New York ISO
Independent System Operator

Improve Duct-Firing Modeling: Kickoff

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ICAPWG/MIWG

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Agenda

- Background
- 2022 Proposed Market Design Concept
- Additional Items
- Next Steps

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Prior Presentations

Date	Working Group	Discussion Points and Links to Materials
08-30-2023	BPWG	Market Project Descriptions: Improve Duct-Firing Modeling (Page 13) https://www.nyiso.com/documents/20142/39653286/August%2030%20BPWG%20Market%20Project%20Descriptions.pdf/7ade6560-c017-c29a-7ab9-769cd3a4c01e
03-07-2023	ICAPWG/MIWG	Improve Duct-Firing Modeling Update https://www.nyiso.com/documents/20142/36639552/Improve%20Duct%20Firing%20Modeling%20Update_MIWG_03072023_final.pdf/2f5af6b8-11b5-f1c2-e0ce-59585dfc1f00
10-27-2022	ICAPWG/MIWG	Improve Duct-Firing Modeling: Market Design Concept Proposed https://www.nyiso.com/documents/20142/34087499/Improve%20Duct%20Firing%20Modeling%20MDCP_MIWG_10272022.pdf/8e18e862-1ba0-513b-bc18-1573fb55f1dc
09-30-2022	ICAPWG/MIWG	Improve Duct-Firing Modeling Update https://www.nyiso.com/documents/20142/33520089/Improve%20Duct%20Firing%20Modeling_MIWG_09302022_final%20(002).pdf/1dd9e83a-a2f2-bac4-b8ed-f3e3d97a9461
08-24-2022	ICAPWG/MIWG	Improve Duct-Firing Modeling Update https://www.nyiso.com/documents/20142/32941988/DBimprove_MIWG_08242022_final.pdf/862020d9-faa1-ab30-9f02-e9aa8604d43f
04-05-2022	ICAPWG/MIWG	Improve Duct-Firing Modeling – Update https://www.nyiso.com/documents/20142/29688278/DBimprove_MIWG_040522_final.pdf/fe5ca5ce-d999-7609-a671-6311d06c573a
02-08-2022	ICAPWG/MIWG	Improve Duct-Firing Modeling – Kick-off https://www.nyiso.com/documents/20142/28305948/DBimprove_MIWG_020822_r2.pdf/cd34412c-cce6-5f84-230e-511b0f00e4cc

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Background

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Project Background

- The Improve Duct-Firing Modeling Project is considering market enhancements to better accommodate combined-cycle gas turbine generators ("CCGTs") equipped with duct-firing.

- 2024 project commitment is to complete the Functional Requirement Specifications (FRS).

- As per NYISO's 2023 Market Vision Report, the project deployment is scheduled for 2025.

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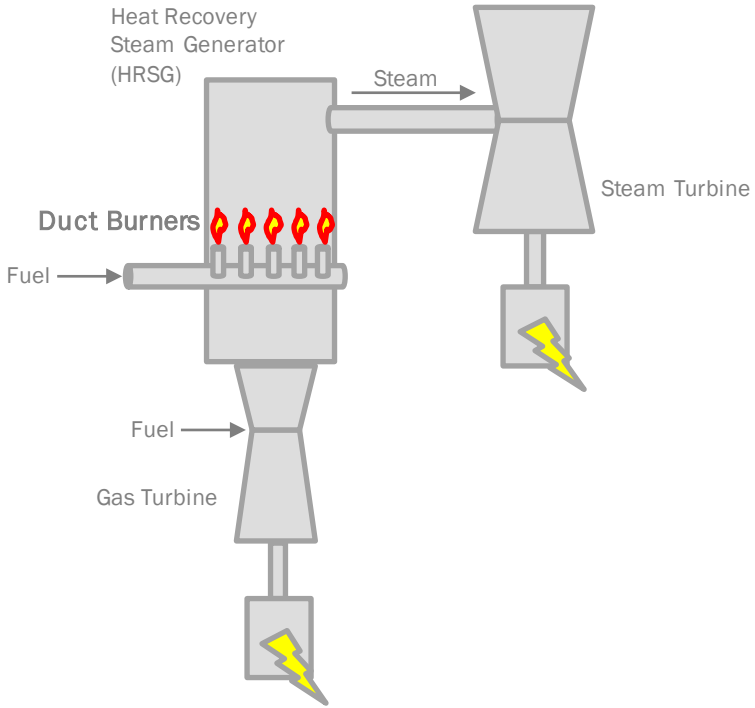
What is Duct-Firing?

