New York ISO
Independent System Operator

Emissions Transparency – Average Emission Rates Proposal

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October 3rd, 2023

Agenda

- Background
- Implied Marginal Emission Rates
- Average Emission Rates
- Next Steps

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Background

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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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Recap from Previous MIWGs

- 4/17
  - Stakeholders were satisfied with proposed methodology for publishing zonal IMERs on a RT 5-min basis.
  - There was a request that we also publish for DAM which we are planning to post as well.
- 7/27
  - Stakeholders remained satisfied with the walkthrough of the inputs for the IMER methodology.
  - Stakeholders voiced concern with the proposal not to publish AERs.

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MER vs. AER

- **Marginal Emissions Rate (MER)**
  - Change in CO_2 emissions resulting from an increase in generation or consumption
  - Relevant for near-term consumption decisions
- **Average Emissions Rate (AER)**
  - Total CO_2 emissions divided by total MWh generated or consumed
  - Relevant for retrospective emissions accounting

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Implied Marginal Emission Rates (IMERs)

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Implied Marginal Emission Rates (IMERs)

- The IMER Design is complete and remains unchanged from the previous 7/27 MIWG presentation.
  - IMERs will be estimated for Day-Ahead and Real-Time on a zonal level
  - LBMP, fuel prices, emission costs and Variable Operating and Maintenance (VOM) costs will be used to estimate implied heat rate, which will then be used to estimate IMER.
    - $Implied\ Heat\ Rate\ (IHRi) = \frac{(LBMP\left(\frac{\$}{MWh}\right) - VOM\left(\frac{\$}{MWh}\right))}{Fuel\ Price\left(\frac{\$}{mmBTU}\right) + Emissions\ Cost\ \left(\frac{\$}{mmBTU}\right)}$
    - $Implied\ Heat\ Rate\ (IHRj) = 0\ if\ (IHRi < IHRmin)\ Else\ IHRmax\ if\ (IHRi > IHRmax)\ else\ IHRi$
    - $Implied\ MER\ (Tons\ of\ Carbon\ per\ MWh) = Tons\ of\ Carbon\ per\ mmBTU * IHRj$

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Average Emission Rates (AERs)

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Average Emission Rates (AERs)

- In response to Stakeholder feedback, NYISO proposes to initially publish two AERs, one NYCA-wide and another for the New York City (NYC) Load Zone
- AER values will be hourly average tons of carbon dioxide (CO_2) per MWh of generation.
- The AER calculation will use
  - Fuel-specific CO_2 content (See slide 11)
  - Average heat rate by fuel type (MMBtu/MWh), for CO_2 emitting resources (location specific, see slides 11, 17)
- AER values will be published and available retrospectively with a lag (e.g., AERs for June 1 – 30 will be available in August).
- The following slides provide additional details for the NYCA and NYC AER calculations.

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NYCA Fuel Types

Fuel Type	CO_2 Emitting	CO_2 Content (tons/mmbtu)	Heat Rate (mmbtu/MWh)
Natural Gas	Yes	0.059	9.7
Dual Fuel	Yes	0.061	12.9
Other Fossil Fuels	Yes	0.116	12.5
Nuclear	No	0	0
Wind	No	0	0
Hydro	No	0	0
Other Renewables	No	0	0

- Fuel Types are taken from the NYISO's existing RT Fuel Mix data.
- Dual Fuel CO_2 content determined through analysis (see slide 12)
- Average Heat Rate determined through analysis (see slide 13)
- Natural gas and liquid fuel CO_2 content from EIA
  - Natural gas
  - Liquid fuel

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Dual Fuel Historical Analysis

- A historical analysis was performed on the ratio of natural gas vs. liquid fuel usage by dual fuel units in the months of January, July, and September of 2022.
- The resulting percentages were used to determine an assumed carbon content for dual fuel units in the calculation of the AER, which shall be calculated and updated annually.

Fuel Type	Percentage	Carbon Content (tons CO_2/mmBtu)
Natural Gas	95.5%	0.059
Liquid Fuel	4.5%	0.119

$$Carbon\ Content = (0.95 * 0.059) + (0.045 * 0.119)$$

$$Carbon\ Content = 0.061$$

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NYCA-Wide Calculation Inputs

- **Generation (MW)**
  - RT fuel mix data with generation (MW) from natural gas, other fossil fuels, dual fuel units, and non-CO_2 emitting resources as well as the carbon content and average heat rate of each of these fuel types will be used in the calculation of hourly NYCA-Wide Average Emission Rates
- **Carbon Content (tons CO_2/mmBtu)**
  - Assumed carbon content for natural gas and liquid fuel are taken from the EIA.
  - Assumed carbon content for dual fuel units are estimated through historical analysis.
- **Average Heat Rate (mmBtu/MWh)**
  - Average Heat Rate was determined for Natural Gas and Liquid Fuel by averaging the heat rate of Natural Gas and Liquid Fuel units throughout the previous year. This value shall be updated annually.
  - Average Heat Rate for Dual Fuel units was estimated through historical analysis.

