New York ISO
Independent System Operator

Gas Constraints Whitepaper Update

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Agenda

- Background
- Need for Improved Winter Modeling
- Outage Double Counting
- Gas Constraint Characteristics
- Modeling Availability vs. Unavailability
- Modeling Concepts
- Modeling Concept Screening
- Next Steps
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Background

- **As supported by the NYSRC and stakeholders, the NYISO is conducting research analyzing the impact of 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
    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
  - The RA effort to reflect gas constraints is being coordinated with the Capacity Market Design's Modeling Improvements for Capacity Accreditation project
    Modeling Improvements for Capacity Accreditation: Natural Gas Constraints (2/28/2023 ICAPWG):
    https://www.nyiso.com/documents/20142/36499713/Gas%20Constraints%2002_28_2023%20ICAPWG_Final.pdf/e258d867-12f9-8453-c93b-49bc94b8e803
    Modeling Improvements for Capacity Accreditation: Natural Gas Constraints (4/27/2023 ICAPWG):
    https://www.nyiso.com/documents/20142/37254128/Natural%20Gas%20Constraints%202023_04_27_Final.pdf/0821aba8-bdcd-b1ce-96f3-2d8a740e1356
- **The objective of the whitepaper is to appropriately reflect the 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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Need for Improved Winter Modeling

- **In the current RA model, winter conditions are not fully reflected. Therefore, the IRM study shows minimal LOLE risk during the winter season**
- **Improving winter modeling will better account for the winter LOLE risk in the RA model, which is expected to increase in the near future**
  - NYCA is expected to become winter peaking by mid-2030's and increasing winter risk will emerge long before that
    - The 2022 RNA study (*2022 RNA*) included a winter gas shortage scenario, where the NYCA wide margin is almost depleted in winter 2027-28 during a cold snap; annual LOLE is also doubled in Y2032
  - Other systems in the Northeast region are also showing tight conditions during winter (see appendix)
- **Implementing gas constraints is an important first step to reflect winter conditions in the IRM study. Other modeling changes, such as seasonal Emergency Assistance, are also being studied. Combining these modeling changes with gas constraints is expected to start reflecting the growing winter risks in the IRM study**

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Outage Double Counting

- Currently, the IRM models generator Equivalent Demand Forced Outage Rate (EFORd) using the 5-year historical data from the Generating Availability Data System (GADS)
- Lack of fuel events that are reported in GADS by generators are captured in the EFORd
  - The lack of fuel cause code is used infrequently by generators
- The NYISO performed analysis comparing historical GADS data and operational reports on unavailability of gas and concluded that GADS data does not capture gas constraints and there are no major concerns for double counting the forced outages that need to be accounted for in this whitepaper
  - The comparison was performed between the few times that the lack of fuel cause code was submitted to GADS and information regarding gas availability that was reported to Grid Operations
- Excluding the lack of fuel events during winter from GADS when calculating the EFORd can be considered
  - Given the infrequent use of the cause code, it may not be necessary at this point
  - We will continue to monitor use of the cause code

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Modeling Availability vs. Unavailability

- **There are two major modeling approaches that can be considered to account for gas constraints**
  - Availability – gas constraints as MWs that are available in a location when the condition is triggered
  - Unavailability – gas constraints as MWs that become unavailable in a location when the condition is triggered
- **However, GE MARS currently does not have capability to capture correlated/shared constraints or derates. Therefore, either approach would require some compromise in order to be feasible with the current structure**
  - Dynamically applying the gas constraint (availability or unavailability) with consideration of unit forced outages will require significant modeling changes to the underlying GE MARS program
- **The availability approach appears to align naturally with the effect of gas constraint that limits the amount of available fuel, but requires significant change to the underlying database**
  - Replacing existing fleet with an aggregated unit – the approach ISONE is adopting (see appendix)
  - Creating dummy bubbles with gas units and with topology limits can be an alternative – NYISO explored this option further
- **The unavailability approach aligns with the existing MARS construct in modeling generator derates and outages, but it has precision issues due to the overlapping between forced outages and gas constraint derates**
  - Leveraging the existing temperature derate construct to derate individual units
  - A negative unit can be an alternative to model unavailability of MWs due to gas constraints

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Modeling Availability vs. Unavailability (con't)

- **NYISO has reviewed both approaches with GE and is pursuing the unavailability approach at this point, with a longer-term plan to address the outage/constraints overlapping issue**
  - The longer-term solution can include introduction of correlated constraints in GE MARS to capture the limitation of available MW on top of unit forced outages
  - The unavailability approach offers simplicity in modeling construct development in the near term, as well as the flexibility to consider modeling LFU bin-specific constraints
  - The benefits of the availability approach can also be realized when the overlapping issue is addressed
    - The NYISO aims to quantify the impact of overlapping issue during further modeling development
  - Aggregated unit modeling was reviewed, and the following issues have been identified:
    - This is a significant change to the underlying IRM database.
    - It requires critical inputs such as unit forced outage rate and performance to develop the modeling for the aggregated unit. Some of the inputs may not be available in the near-term
    - It also adds to modeling complications if LFU bin-specific constraints is considered