- **In some combined-cycle power stations, the Heat Recovery Steam Generators (HRSGs) are equipped with duct burners, which add additional heat to the steam cycle by burning fuel directly in the exhaust duct.**
  - The additional heat from the duct burners increases steam flow to the steam turbine, and results in power increase from the steam turbine only.
  - Typically, the operation of duct burners is limited to the last 1-10% of combined cycle output and requires the gas turbine to be near (or at) maximum output prior to use.
  - There are exceptions to this typical operation in NYISO's fleet, mostly in plants designed for cogeneration.



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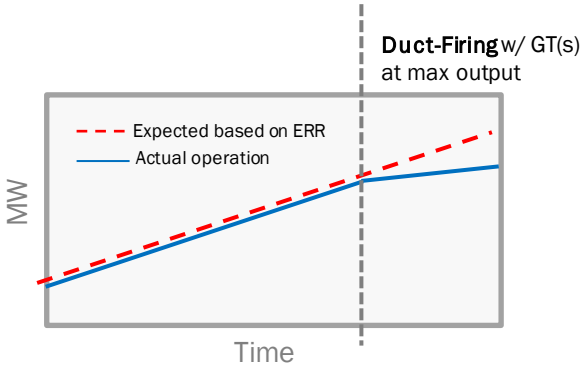
Problem Statement

- **For Energy market participation, up to three normal response rates (NRRs) may be used to characterize the MW/min ramp rate of a generator with respect to MW output.**
  - The NRR values and breakpoints can be tailored to best fit the specific generator's operating characteristics.
    - For example, reduced ramp rate capability in a certain range of operation (e.g., ramping on duct burners alone).
    - NRRs only apply to normal energy dispatch.
- **For Operating Reserves scheduling, the emergency response rate (ERR) is used.**
  - ERR is a single value required to be greater than or equal to all NRRs.
    - Thus, it does not appropriately capture the variable ramp rate over the complete operating range of some units.



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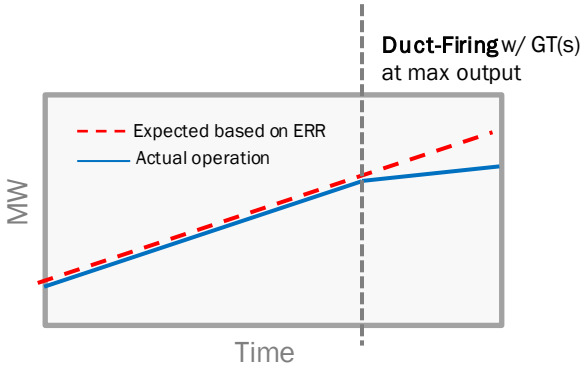
Problem Statement (cont'd)

- It has been observed that CCGTs equipped with duct-firing systems may not be able to physically achieve their registered ERR when ramping through the region where duct burners are used.
- This project explores changes to accommodate the operating capability of CCGTs when they are in the duct-firing region and called upon to provide reserves.



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2024 Scope

- The 2024 FRS represents a project goal and project timeline to achieve the 2022 MDCP, which is a well-defined set of enhancements supported by stakeholders and are significant improvements to the current status-quo.
- The enhancements proposed in the project would enable CCGTs with duct-firing capability to provide reserves appropriately based on their multiple ramp rates and allow eligible CCGTs to limit their regulation/reserve schedule to a level before the start of their duct-firing range.
- NYISO proposes to maintain the 2024 scope as proposed in the 2023 BPWG project description and any changes to the scope at this point of time can lead to delays in the achievement of the FRS goal which in turn would delay deployment.

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2022 Proposed Market Design Concept

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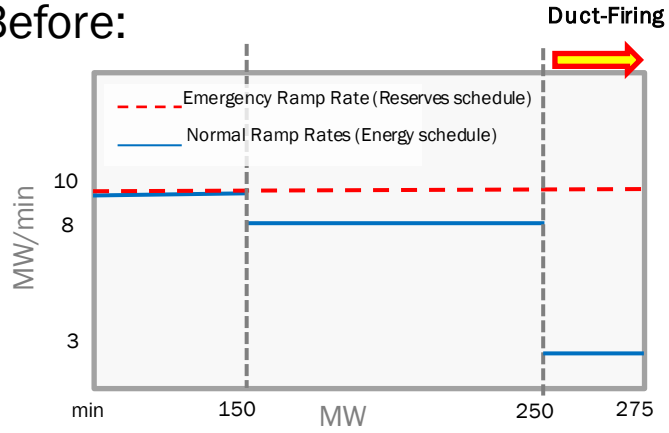
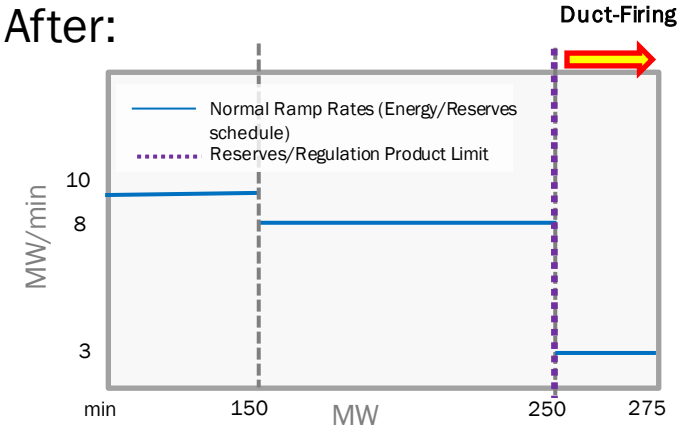
Proposed Market Design

