STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASE 16-E-0060 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service.

Con Edison Outcome-based EAM Collaborative: Emissions Metric Report

April 30, 2018

COLLABORATIVE PARTICIPANTS

Acadia Center, Association for Energy Affordability, Inc., City of New York, Consolidated Edison Company of New York, Inc., Consumer Power Advocates, E Cubed, EnerNOC, Environmental Defense Fund, New York Energy Consumers Council, New York State Department of Public Service, New York Metropolitan Transportation Authority, Pace Energy and Climate Center, and Utility Intervention Unit

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1. Background

The Public Service Commission's ("Commission") *Order Approving Electric and Gas Rate Plans* ("Order") in these proceedings adopted program-achievement based and outcome-based earnings adjustment mechanisms ("EAMs") for Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company").[1] The EAM concept was introduced in the Reforming the Energy Vision ("REV") proceeding and formalized in the REV Track 2 Order.[2]

Program-achievement based EAMs are designed to incentivize the Company to deliver higher levels of energy and demand savings through its direct efforts implementing its energy efficiency and demand management programs. The programmatic EAMs incentivize incremental annual energy ("GWh") savings and incremental annual system peak demand ("MW") reductions.

Outcome-based EAMs seek to incentivize the Company to facilitate activities linked to desired outcomes within the entire Con Edison service territory regardless of whether such activities result solely from the Company's efforts or are facilitated through broader actions by other market actors.[3] The initial outcome-based EAMs developed in the rate proceeding are Distributed Energy Resource ("DER") Utilization, Energy Intensity, and Customer Load Factor, with details to be worked out and developed through a collaborative process with interested parties ("the Collaborative").

The rate plan approved by the Commission broadly defined the goals and fixed the overall incentive amounts related to outcome-based EAMs and deferred the details to the Collaborative. The Collaborative commenced in September 2016, and most of the Collaborative members filed *Comments Supporting Resolution of Outcome-based EAM Collaborative Issues* ("Collaborative Report") on November 2, 2016,[4] with opposing parties filing separate comments, and the Commission approved the Collaborative's recommendations in the Order.[5] The Order established the EAMs and associated metrics, targets and incentives for Rate Year ("RY") 1.

The Collaborative parties met in person or by phone on several occasions from June through August 2017, and filed their consensus *2017 Outcome-based EAM Collaborative Report* on August 23, 2017, with metrics,[6] targets and incentive levels, for RY2 EAMs.[7]

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[1] Case 16-E-0060, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service*, Order Approving Electric and Gas Rate Plans ("Order") (issued January 25, 2017).

[2] Case 14-M-0101, *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision*, Order Adopting a Ratemaking and Utility Revenue Model Policy Framework (issued May 19, 2016) ("Track 2 Order").

[3] These EAMs seek to influence and measure outcomes based on metrics and incentivize the Company to facilitate achievement of targets associated with those metrics.

[4] Case 16-E-0060, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service*, Comments Supporting Resolution of Outcome-based EAM Collaborative Issues ("Collaborative Report") (filed November 2, 2016).

[5] Order, p. 82.

[6] The term "metric," as used in this report and as used in the Collaborative materials and reports more broadly, refers to the measurable factor that is related to the outcome for which a specific achievement is being sought.

During the 2017 outcome-based EAM discussions, some Collaborative parties expressed interest in developing an outcome-based Greenhouse Gas ("GHG") or carbon dioxide equivalent ("CO_2e") emissions related metric for consideration in RY2 or RY3. The Collaborative parties agreed to develop such a metric (either as an EAM or scorecard) to capture GHG emissions reductions achieved in the Company's service territory and to consider measures of all types, such as energy efficiency, load shifting, distributed energy resources such as batteries and heat pumps, beneficial electrification of end uses, and behavioral changes.

2. 2017-18 Outcome-based Emissions EAM Collaborative Consensus and Participation

On September 29, 2017, the Collaborative reconvened to develop an outcome-based GHG emissions reduction ("Emissions") metric. Parties participating in all or some of the 2017-18 Collaborative meetings included Acadia Center, Association for Energy Affordability, Inc., City of New York ("NYC"), Con Edison, Consumer Power Advocates, E Cubed, EnerNOC, Environmental Defense Fund, New York Energy Consumers Council, New York Metropolitan Transportation Authority ("MTA"), New York State Department of Public Service ("Staff"), Pace Energy and Climate Center, and Utility Intervention Unit.