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Gas Constraint Modeling Characteristics

- **Gas constraints are to be applied to certain thermal units in Zones F – K**
  - As illustrated by Potomac Economics, pipeline bottlenecks impact southeast NY
    https://www.nyiso.com/documents/20142/33916814/MMU%20Gas%20Availability%20Presentation__20221020.pdf/bf599ef4-eb0f-a436-8b1c-33eb129319fc
  - Gas constraints will not be applied to units in Zones A – E at this point
    - Existing studies have not shown significant gas constraints in Zone A - E
    - Gas constraints can be applied to Zone A – E if needs are identified in the future
- **Gas constraints are to be applied in January, February, and December**
  - Winter spell 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 LFU bins in the model**
  - This is to represent different gas constraints effects due to different weather conditions

These characteristics should be revised and updated as new information is available

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Modeling Concepts

- **Four modeling concepts are currently being considered (see appendix for more detailed review of each concept):**
  - Modeling Concept 1: Gas Constraint Triggered by Dummy Generator Condition
  - Modeling Concept 2: Gas Constraint Triggered by Date Range Condition
  - 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

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Modeling Concept Screening

Screening Considerations	Modeling Concepts			
	Gas Constraint Triggered by Dummy Generator Condition	Gas Constraint Triggered by Date Range Condition	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

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Next Steps

- **Based on ICS feedback, more comprehensive functional testing will begin to further develop the modeling for winter gas constraints**
  - The NYISO recommends focusing our efforts on Modeling Concept 1
- **The NYISO will return at the August ICS meeting with preliminary results of modeling development work and collect feedback to develop modeling recommendations under the Gas Constraint Whitepaper**
  - NYISO aims to develop different load level thresholds for the gas constraints for different LFU bins
  - NYISO aims to develop different gas constraint magnitudes to be applied for different LFU bins
- **The whitepaper will also recommend an on-going process to review and update the gas constraint assumptions in the IRM model based on new information**
  - The assumptions used in the initial modeling recommendation may not reflect future conditions and market evolution

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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

External Area Winter Information

- IESO is forecasting an increase in winter peaks over the next decade and is expected to become a winter-peaking system
  - https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Dec2022/2022-Annual-Planning-Outlook.ashx
- ISONE has fuel availability concerns as it is at the “end of the pipeline” and is also forecasting increasing winter peaks
  - https://www.iso-ne.com/about/what-we-do/in-depth/natural-gas-infrastructure-constraints
  - https://www.iso-ne.com/static-assets/documents/2023/05/2023_celt_report.xlsx
- HQ set all time winter peak early 2023 and expected to have significant winter demand growth in the next 10 years
  - https://montreal.ctvnews.ca/quebecers-break-record-for-electricity-demand-as-cold-snap-continues-1.6259858
  - https://news.hydroquebec.com/media/filer_private/2023/01/20/overview_of_hydro-quebecs_energy_resources.pdf
- PJM faced significant winter reliability risk during Winter Storm Elliott. Enhancing the reliability model to reflect winter risk is one of the priorities under PJM’s capacity market reform
  - https://www.pjm.com/-/media/committees-groups/cifp-ra/2023/20230517/20230517-item-02---ws-elliott-recommendations.ashx
  - https://www.pjm.com/-/media/committees-groups/cifp-ra/2023/20230329/20230329-item-04---pjm-cifp-ra-initial-proposal---stage-1-posting.ashx

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ISONE Aggregated Gas Model

- **ISONE is planning to adopt modeling the gas constraint using Aggregated Gas Model to represent gas constraints in Resource Adequacy model later this year (*ISONE Methodology*)**
  - The Aggregated Gas Model is applied during December, January and February
  - It replaces the existing thermal fleet with one unit with fixed output profile and one storage unit
    - The unit with fixed output profile represents available pipeline gas. The hourly profile is based on daily gas volume forecast and is converted into hourly profile based on historical hourly gas burnt for a typical day
    - The storage unit represents available LNG based on seasonal forecast. The ELR functionality is utilized
  - An interface limit is also implemented as a topology limit to represent total gas capacity available behind the gas pipeline

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Modeling Concept 1

- **Gas Constraint Triggered by Dummy Generator Condition**
  - 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 Date Range Condition**
  - 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 (i.e. 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 shown 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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