- **Use multiple ramp rates for scheduling reserves**
  - Consistent with scheduling of energy today, leverage normal ramp rate “segments” (instead of the single emergency rate) to schedule reserves.
  - The ramp rates utilized for operating reserve shall be the same as energy ramp rates which are registration parameters.
- **Allow limited participation for reserve and regulation products**
  - If necessary due to limitations of the plant’s configuration, the MP may set a participation limit for reserves that is lower than the unit’s operating capacity.
  - The existing ramp rate breakpoint for duct-firing range shall be used for setting the threshold limit when MP opts to limit participation in the 10-min reserve product.
  - Opting to use the participation limit shall be a registration parameter and eligibility for utilizing the participation limit will be validated by MMA.

Before:



After:



*example values

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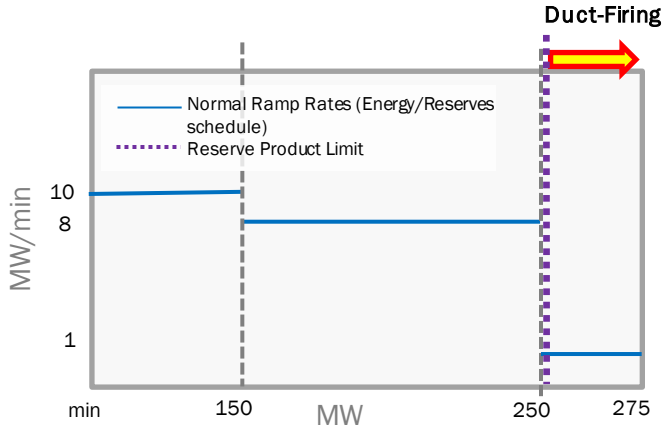
Example

- **Unit has multiple ramp rates as shown in the figure and has a transition time of 10 minutes to move from the second region (150-250 MW) to the duct-firing region (250-275 MW).**
  - Unit could opt for a participation limit in 10-min spinning reserve which would limit the unit's participation in 10-min reserves until 250 MW but provide full range of 275 MW in 30-min reserve.
- **The participation limit only applies to reserves and regulation.**
  - The full range will continue to be used for energy when participation limit is employed for reserves and regulation.



*example values

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Additional Items

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Real Time Dispatch – Corrective Action Modes (RTDCAM)

- The RTDCAM functions override the normal RTD executions, as determined by the NYISO Operators, to deal with "off-normal" power system conditions.
- In DA SCUC, RTD, and RTC, Multiple Ramp Rates and Limiting participation would be enabled while in the RTDCAM mode, the Limiting Participation flag would be used to limit the dispatch of the units that employ the flag until the start of the duct-firing range.
- If this unit, that employed the Limiting Participation flag, is already within the duct-firing mode providing energy, then the unit will not be dispatched any higher or lower from this level.
- This mode would still use the Emergency Response Rate and not the multiple ramp rates.
- This mode uses Linear Programming and introducing multiple ramp rates to this mode would introduce binaries which would in turn convert the Linear Programming problem into a Mixed Integer Programming problem which would take more time to converge.
- Since this mode is used by operators for off-normal power system conditions, it is important for this mode to converge quickly upon a solution and introducing MRR into this mode would increase the run time.

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Ramp Rates' Parameter Change Update

- Last year, NYISO suggested for MPs to utilize the consultation process, in response to biddable ramp rates, to change their units' ramp rates based on ambient conditions.
- NYISO will review these cases within the period of three business days as mentioned in the Market Participants User Guide (MPUG) for dealing with ramp rate consultation requests.

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Next Steps

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Next Steps

- **Feb**
  - Consumer Impact Analysis Methodology
  - Review final market design
- **March**
  - Consumer Impact Analysis Results
  - Draft Tariff Revisions
- **April**
  - Final Tariff review
  - BIC/MC Vote
  - Filing date TBD pending tariff/BIC/MC
- **End of Q3**
  - FRS Complete

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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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