Emissions Transparency: IMER Inputs' Walkthrough

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Agenda

- Background
- Implied Marginal Emission Rates' Methodology
- Walkthrough of the Inputs
- Next Steps

Definitions

- Marginal Emission Rates ("MER"): Change in CO_2 emissions resulting from an increase in generation or consumption.
- NYCA: New York Control Area
- RT: Real Time
- DAM: Day-Ahead Market
- NG: Natural Gas
- RTD: Real Time Dispatch
- RTD-CAM: Real Time Dispatch-Corrective Action Mode

Background

Background

- The Emissions Transparency project is a stakeholder requested project to publish marginal and average zonal emissions rates along with the LBMPs on a DAM and RT basis.

- We are targeting a 2023 Functional Requirements Specification (FRS) by the end of Q4.

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Proposed Methodology for Implied Marginal Emission Rates (IMERs)

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Implied Marginal Emission Rates' Proposed Methodology

- **The proposed methodology will be like the marginal emission rate calculation method discussed as part of the Carbon Pricing project in 2019.**
  - LBMP, fuel prices, emission costs and variable operating & maintenance ("VOM") costs will be used as inputs to estimate the implied heat rate. This implied heat rate will then be used to estimate the Implied MERs based on the implied marginal fuel.
  - The upper and lower boundaries for the implied heat rate will be set by using the minimum and maximum implied heat rates.
  - The implied marginal fuel will be determined to be liquid fuel or natural gas based on which fuel price is lower after the implied marginal gas fuel type is estimated for the zones based on limiting constraints mapped to reserve regions and historical analysis.
    - Limiting constraints identify persistent congestion patterns and thus enable IMERs to be calculated on a more granular level than NYCA-wide
  - The Implied MERs will be estimated on a zonal level for RT and DAM.

Proposed Methodology

- $$Implied\ Heat\ Rate\ (IHRi) = \frac{(LBMP\left(\frac{\$}{MWh}\right) - VOM\left(\frac{\$}{MWh}\right))}{Fuel\ Price\left(\frac{\$}{mmBTU}\right) + Emissions\ Cost\ \left(\frac{\$}{mmBTU}\right)}$$

- $Implied\ Heat\ Rate\ (IHRj) = 0\ if\ (IHRi < IHRmin)\ Else\ IHRmax\ if\ (IHRi > IHRmax)\ else\ IHRi$

- $Implied\ MER\ (Tons\ of\ Carbon\ per\ MWh) = Tons\ of\ Carbon\ per\ mmBTU\ * IHRj$

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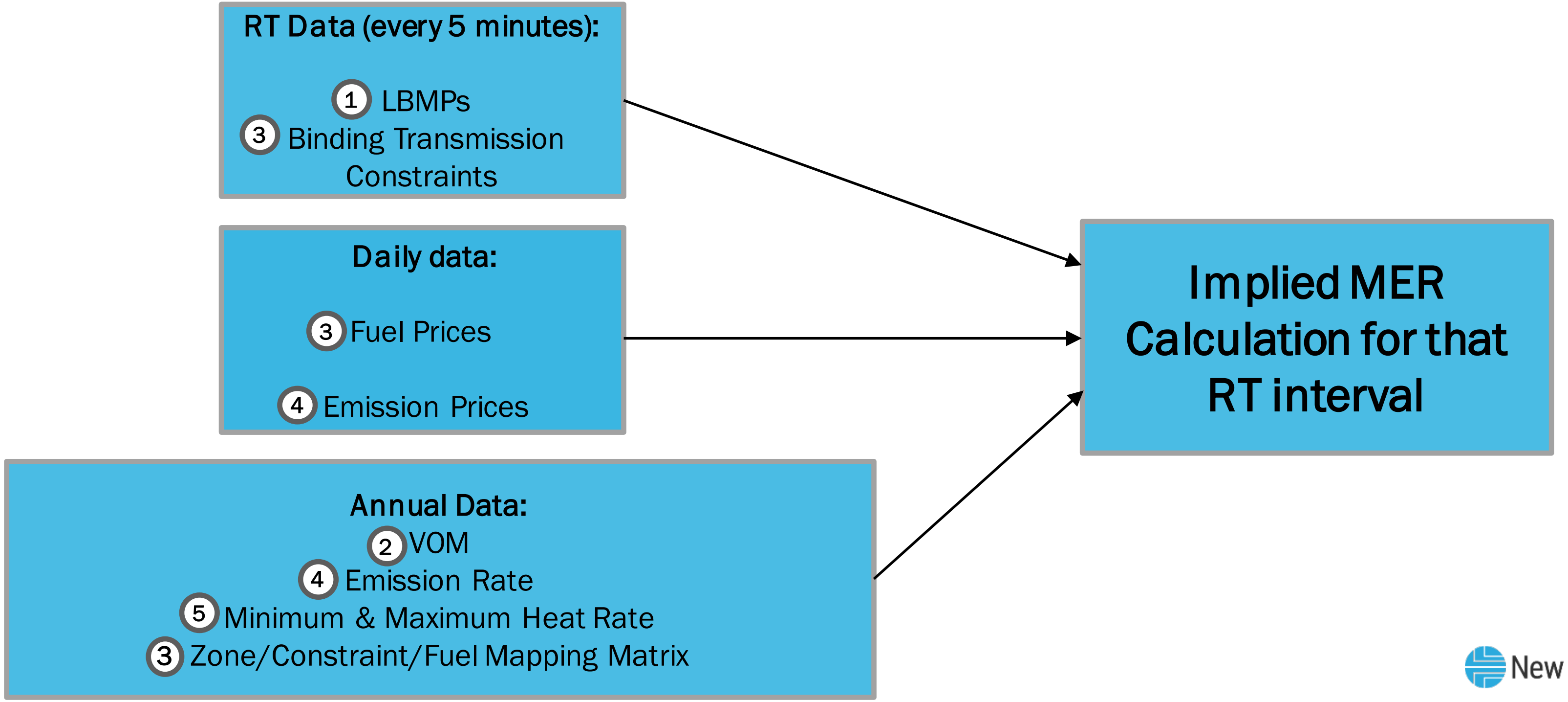
Proposed Methodology (For RT)



