available gas portion remains unchanged from PBC
  - Available oil portion will be updated with the total firm MW from oil-only units and the oil portion of the dual-fuel units

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Initial Recommendation Test Results

- **The NYISO performed tests implementing the initial recommendation modeled with the "existing unit derate" methodology**
  - For more information regarding the "existing unit derate" methodology refer to the presentations on the gas constraints whitepaper at the 11/1/2023 and 11/28/2023 ICS meetings
  - The derates were calculated accounting for EFORds of the impacted units in each zone

Case	IRM (Delta)	J LCR (Delta)	K LCR (Delta)	G – J (Delta)
2024 IRM FBC (Base Case)	23.1%	72.7%	103.2%	84.6%
Initial Fuel Constraint Recommendation (Tan45)	23.4% (+0.3)	72.7% (-)	103.1% (-0.1)	84.6% (-)

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Next Steps

Next Steps

- **The NYISO will refine the initial fuel constraint model recommendation and the process to update the assumptions based on inputs received from the ICS**
- **Based on the accepted fuel constraint model, NYISO will review appropriate methodologies for Capacity Accreditation Factor (CAF) calculations related to fuel availability elections by generators**
  - Specifically, the methodology for modeling the marginal proxy unit for the applicable CAF calculations
  - The discussion on CAF related topics will be conducted in the ICAP Working Group meetings
- **The NYISO plans to finalize the recommendation and complete the whitepaper in Q1 2024**
  - The final report will serve as a summary of all the prior research and discussion

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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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Questions?

Appendix

Background

- **As supported by the NYSRC and stakeholders, the NYISO is conducting research analyzing the impact of extreme winter conditions on gas availability to New York electric power generators**
- **The gas constraints whitepaper is part of the 5-year strategic plan for Resource Adequacy ("RA") modeling improvements**
  - The scope of this whitepaper was discussed and accepted at the 2/1/2023 ICS meeting and an update on the modeling and research was presented at the 5/30/2023 ICS meeting

    Gas Constraints Whitepaper: Scope (2/1/2023 ICS):
    https://www.nysrc.org/PDF/MeetingMaterial/ICSMeetingMaterial/ICS%20Agenda%20273/Gas%20Constraints%20Whitepaper_Scope_2023.02.01_revised[13443].pdf
    Gas Constraints Whitepaper Update (5/30/2023 ICS):
    https://www.nysrc.org/wp-content/uploads/2023/07/11_ICS_GasConstraintsWhitepaperUpdate_2023.05.30_v415826.pdf
  - A Winter Constraints sensitivity relating to this modeling effort was presented at the 8/29/2023 ICS meeting

    Winter Constraints Sensitivities (8/29/2023 ICS):
    https://www.nysrc.org/wp-content/uploads/2023/08/WinterConstraintsSensitivities_2023.08.2921424.pdf
  - This effort is also being coordinated with the Capacity Market Design's Modeling Improvements for Capacity Accreditation Project (Previous discussions on next slide)
- **The objective of the whitepaper is to develop enhancements to appropriately reflect the impact of gas constraints during the winter period in the IRM study, via answering the following questions:**
  - What are the characteristics of winter gas constraints on the availability of electric power generators?
  - What are the reasonable levels of such gas constraints to be reflected in the IRM study while avoiding potential double counting with an electric power generator's forced outage rate?
  - What is the recommended modeling approach to represent these characteristics in the RA model?

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Timeline

Milestone	Date
Present Scope to NYSRC	2/1/2023
Finalize Scope	2/15/2023
Monthly ICS Updates	Ongoing
Identify Factors for Reasonable Gas Constraint Modeling Characteristics	Q1 2023
Additional Analysis and Gas Constraint Characterization	Q2 2023
Research Completed	Q2 2023
Present Findings of Research at ICS	End of Q2 2023
MARS Modeling Development and Testing	Q3 – Q4 2023
Present Findings/Modeling Enhancement Recommendations to NYSRC	December ICS Meeting
Implement NYSRC Approved Changes to IRM Model *-- sensitivity in the PBC and possible base case adoption in 2025-2026 IRM Study*	Following NYSRC Review

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Previous Presentations

- 2/1/2023 ICS: Gas Constraints Whitepaper: Scope
    - https://www.nysrc.org/wp-content/uploads/2023/05/Gas-Constraints-Whitepaper_Scope_2023.02.01_revised13443.pdf
- 5/30/2023 ICS: Gas Constraints Whitepaper Update
    - https://www.nysrc.org/wp-content/uploads/2023/07/11_ICS_GasConstraintsWhitepaperUpdate_2023.05.30_v415826.pdf
- 8/29/2023 ICS: Winter Constraints Sensitivities – 2024 - 25 IRM
    - https://www.nysrc.org/wp-content/uploads/2023/08/WinterConstraintsSensitivities_2023.08.2921424.pdf
- 10/4/2023 ICS: Gas Constraints Whitepaper Update
    - https://www.nysrc.org/wp-content/uploads/2023/10/IRM24_GasConstraintsWhitepaperUpdate_2023.10.0422503.pdf
- 11/1/2023 ICS: Gas Constraints Whitepaper Update
    - https://www.nysrc.org/wp-content/uploads/2023/10/GAS-Constraint-Whitepaper-Update-ICS-110122936.pdf
- 11/28/2023 ICS: Gas Constraints Whitepaper Update
    - https://www.nysrc.org/wp-content/uploads/2023/11/Gas-Constraints-Modeling-11282023-ICS23376.pdf

