QCoefficient
Turning Buildings into Batteries™

Proposed Rules Regarding Local Law No. 97
Comments by QCoefficient, Inc.

November 7. 2024

Executive Summary

A proper hourly marginal carbon emission rate for NYC reveals and enables a very large and year-round Brooklyn/Queens emissions reduction.

A proper hourly marginal carbon emission rate reflects local NYC unit commitment decisions made by NYISO in the day-ahead market.

> Corollary: average emission rates derived from U.S. EPA data and the marginal emission rate formulated in LL97 lead to inefficient and even wrong capital and operating decisions by buildings. Similarly, LL97 emission rates undervalue local NYC energy efficiency and distributed PV.

Key Premise

Carbon emissions are largely decided for a given day when the New York Independent System Operator (NYISO) selects (a day in advance) which generating plants to turn on overnight. This day-ahead process is called security-constrained unit commitment (SCUC). The biggest and best opportunity to reduce CO_{2e} is to help NYISO drop the marginal generating plant from SCUC, that is, to drop the marginal Queens/Brooklyn baseload generating plant from SCUC every week.

This opportunity is signaled by a NYISO hourly marginal carbon emission rate that reflects unit commitment decisions made each day ahead.

By contrast, the "average" emission rates calculated by the U.S. Environmental Protection Agency and broadly used in the energy industry – whether for CO_{2e}, SO_2, NO_x or PM – are second best in two respects. The first and fatal flaw is that such rates reflect only the much smaller emissions reduction opportunities left over once the baseload generating plants have already been selected by SCUC and turned on. The second flaw is that average emission rates cannot time-differentiate – by season, day-of-week, or hour. Concerning emissions, when a building uses electricity is just as important as how much. Hourly marginal emission rates are highly variable.

Regarding buildings: proper hourly marginal carbon emission rates that reflect SCUC tell the building industry how to best invest in and operate buildings for greatest carbon reduction. "Hourly" distinguishes which hours are important to SCUC each week … and the many hours that are not important.

For energy efficiency and distributed photovoltaics: programs and technologies that affect SCUC have greater carbon reduction value than do programs and

technologies that only move the needle, that is, that only affect the incremental dispatch of already selected and operating baseload generating plants.

Coordinated action at scale: Removing generation from unit commitment each week requires coordinated action at scale – leveraging a portfolio of local PV, energy efficiency, energy storage and demand response capable of displacing 100 to 400 MW of local generation. Marginal CO_{2e} emission rates both reveal the opportunity and coordinate the necessary NYC capital and operating improvements. Anything other than a marginal emission rate undervalues and misdirects investment.

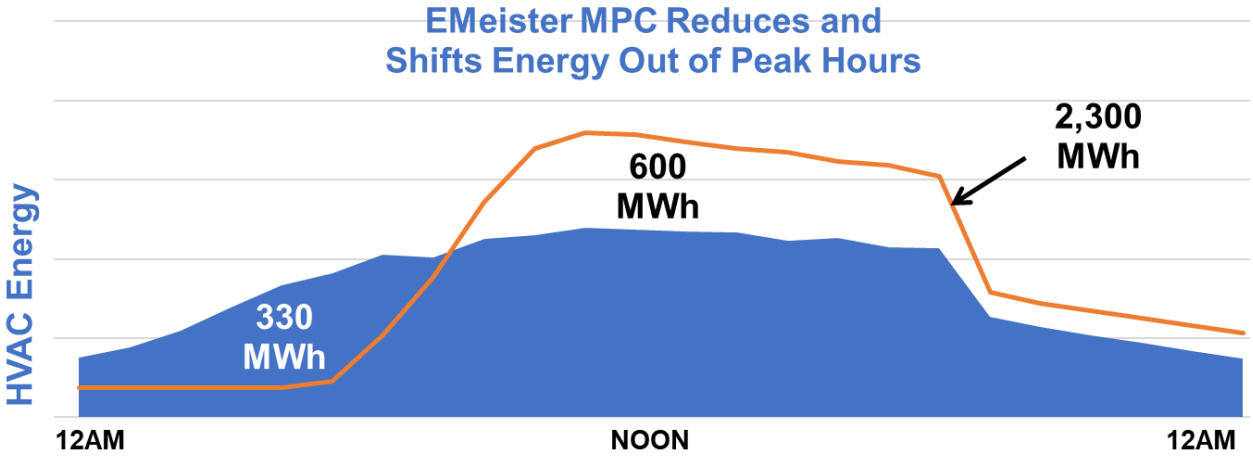
The two examples that follow provide numerical examples of the large opportunity revealed and enabled by marginal hourly carbon emission rates that capture SCUC