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Example

LBMP ($/MWh)	$50
Fuel Price ($/mmBTU) *(Marg. Fuel is NG)*	$4.5
Variable Operating and Maintenance Cost ("VOM") ($/MWh)	$4
Tons of Carbon per mmBTU *(for NG)*	0.059
Emissions Cost ($/mmBTU)	$2.36
Implied Heat Rate (mmBTU/MWh)	($50 - $4)/($4.5 + $2.36) = 6.71
MER (tons per MWh) *(Assuming the implied heat rate is within the bounds)*	6.71 * 0.059 = 0.40

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Walkthrough of the Inputs

1. Locational Based Marginal Prices ("LBMPs")

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- **Implied Marginal Emission Rates will be published for the Day-Ahead and Real Time markets**
  - Real Time IMER will use the financially binding zonal LBMPs from RTD and RTD-CAM, as posted.
    - LBMPs are calculated for the RT market on a 5-min basis for each zone, with additional RT LMBPs calculated during RTD-CAM events.
  - DAM IMERs will use the financially bindings zonal DAM LBMPs, as posted.
    - DAM LBMPs are hourly values
  - IMERs will be final upon posting and will not be revised in the event of a LBMP price correction

2. Variable Operations and Maintenance (“VOM”) Costs

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- The IMER calculation will use NYCA VOM values based on historic analysis of VOM
  - Analysis will be updated annually.
- The variable operations and maintenance ("VOM") cost is a cost that is a part of the supplier's bids which ultimately feeds into the LBMPs.
- The NYCA VOM will be calculated using a marginal weighted average approach which is laid out below.
  - The unique values of marginal units are listed for a given time period and the count of intervals, when these units are marginal, are determined.
  - A weight is assigned to these units based on the count of intervals and the VOM is then multiplied with the weight to calculate the weighted VOM for each of these units.
  - These weighted VOMs are added up to determine the marginal-weighted average VOM.