Parties that have indicated their affirmative support for the proposal outlined in this document include Acadia Center, Association for Energy Affordability, Inc., Con Edison, Consumer Power Advocates, E Cubed, EnerNOC, Environmental Defense Fund, MTA, NYC, Pace Energy and Climate Center, and Staff. Parties that neither support nor oppose the proposal include New York Energy Consumers Council and Utility Intervention Unit. No parties oppose the proposal.

The Collaborative met six times, starting in September 2017 and on an approximate monthly basis, to better understand GHG emissions in the Company's service territory and GHG emissions impacts of different technologies and practices in order to develop a scorecard[8] for RY2 and to better inform the RY3 collaborative that will consider development of metrics, targets, and incentive levels for outcome-based EAMs, as well as any appropriate scorecards, in RY3. The Collaborative parties intend to reconvene before the summer of 2018 to define the RY3 EAM metrics, targets, and incentive levels.

Metrics can be used for tracking performance only, for example in the form of a scorecard, or can be assigned monetary incentives, for example in the form of an EAM.

[7] Case 16-E-0060, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service*, 2017 Outcome-based EAM Collaborative Report (filed August 23, 2017).

[8] Scorecards are generally used to track metrics that parties are interested in for informational purposes (see footnote 6 for "metric"), and are distinct from EAMs that both track the metric and are tied to incentives related to how that metric registers relative to target levels.

3. Greenhouse Gas Emissions Reduction Metric and Scorecard

a. Summary

The Collaborative discussions resulted in a consensus regarding the structure of the emissions-related EAM metric. The Collaborative parties agreed that a targeted approach, focused on specific technologies and practices with beneficial emissions impacts, would form the basis of a primary emissions-related outcome-based EAM metric for RY3 (and as a scorecard only in RY2) to encourage Company actions to reduce emissions. The targeted approach measures annualized avoided kilograms ("kg") of CO_2e emissions from specific interventions in the Company's service territory. Although the targeted approach will capture the impact of some technologies also found in the Company's Distributed Energy Resource ("DER") Utilization EAM, the Collaborative agreed that it is necessary to include those technologies in an Emissions EAM for the following reasons: (i) the technologies provide emissions benefits that the consensus parties seek to facilitate; (ii) scorecards and outcome-based metrics can and should capture territory-wide impacts such as those from the New York State Energy Research and Development Authority ("NYSERDA") and other utility activities and programs; and (iii) the overlap between technologies that are the largest contributors to DER Utilization and those that are the largest contributors to the emissions EAM metric are generally minimal.[9] Additionally, it was agreed that total annual energy efficiency savings would not be included in the emissions EAM metric since it is a large contributor to the Energy Intensity EAM metric and the programmatic energy efficiency EAM metric, and would likely be a large contributor to the Emissions EAM if included.

A broader approach, initially based on components of the annually-published New York City GHG Inventory,[10] would form the basis for a scorecard metric (both in RY2 and RY3 using the most recent data available) that will seek to provide insights, over the longer term, into GHG emissions from a wider perspective in the Company's service territory. The broad approach measures total annual CO_2e emissions associated with energy consumption by customers in Con Edison's service territory.

The Collaborative agreed that the broad approach would be further investigated to determine the appropriateness of its continued use as a scorecard and/or evolution into an alternate GHG emissions EAM metric. The following sections describe each approach in additional detail.

[9] The overlapping technologies include battery storage, electric vehicles, solar photovoltaics, and ice energy storage. The DER Utilization measurement methodologies are primarily weighted based on their expected capacity factors or annual energy, which are lower for these overlapping technologies. Consequently, they are not expected to be the larger contributors to the DER Utilization metric. The largest contributors to the DER Utilization metric are expected to be high capacity factor technologies such as combined heat and power and fuel cells, neither of which are included in the Emissions metric discussed in this document.

[10] The New York City GHG Inventory is compiled in accordance with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories BASIC Level, which covers emissions sources from stationary energy (buildings), in-city transportation, and waste generated in-city. It is updated each year and the most recent version can be found as an Appendix III to 1.5°C: Aligning New York City with the Paris Climate Agreement, available at: http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmt-02282018_web.pdf

b. Targeted Approach

i. Discussion

The targeted approach addresses annualized avoided kg CO_2e from rooftop and community solar photovoltaics ("PV"), electric vehicles ("EV"), air-source heat pumps ("ASHP"), ground-source heat pumps ("GSHP"), battery storage, ice energy storage, electric water heaters, wind energy, and voluntary renewable energy certificates ("VREC"). These technologies, or market activity in the case of VRECs, were selected due to their beneficial emissions impacts.[11]

ii. Measurement

To standardize measurement across technologies, all measurements for the targeted approach will be in annualized avoided kg CO_2e using the formulae described in this section. For each DER type, Con Edison will determine annualized avoided kg CO_2e from incremental[12] resources as follows:

Total Avoided Emissions (kg CO_2e) = Rooftop Solar PV annualized avoided kg CO_2e
+ Community Solar PV annualized avoided kg CO_2e
+ Electric Vehicle annualized avoided kg CO_2e
+ Heat Pump (ASHP and GSHP) annualized avoided kg CO_2e
+ Battery storage annualized avoided kg CO_2e
+ Ice energy storage annualized avoided kg CO_2e
+ Electric heat pump water heater annualized avoided kg CO_2e
+ Wind energy annualized avoided kg CO_2e
+ Voluntary REC annualized avoided kg CO_2e

Kilograms CO_2e are treated as positive values with the sum of avoided kg CO_2e emissions determining achievement. The avoided emissions measurements use electricity emissions factors of Grid kg CO_2e per Megawatt-hour ("MWh") and/or Peak kg CO_2e per MWh, and other technology-specific factors, to determine annualized avoided kg CO_2e. For the purposes of the Emissions EAM, the Grid kg CO_2e value is the average 2015 New York City emissions factor from the 2017 New York City GHG Inventory.[13] The Peak kg CO_2e per MWh value is sourced from the Environmental Protection Agency's ("EPA") Emissions & Generation Resource Integrated Database ("eGRID") for the Northeast Power Coordinating Council ("NPCC") NYC/Westchester subregion.[14]

[11] Broad energy efficiency has significant beneficial emissions impacts, but was not selected for the Emissions EAM metric because it is already directly or indirectly supported through the Company's programmatic or existing outcome-based EAMs.

[12] For each DER technology in the Emissions EAM for which interconnection to the Company's electric delivery system is required, incremental resources, for the purposes of determining achievement under this EAM, are defined as all DERs belonging to the respective technology that becomes electrically connected to the Con Edison delivery system during the rate year.

[13] Listed in Appendix H, methodology in Appendix B, http://www.dec.ny.gov/docs/administration_pdf/nycghg.pdf

[14] https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Because not all DERs are individually metered or measured, annualized kg CO_2e emissions avoided from incremental DERs will be determined using the formulae and assumptions described below. Additional measurement details can be found in Appendix A.

Rooftop Solar Photovoltaics

The rooftop solar PV[15] measurement will include all incremental rooftop solar PV installations as summed at the end of the rate year. End-of-year incremental installed capacity will be tracked from interconnected rooftop solar PV submitted through the New York State Standardized Interconnection Requirements ("NYS SIR") process.[16] The Company will count these rooftop solar PV installations toward the Emissions EAM metric when it submits a final interconnection letter to the customer noting that all interconnection work has been completed, which enables the rooftop solar installation to begin operating as part of the overall Con Edison delivery system.

Each PV installation reduces GHG emissions by avoiding energy (MWh) that would have been generated and supplied by the wholesale markets. The Company's service territory is supplied by a mix of generation sources including those with GHG emissions. Every MWh generated by the PV system can thus be assumed to displace an equivalent amount of wholesale generation, consequently avoiding GHG emissions. Annualized avoided kg CO_2e emissions from rooftop solar PV[17] installations will be determined by calculating the annual output of the PV system in MWh and multiplying by the average emission intensity of wholesale supply.

$$(MW\ solar\ PV) * (14.1\%\ Capacity\ factor) * (Annual\ Hours) * \left(\frac{Grid\ kg\ CO_2e}{MWh}\right)$$

Where:

MW solar PV	The MWs of solar PV installed and that can be expected to have begun operations in the Company's service territory in the rate year
Annual Hours	8,760
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

Community Solar Photovoltaics

The community solar PV measurement will include all incremental community solar PV installations as summed at the end of the rate year. End-of-year incremental installed capacity will be tracked from interconnected community solar PV submitted through the NYS SIR process. The Company will count

[15] As used herein, "rooftop solar PV installations" include pad- and pedestal-mounted solar PV installations.
[16] The customer is allowed to commence parallel operation of its DER upon satisfactory completion of witness testing (a step in the SIR), which occurs prior to the Company issuing the final interconnection letter.
[17] Case 15-E-0751, *In the Matter of the Value of Distributed Energy Resources*, Copy of Solar Simulations for DPS (October 28, 2016).

those community solar PV installations toward the Emissions EAM metric when the Company submits a final interconnection letter to the customer noting that all interconnection work has been completed, which enables the community solar installation to begin operating as part of the overall Con Edison delivery system.