Local energy efficiency substantially reduces NYC SCUC and emissions

NYC buildings can reduce SCUC every week of the year through capital and operating improvements focused on:

- reducing weekly peak hours electric use (energy efficiency).
- shifting use out of weekly peak hours (storage).
- providing NYISO operating reserves during weekly peak hours (storage or DR).
- local distributed PV and its coincidence with weekly peak hours.

EMeister Model Predictive Control (MPC) does all four. EMeister MPC is one of many examples of an efficiency measure that affects SCUC day-ahead and therefore can make good use of marginal hourly CO_{2e} emission rates that reflect SCUC. Several examples of EMeister MPC actual performance in Chicago and New York City buildings can be found at https://www.buildingsasbatteries.com/.



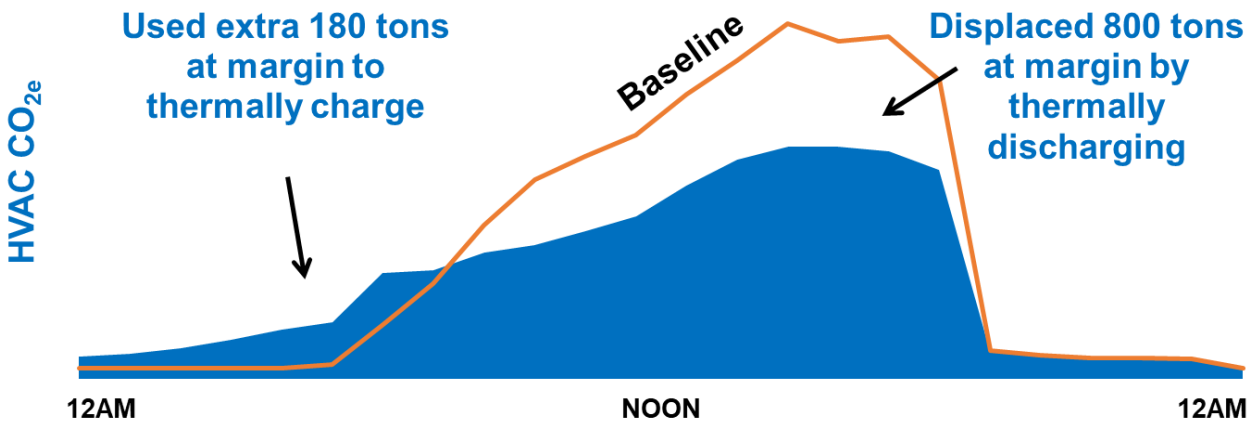
In this example, EMeister MPC was deployed in a LEED-rated 1 million sqft Manhattan headquarters in 2019. 2019 is important only because it is pre-Covid and QCoefficient had derived hourly carbon emission rates for that year from historical U.S. EPA data.

For a four-month cooling season, EMeister MPC reduced and shifted 600 MWh of HVAC electric use out of expensive, inefficient and high emissions occupancy hours. To