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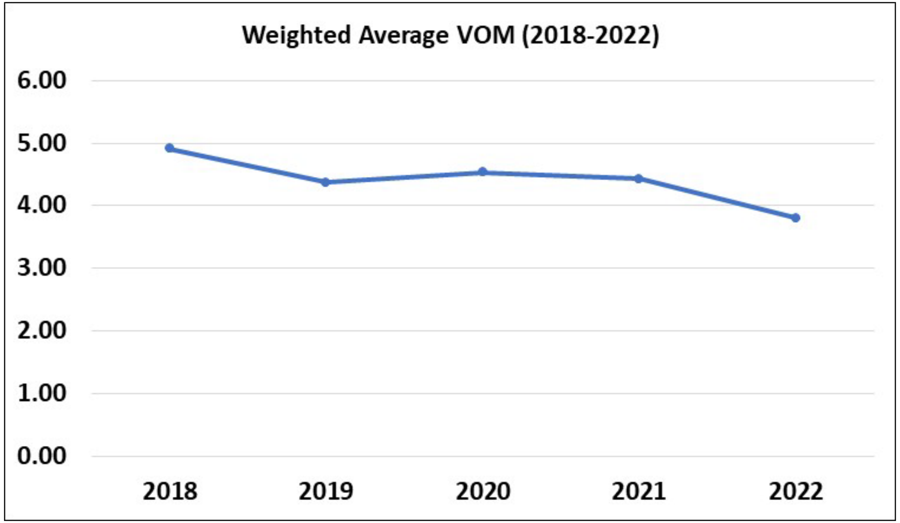
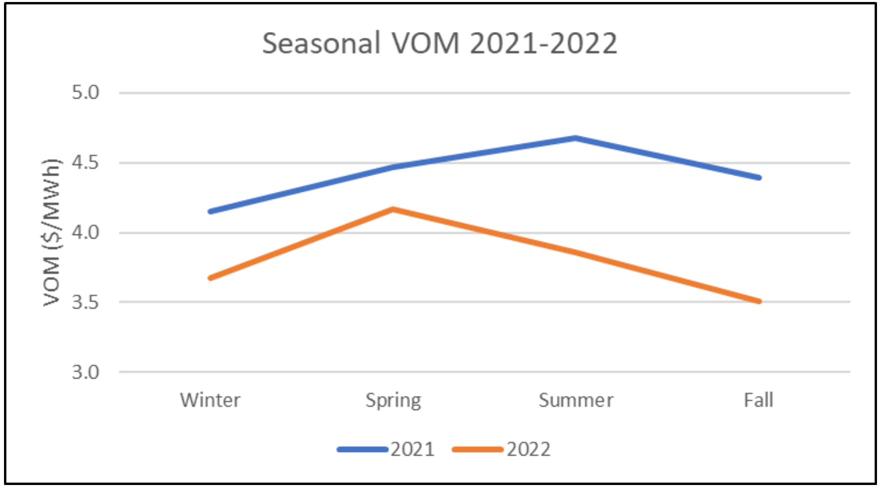
VOM Analysis





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VOM Analysis – Key Findings

- The VOM results aligned with expectations, validating the methodology used.
- There were no significant trends in VOM from 2018-2022.
- There was no significant seasonal trend for VOM results.

3. Fuel Prices

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- The fuel price for the implied marginal unit will be the posted fuel price for the relevant fuel type and price index
  - The fuel price index is determined based on transmission congestion patterns, as discussed on the next slide
    - Transmission congestion patterns and their relationship to marginal suppliers' fuel prices indices will be updated annually
  - The fuel type is the lower priced fuel of the relevant natural gas price index and the relevant liquid fuel price index
    - If the liquid fuel price is lower than the gas fuel type, then the liquid fuel price will be used in the calculation of the Implied Heat Rate and vice versa.

- Fuel price data are typically non-public (i.e., can be purchased through a vendor)

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Identifying the fuel price index

- Transmission congestion leads to having multiple marginal suppliers across the state.
- NYISO reviewed historical marginal supplier and transmission congestion data.
- NYISO also determined the fuel source (i.e., fuel price index) of the marginal suppliers
- From the above data, NYISO calculated marginal suppliers' most common fuel price index for a given set of transmission constraints.
- For example,
  - For a constraint such as the Central East Voltage Collapse (where we would expect one or more marginal units in Zones A-E and one or more marginal units in Zones F-K), if the most occurring marginal fuel types are NG Dominion NP for Zones A-E, and NG Iroquois Z2 for Zones F-K, then for this binding constraint, the marginal fuel type would be NG Dominion NP for Zones A-E and NG Iroquois Z2 for Zones F-K in that Zone/Constraint/Fuel mapping matrix.
- The methodology was evaluated for 2018-2022 for the months of January, July, and September to best represent winter, summer, and shoulder seasons, respectively.