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Example: NYCA-Wide Calculation

Fuel Type Category	Generation (MW)	Carbon Content (tons CO_2/mmBtu)	Heat Rate (mmbtu /MWh)
Dual Fuel	2700	0.061	12.9
Natural Gas	1900	0.059	9.7
Other Fossil Fuels	5	0.119	12.5
Non-CO_2 Emitting Resources	6800	N/A	N/A

$$AER_{NYCA,h} = \frac{\sum Emissions_{NYCA,h}}{\sum Generation_{NYCA,h}}$$

$$AER_{NYCA,h} = \frac{(2700 * 0.061 * 12.88) + (1900 * 0.059 * 9.66) + (5 * 0.119 * 12.45)}{11405}$$

$$AER_{NYCA,h} = \frac{1994.74\ tons\ CO_2}{11405\ MWh}$$

$$= 0.17 \text{ tons of } CO_2 \text{ per MWh}$$

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NYC Calculator

$$AER_{h,NYC} = \frac{Emissions_{h,NYC} + Emissions_{h,Rest\ of\ NYCA} + Emissions_{h,PJM} + Emissions_{h,HQ}}{\sum(Generation_{h,NYC}, Imports)}$$

- **$Emissions_{h,NYC}$ and $Emissions_{h,Rest\ of\ NYCA}$ represent the carbon emissions from NYC's generation mix and from imports into NYC from the Rest of NYCA, respectively.**
  - Calculated by summing the product of each carbon-emitting fuel types carbon content, hourly MW, and heat rate.
- **$Emissions_{h,PJM}$ and $Emissions_{h,HQ}$ represent the carbon emissions from imports into NYC from PJM and from HQ, respectively.**
  - Calculated by multiplying the hourly import value (MW) by carbon intensity.
- **NYC generation, NYC and Rest of NYCA generation mix, and import values shall be updated within the calculator by the NYISO on an hourly basis.**
- **Carbon content and average heat rate for each fuel type shall be updated on an annual basis.**
- **Users of the calculator shall input the PJM and HQ import carbon intensity values in order to create the resulting output AER.**

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Definition of imports into NYC

- **Based on today's system. Will change if additional transmission capability is added to the system**
- **NYC imports from NYCA**
  - Flow on Sprain Brook-Dunwoodie South interface from Upstate
  - Flow on Jamaica-Valley Stream and Jamaica-Lake Success lines
- **NYC imports from PJM**
  - MW sink into NYC from Linden VFT, Marion-Farragut, Hudson-Farragut, Linden Goethals, HTP
- **NYC imports from HQ (expected)**
  - MW sink into NYC from Champlain-Hudson Power Express

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Example: NYC Calculator

Fuel Type Category	NYC Generation (MW)	Rest-of-NYCA Fuel Mix (MW)	Carbon Content (tons CO_2/mmBtu)	NYC Heat Rate (mmbtu/ MWh)	Rest-of-NYCA Heat Rate (mmbtu/MWh)
Dual Fuel	1000	1700	0.061	14.3	11.1
Natural Gas	800	1100	0.059	12.4	8.7
Other Fossil Fuels	5	0	0.119	16.7	12.2
Non-CO2	195	6605	N/A	N/A	
Total	2000	9405	-	-	

	Rest-of-NYCA	PJM	HQ
Emissions intensity (tons CO_2/MWh)	[(1700*0.061*11.1) +(1100*0.059*8.7)] /9405 = 0.18	0.3	0
Import Value (MW)	1000	1000	500

$$Emissions_{h,NYC} = (1000 * 0.061 * 14.27) + (800 * 0.059 * 12.43) + (5 * 0.119 * 16.18) = 1466.79 \text{ tons } CO_2$$

$$Emissions_{h,Rest\ of\ NYCA} = 1000 * 0.18 = 180 \text{ tons } CO_2$$

$$Emissions_{h,PJM} = 1000 * 0.3 = 300 \text{ tons } CO_2$$

$$Emissions_{h,HQ} = 500 * 0 = 0 \text{ tons } CO_2$$

$$\sum(Generation_{h,NYC}, Imports) = 2000+1000+1000+500=4500$$

$$AER_{h,NYC} = \frac{1466.79 + 180 + 300}{4500} = \mathbf{0.43\ tons\ CO_2\ per\ MWh}$$

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Next Steps

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Next Steps

- Return to stakeholders to review the Emissions Transparency design in its entirety
- Functional Requirements Specifications – Target Date Q4 2023

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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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