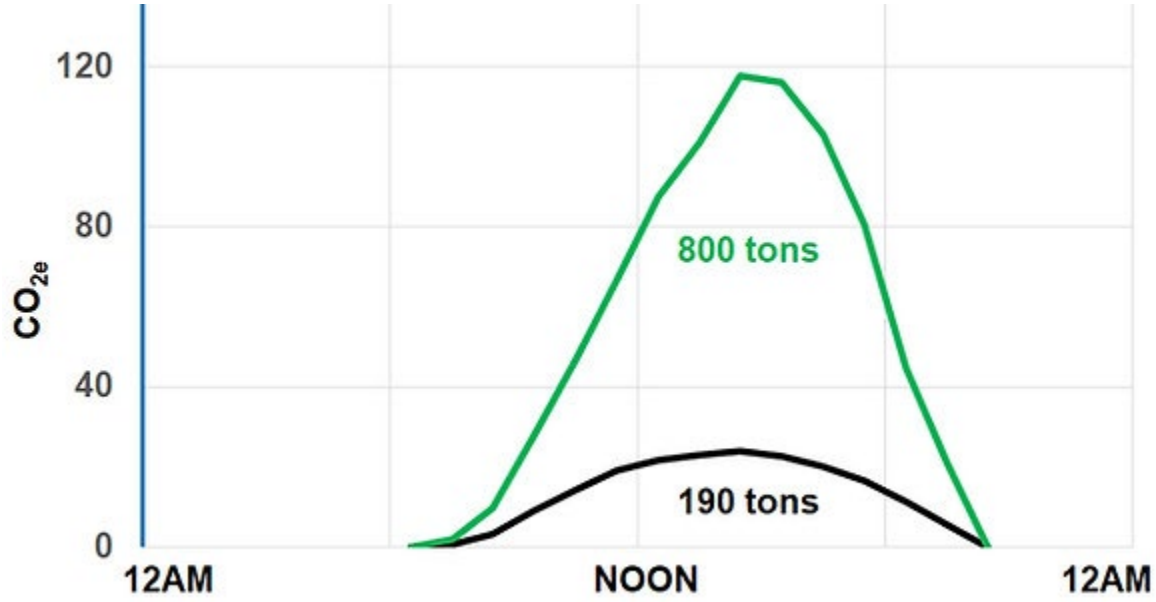
achieve this result, EMeister MPC used an additional 330 MWh to precool and subcool the building during inexpensive, efficient and low emissions pre-occupancy hours.

The LL97 carbon footprint for this building HVAC was 663 tons. Reference: Administrative Code section 28-320.3.1.1

Using corresponding marginal hourly carbon emission rates that reflect SCUC decisions made by NYISO in the day-ahead market, EMeister MPC reduced carbon emissions at the margin by 620 tons (800 – 180). Again, the carbon emissions reduction was a byproduct of reducing the electric bill (especially peak demand and energy) by several hundred thousand dollars and at no capital expense.



Local photovoltaics substantially reduces NYC SCUC and emissions



In this example, again in 2019, 1 MW of distributed PV located in Manhattan would have

generated 660 MWh and displaced 800 tons of CO_{2e} (green line) during the 2019 cooling season (June 10 to September 29). The PV azimuth (230°) and tilt (25°) were selected to maximize PV production during ConEd distribution system peak hours.

The 800 tons of CO_{2e} was displaced by helping remove the Brooklyn/Queens marginal baseload generator from NYISO SCUC each week.

For reference, instead simply assuming that the 660 MWh is credited against building electric load at an average emission rate of 0.000288962 tCO_{2e}/kWh, the PV is valued at 190 tons (black line). Reference: Section 28-320.3.1.1 of the NYC Administrative Code.

For detailed information regarding how QCoefficient reverse-engineered 2019 marginal hourly carbon emission rates, see QCoefficient, Inc., December 2020. "An analysis of New York's Summer 2019 fossil-fueled electric generation demonstrates that NYC commercial office buildings can dramatically reduce carbon emissions."

"Using eGrid for Environmental Footprinting of Electricity Purchases"

This U.S. EPA publication excellently documents a method for using average regional emission rates for footprinting. For example, for NYC for 2020, EPA recommends use of an average CO_{2e} emission rate of 636.0 lbs/MWh or 0.32 tons/MWh for footprinting. For evaluating the effect of efficiency measures at the margin, this same method recommends use of an average fossil fuel CO_{2e} emission rate of 971.4 lbs/MWh or 0.49 tons/MWh. This rate is "marginal" in that it properly reflects that efficiency measures reduce fossil plant operation, that is, do not reduce nuclear or renewable plant operation. However, this rate implicitly reflects the real-time market, and not the opportunity provided by SCUC in the day-ahead market. This EPA rate also does not reflect time-of-use. The EPA does not have the local expert ISO knowledge needed to capture time-of-use or SCUC for marginal emission rates.

References to CO_{2e} footprint throughout this document and the QCoefficient website are based on this document. More specifically,

> ***Huetteman, Justine, Travis Johnson, and Jeremy Schreifels. "Using eGRID for Environmental Footprinting of Electricity Purchases." U.S. EPA. 2020.**