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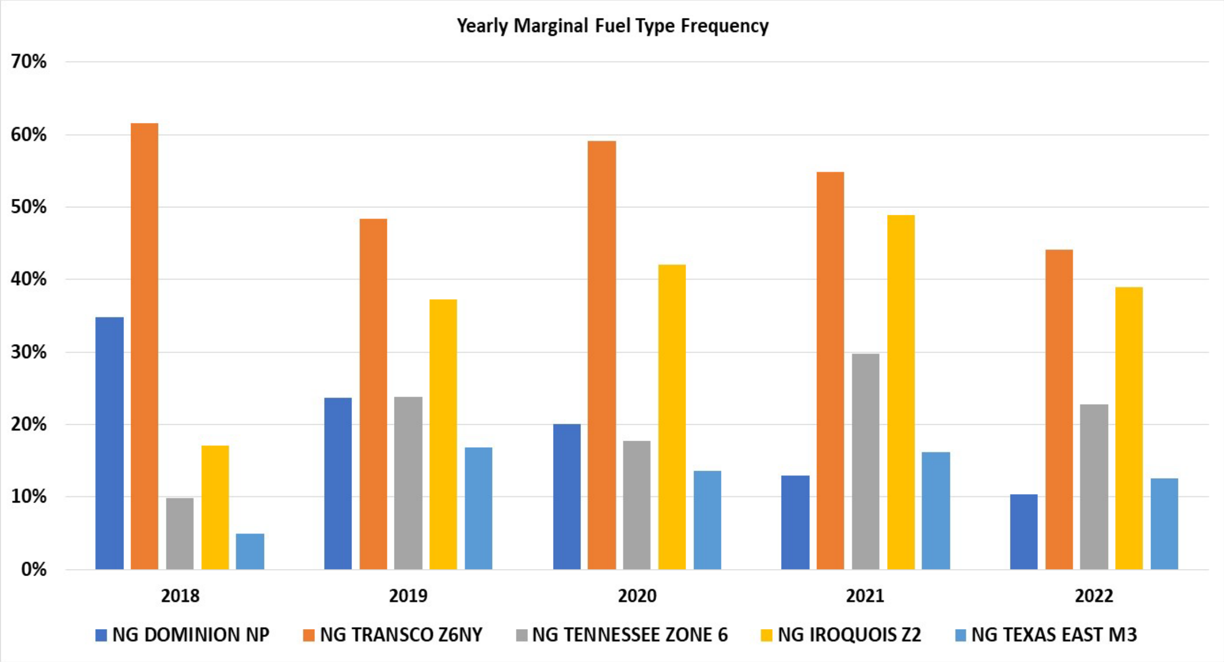
Identifying the fuel price index (2)

- The frequency of the top five most occurring marginal fuel types are plotted for 2018-2022 to understand how the frequencies are shifting between the fuel types during the study period.
- Over the years, NG Dominion NP has been steadily decreasing while NG Iroquois Z2 has been increasing except for between 2021 and 2022.
- NG Transco Z6 is the most occurring fuel type in the entire study period.
- NG Tennessee Zone 6's frequency has been almost equal to or greater than that of NG Dominion NP in all years after 2018.



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Identifying the fuel price index (3)

- Individual Matrices were constructed for January, July, and September for the years 2021 and 2022 to show the differences between these months to understand the seasonality of these matrices.
  - It was observed that the differences are very minor between the three matrices for the three months for 2021 and 2022.
  - Yearly matrices were also constructed for the years 2018-2022 by combining the data from the three months.
- This analysis indicates that the fuel price index of marginal suppliers is relatively predictable and changes in marginal suppliers' fuel prices indices are relatively smooth over time
- NYISO proposes to update the fuel price index analysis annually.

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4. Emission Costs

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- IMER calculation will account for emissions compliance costs for NOx and CO2
  - The emission rates will be updated annually while the emission prices will be used from the non-public source that is used for internal reference level calculations.
- The total emissions cost ($/MMBtu) is determined by summing up the products of the emission rates (tons/MMBtu) with the respective emission prices ($/ton)
- The NYCA wide emission rates for NOx and CO2 will be calculated using a marginal weighted average approach which is laid out below.
  - The unique values of the marginal units are listed for a given time period and the count of intervals, when these units are marginal, are determined.
  - A weight is assigned to these units based on the count and the emission rate is then multiplied with the weight to calculate the weighted emission rate for each of these units.
  - These weighted emission rates are added up to determine the marginal-weighted average emission rate.