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Gas Constraint Modeling: Initial Characteristics

- **Gas constraints are to be applied to certain thermal units in Load Zones F – K**
  - Prior analysis by the MMU demonstrates the current significance of pipeline bottlenecks in southeast NY https://www.nyiso.com/documents/20142/33916814/MMU%20Gas%20Availability%20Presentation__20221020.pdf
  - Gas constraints will not initially be applied to units in Load Zones A – E
    - Further analysis is required to determine the prevalence of significant gas constraints in Load Zones A - E
    - Gas constraints can be applied to Load Zones A – E if needs are identified in the future
- **Gas constraints are to be applied in December, January, and February**
  - Winter cold weather conditions are most likely to occur during these months
- **Load level will be used as a proxy for temperature to trigger the gas constraint in the model**
  - Demand for gas is closely related to temperature during winter
- **Different magnitude levels of gas constraints are to be applied to represent different winter weather scenarios across the different load forecast uncertainty (LFU) bins in the model**
  - This is to represent different gas constraints effects due to different weather conditions

These characteristics should be revised and, as necessary, updated as new information becomes available

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Modeling Concepts

- **Four modeling concepts are currently being considered:**
  - Modeling Concept 1: Gas Constraint Triggered by Load Condition via Dummy Profile
  - Modeling Concept 2: Gas Constraint Triggered by Load Condition via Specific Dates
  - Modeling Concept 3: Gas Constraint Modeled with Dummy Bubbles and Topology Limits
  - Modeling Concept 4: Gas Constraint Modeled with Negative EOP Step
- **The NYISO has worked with GE to conduct screening of these modeling concepts to select an option for further modeling development. The screening considerations are:**
  - Feasibility to implement the modeling concept in GE MARS
  - Ability to implement without affecting base case results
  - Ability to differentiate gas constraints by bin level
  - Ability to customize the constraint to the daily/hourly level
  - Ability to dynamically account for generator outages

Modeling Concept Screening

Screening Considerations	Modeling Concepts			
	Gas Constraint Triggered by Load Condition via Dummy Profile	Gas Constraint Triggered by Load Condition via Specific Dates	Gas Constraint Modeled with Dummy Bubbles and Topology Limits	Gas Constraint Modeled with Negative EOP Step
Feasiblity in the GE MARS Model	Medium High	Medium High	Medium	High
Ability to implement without affecting base case results	High	High	Low	High
Ability to differentiate gas constraint by bin level	High	High	High	Low
Ability to customize constraint to daily/hourly level	High	Medium	High	Medium Low
Ability to dynamically account for generator outages	Medium Low	Medium Low	High	Medium Low
Overall Comparison of Pros/Cons	**Straightforward implementation Highly customizable No undesired impacts**	**Straightforward implementation Customizable to an extent No undesired impacts**	**Complex implementation Highly customizable May have undesired impacts**	**Simplest implementation Limited customization No undesired impacts**

Modeling Concept 1

- **Gas Constraint Triggered by Load Condition via Dummy Profile**
  - A dummy intermittent resource is added to the GE MARS model with hourly production profiles
    - Unit will be added to a dummy zone as to not impact base case results
  - The hourly production profiles are used to derate gas constrained generators to remove the desired amount of ICAP from the simulation

Pros	Cons
• No GE development needed • Straightforward modeling implementation • No impact to base case results • Able to have different gas constraint magnitude at different load bins • Able to customize constraint down to the daily or hourly level	• Unable to dynamically account for generator outages (potential to undercount desired impact)

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Modeling Concept 2

- **Gas Constraint Triggered by Load Condition via Specific Dates**
  - A date range condition predetermined based on the load shapes is added to the GE MARS model
  - During the date range implemented, the gas constrained generators are derated to remove the desired amount of ICAP from the simulation

Pros	Cons
• No GE development needed • Straightforward modeling implementation • No impact to base case results • Able to have different gas constraint magnitude at different load bins • Able to customize constraint down to the daily level	• Unable to customize constraint down to the hourly level • Unable to dynamically account for generator outages (potential to undercount desired impact)

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Modeling Concept 3

- **Gas Constraint Modeled with Dummy Bubbles and Topology Limits**
  - Dummy bubbles connected to load zones are created in the GE MARS model (e.g., Zone G is connected to Zone G_Dummy)
  - All gas constrained generators are moved in the model from the load zone to the dummy bubble
  - Interface limits are implemented during predetermined periods to limit the amount of capacity that can be provided to the load zone from the dummy bubble

Pros	Cons
• No GE development needed • Able to have different gas constraint magnitude at different load bins • Able to customize constraint down to the daily or hourly level • Able to dynamically account for generator outages	• Complex modeling implementation • May impact base case results (undesired impacts have been identified in testing when moving large numbers of generators to dummy bubbles)

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Modeling Concept 4

- **Gas Constraint Modeled with Negative EOP Step**
  - A negative EOP step is added to the GE MARS model that effectively removes generation from the system, similar to how Operating Reserves are modeled at EOP step 1

Pros	Cons
• No GE development needed • Simplest modeling implementation • No impact to base case results	• Unable to have different gas constraint magnitude at different load bins • Unable to customize down to the daily or hourly level • Unable to dynamically account for generator outages (potential to overcount desired impact)

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