The methodology for the community solar PV avoided GHG calculation is the same as the rooftop solar PV calculation except for a higher capacity factor. Annualized avoided kg CO_2e emissions from community solar PV[18] installations will be calculated as:

$$(MW\ solar\ PV) * (15.5\%\ Capacity\ factor) * (Annual\ Hours) * \left(\frac{Grid\ kg\ CO_2e}{MWh}\right)$$

Where:

MW solar PV	The MWs of solar PV installed and that can be expected to have begun operations in the Company's service territory in the rate year
Annual Hours	8,760
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

Electric Vehicles

The EV measurement will consider incremental EV registrations in the Company's service territory in the rate year. The Company tracks registrations in its service territory provided to it by the NYSERDA, which receives information from the New York State Department of Motor Vehicles.

Electric vehicles reduce GHG emissions because GHG emissions associated with the electricity used by EVs for New York City and Westchester are lower than GHG emissions resulting from a gasoline-based internal combustion engine. The formula below calculates the net avoided GHG emissions from replacing an internal combustion engine vehicle with an EV.

$$(EVs) * \left(\frac{Annual\ MWh}{EV}\right) * \left(\frac{mile}{MWh}\right) * \left(\frac{kg\ CO2e}{mile_{ICE\ Vehicle}} - \frac{kg\ CO2e}{mile_{EV}}\right)$$

Where:

EVs	The number of EVs registered in the Company's service territory in the rate year
Annual MWh / EV	The annual MWh consumed by an EV at charging locations, based on assumptions identified in Appendix A.

[18] *Id.*

Mile / MWh	The average number of miles associated with one MWh of EV discharge
kg CO_2e / $Mile_{ICE\ Vehicle}$	The emissions associated with one mile travelled in an internal combustion engine vehicle
kg CO_2e / $Mile_{EV}$	The emissions associated with one mile travelled in an EV, using the average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

The above formula is applicable to light duty electric vehicles. Going forward, the Company will seek to develop emissions benefits associated with heavy duty and transit electric vehicles for the purposes of the Emissions EAM metric.

Heat Pumps

The heat pump measurement will consider all incremental air-source heat pumps ("ASHP") and ground-source heat pumps ("GSHP") installations as summed at the end of the rate year. End-of-year incremental installed units will be tracked through Company activity and NYSERDA reported installations.

Emissions benefits related to heat pump installations depend on the existing heating and cooling technology they are replacing or the heating and cooling technologies that would have otherwise been installed. However, for the purposes of the EAM, the Collaborative has developed a single framework for calculating avoided GHG emissions associated with heat pumps, which can be expected to be representative of heat pump installations in Company territory.

The annualized avoided kg CO_2e emissions from ASHP and GSHP installations will be determined by calculating the net cooling and heating emissions impact. The ASHP and GSHP calculations will be conducted separately using the below formula, but with varying input values (see Appendix A). The net cooling emissions impact calculates the avoided MWhs of consumption and applies the average grid emission intensity to determine the kg CO_2e avoided. The net heating emissions impact calculates the avoided emissions from replacing a natural gas or fuel oil fired heating system while accounting for the increased emissions associated with the increased electricity consumption by the heat pump.

$$(Heat\ Pump\ Units) * \left[\begin{array}{c} \left(\frac{MWh\ Cooling\ Avoided}{Unit\ Heat\ Pump} * \frac{Grid\ kg\ CO_2e}{MWh}\right) \\ + \left(Avoided\ Dth * \frac{kg\ CO_2e}{Dth}\right) \\ + \left(Avoided\ gallons * \frac{kg\ CO_2e}{gallon}\right) \\ - \left(\frac{MWh\ Heating\ Consumed}{Unit\ Heat\ Pump} * \frac{Grid\ kg\ CO_2e}{MWh}\right) \end{array} \right]$$

Where:

Heat Pump Units	The number of heat pumps (ASHPs and GSHPs) installed in the Company's service territory in the year of the EAM
MWh Cooling Avoided	The reduction in MWh consumed for cooling due to switching to an ASHP or GSHP from a less efficient air-conditioning system
Avoided Dekatherms ("Dth")	The reduction in Dth of natural gas consumed for heating due to switching to an ASHP or GSHP from a natural gas fired heating system
Avoided gallons	The reduction in gallons of fuel oil consumed for heating due to switching to an ASHP or GSHP from a fuel oil fired heating system
kg CO_2e / Dth	The emission intensity of burning natural gas (Dth)
kg CO2e / gallon	The emission intensity of burning fuel oil (gallons)
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined
MWh Heating Consumed	The increase in electric consumption for heating due to replacing a natural gas fired heating system with an ASHP or GSHP

For the purposes of this EAM metric, it is assumed that 80 percent of heat pumps replace a window air conditioning ("AC") unit, and 20 percent of heat pumps replace central air conditioning for the cooling season.[19] For the heating season, each heat pump replaces its equivalent amount of heating load as from a natural gas or fuel oil fired furnace. Also for the purposes of this EAM metric calculation, 70 percent of heat pump installations will replace its equivalent amount of heating load from a natural gas fired furnace, and 30 percent of heat pump installations will replace its equivalent amount of heating load from a fuel oil fired furnace.

To assist in the development of this metric and to understand the reasons heat pumps are being installed, and their resulting emissions reductions, the Company will, to the extent possible, in its EM&V evaluation of heat pump installations and/or market research activities[20] collect empirical data on or estimate the following: (i) the basis of the decision to install a heat pump; (ii) the nature and type of equipment that is being removed; (iii) full replacement or displacement the existing heating equipment, and fuel source used for existing heating (electricity, natural gas, fuel oil, other); (iv) whether the

[19] The cooling and heating replacement scenarios are based on the U.S. Census Bureau's 2015 American Housing Survey data for New York City, which may not include data from Westchester County and may include data from Newark and Jersey City, New Jersey, but is generally representative of installations in Company territory.
[20] Including the joint efforts of the City, the Company, and NYSERDA currently underway.

customer previously had one or more air conditioners, and if so, what type; and (v) the type of heat pump being installed (e.g., split vs packaged, single or multi zone, ducted or ductless). Stakeholders participating in the Collaborative expressed interest in gathering as much information as possible related to heat pump installations in the Company's territory.

Battery Storage

The battery storage measurement will include all incremental battery installations as summed at the end of the rate year. End-of-year incremental installed capacity will be tracked from interconnected battery storage submitted through the NYS SIR process. The Company will count those battery installations toward the Emissions EAM when the Company submits a final interconnection letter to the customer noting that all interconnection work has been completed, which enables the battery installation to begin operating as part of the overall Con Edison delivery system.

Battery storage systems are generally used to reduce a facility's electric demand during peak usage times. As a result, battery storage systems avoid GHG emissions by discharging when the emissions intensity of the grid is higher and charging during times when grid emissions are lower. The methodology below calculates the avoided emissions from discharging the battery at peak times and subtracts the emissions associated with charging the battery. The emissions associated with charging are adjusted by the round-trip efficiency of the battery because some electricity is lost in the storage-to-discharge cycle of the battery storage system.

$$(MW\ inverter\ rating) * \left[\left((Discharge\ time\ per\ day) * (365\ days\ per\ year) * \left(\frac{Peak\ kgCO_2e}{MWh}\right)\right) - \left(\frac{(Charge\ time\ \ per\ day) * (365\ days\ per\ year) * \left({}^{Grid\ kgCO_2e}/_{MWh}\right)}{83\%\ Round\ Trip\ Efficiency}\right)\right]$$

Where:

MW inverter rating	The MWs of capacity of the battery storage system, at the inverter
Discharge time per day	The hours per day a battery storage system discharges[21]
Charge time per day	The hours per day a battery storage system charges
Peak kg CO_2e / MWh	The emission intensity associated with peak electric demand from the EPA eGRID for the NPCC NYC/Westchester subregion
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

[21] The Company will work to refine battery charge and discharge characteristics through battery projects in its service territory for which data is available.

Round Trip Efficiency	The efficiency of a battery storage system reproducing the electricity it consumed during charging

Ice Energy Storage

The ice energy storage measurement will consider all incremental ice energy storage (i.e., excluding chillers that do not utilize storage to shift load) as summed at the end of the rate year. Project specifications will be collected through the Company's Incremental System Peak MW Reduction and Non-Wires Solutions ("NWS") programs, including the 2019 Demand Management Program. If a project is installed outside of these programs, the Company will try to obtain the required information from the companies or customers involved.