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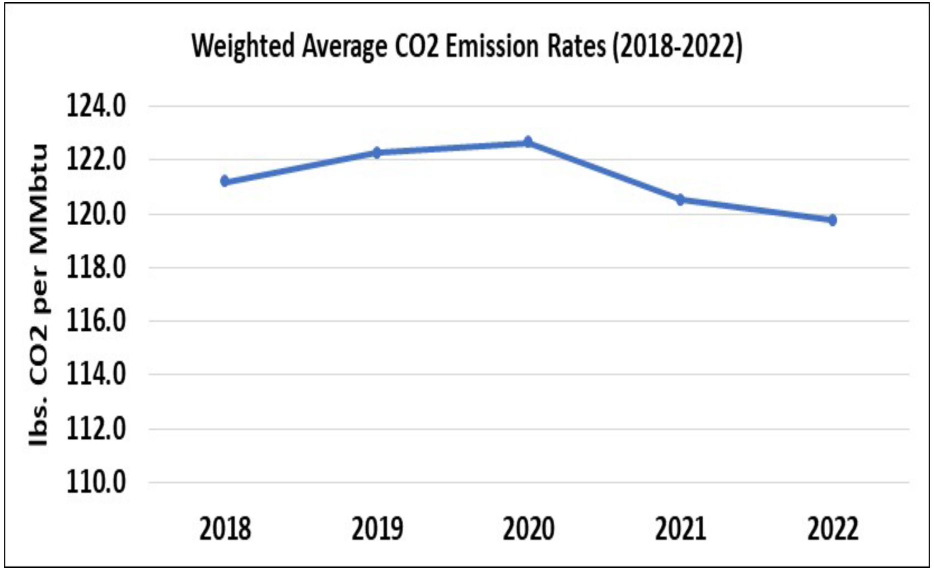
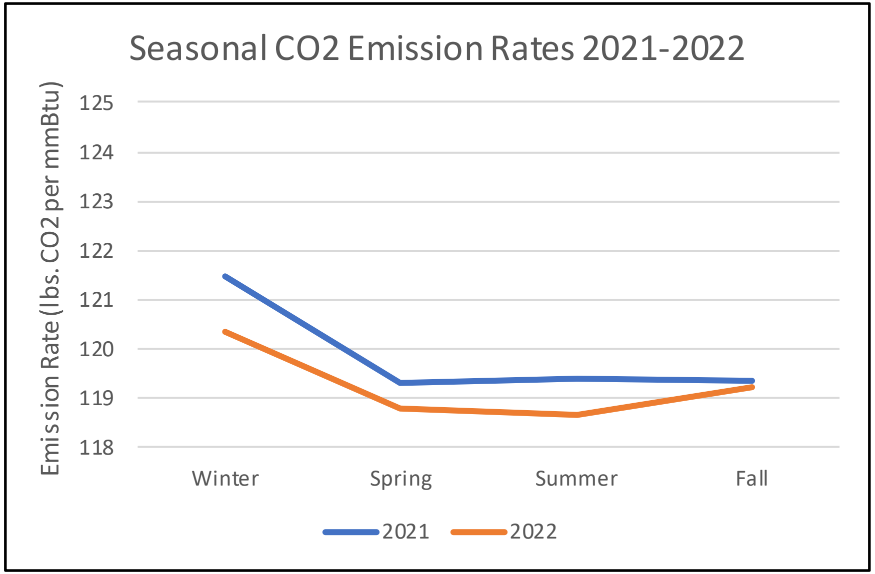
Emission Rate Analysis – CO2





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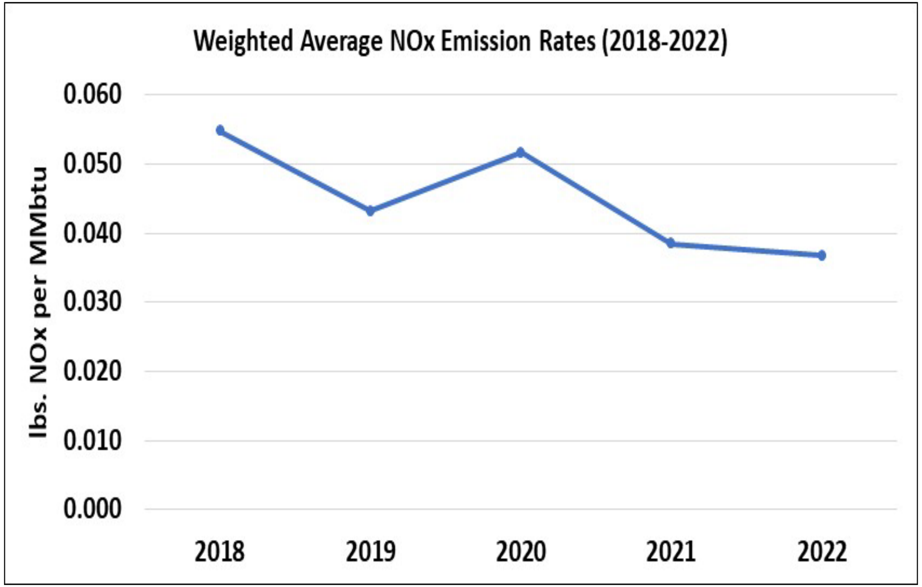
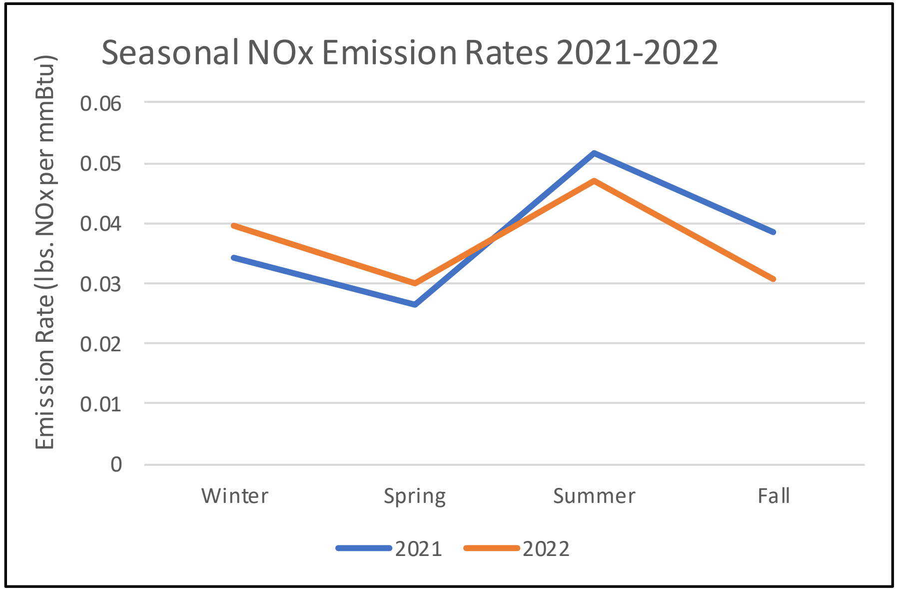
Emission Rate Analysis – NOx





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Emission Rate Analysis – Key Findings

- Emission Rate results aligned with expectations, validating the methodology used.
- There were no significant trends in Emission Rates from 2018-2022.
- There were slight trends based on season in CO_2 and NO_x emission rates.
  - CO_2 – Highest in Winter, consistent the rest of the year.
  - NO_x – Highest in Summer, consistent the rest of the year.

5. Maximum and Minimum Heat Rates

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- IMER calculation will use maximum and minimum heat rates determined based on the maximum and minimum heat rates of the fleet in a given study period.
  - The maximum and minimum heat rates will be updated annually.
- The maximum and minimum heat rates are used to set the upper and lower bounds to the implied heat rate calculated from the first step in the methodology.
- For example,
  - Shortage pricing could raise the LBMPs to high levels which in turn could result in unreasonably high implied heat rates. The maximum heat rate would help mitigate such conditions by limiting the implied heat rate to the upper limit.
  - During the intervals, when renewable resources are marginal, the LBMPs could be very low resulting in low implied heat rates which would be set to zero when below the minimum heat rate.

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6. Assumed Tons of Carbon per MMBtu

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- The assumed tons of Carbon per MMBtu is multiplied with the implied heat rate to determine the Implied Marginal Emission Rate (“IMER”).
- This input would be different for a liquid fuel and natural gas type.
- The emission rates used at the time of implementation would be consistent with the EIA estimates.
  - https://www.eia.gov/tools/faqs/faq.php?id=73&t=11

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Next Steps

Next Steps

- Finalize the project market design and bring it forward to an upcoming stakeholder meeting
- Draft the Functional Requirements Specifications – Target Completion Date Q4 2023

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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