Annualized avoided kg CO_2e emissions from ice energy storage are calculated as explained below. Analogous to batteries, ice energy storage reduces emissions during system peak times during the summer by avoiding peak electricity use while the ice storage system "discharges," and has lower associated grid emissions when it recharges, i.e., makes ice from water. The net beneficial emissions impact is the difference between the higher emissions avoided during the discharge time and the lower emissions during the charge time.

$$(Ice\ Energy\ Storage\ Plants) * \left(\frac{0.55kW}{cooling\ ton}\right) * \left(\frac{tons}{install}\right) * \left[\left((Discharge\ time\ per\ day) * (110\ days\ per\ year) * \left(\frac{Peak\ kgCO_2e}{MWh}\right)\right) - \left(\frac{(Charge\ time\ \ per\ day) * (110\ days\ per\ year) * \left({}^{Grid\ kgCO_2e}/_{MWh}\right)}{90\%\ Round\ Trip\ Efficiency}\right)\right]$$

Where:

Ice Energy Storage Plants	The number of ice energy storage plants installed and that can be expected to have begun operations in the Company's service territory in the rate year
0.55kW / cooling ton	Electricity associated with each ton of ice energy storage
Discharge time per day	The hours per day an ice storage plant discharges
Charge time per day	The hours per day an ice storage plant charges
Peak kg CO_2e / MWh	The emission intensity associated with peak electric demand from the EPA eGRID for the NPCC NYC/Westchester subregion

Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined
Round Trip Efficiency	How efficient an ice storage plant is at reproducing the energy it consumed during charging

Electric Heat Pump Water Heaters

The electric heat pump water heater measurement will consider all incremental electric heat pump water heater installations as summed at the end of the rate year. End-of-year incremental installed units will be tracked from the Company's energy efficiency incentive programs and NYSERDA-provided data.

Annualized net avoided kg CO_2e emissions from electric heat pump water heaters will be calculated by determining the avoided emissions from removing a natural gas fired hot water tank while accounting for the lower emissions associated with the electric consumption of the heat pump water heater. For the purposes of the Emissions EAM, the Collaborative has developed this single framework for calculating avoided GHG emissions associated with electric heat pump water heaters, which can be expected to be generally representative of electric heat pump water heater installations in Company territory.

$$(Electric\ Heat\ Pump\ Water\ Heater\ Units) * \left[\left(Avoided\ Dth * \frac{kgCO2e}{Dth_{CH4}}\right) - (MWh\ Heating\ Consumed) * \left({}^{Grid\ kgCO_2e}/_{MWh}\right)\right]$$

Where:

Electric Heat Pump Water Heater Units	The number of electric heat pump water heater units installed and that can be expected to have begun operations in the Company's service territory in the rate year
Avoided Dth	The reduction in natural gas consumption in Dth from removing a natural gas fired water heater
kg CO_2e / Dth_{CH4}	The emission intensity of burning natural gas
MWh Heating Consumed	The increase in electric consumption for water heating due to replacing a natural gas water heater with an electric heat pump water heater
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

Wind Energy

The wind energy measurement will initially consider all incremental distributed wind energy installations interconnected to the Company's electric distribution system as summed at the end of the rate year. End-of-year incremental installed capacity will be tracked from interconnected wind energy projects submitted through the NYS SIR process. The Company will count those wind energy installations toward the Emissions EAM metric when the Company submits a final interconnection letter to the customer noting that all interconnection work has been completed, which enables the wind energy installation to begin operating as part of the overall Con Edison electric distribution system.

The methodology for wind energy avoided GHG calculation is the same as the rooftop solar PV calculation except for a higher capacity factor. Annualized avoided kg CO_2e emissions consumed by wind energy[22] installations will be calculated as:

$$(MW\ wind\ energy) * (15\%\ Capacity\ factor) * (Annual\ Hours) * \left(\frac{Grid\ kg\ CO_2e}{MWh}\right)$$

Where:

MW wind energy	The MWs of distributed wind energy installed and that can be expected to have begun operations in the Company's service territory in the rate year
Annual Hours	8,760
Grid kg CO_2e / MWh	The average New York City emissions factor from the most recent New York City GHG Inventory available at the time the EAM metric targets are determined

Voluntary Renewable Energy Certificates

The Collaborative parties agreed that additional discussions related to VRECs are necessary and will consider inclusion of VRECs for Collaborative discussions on metric, targets, and incentives for RY3 outcome-based EAMs.

The parties agree that the VREC measurement will consider all in-state VREC activity in the Company territory in the rate year. Each in-state VREC represents one MWh of renewable energy produced in New York State and acquired in or on behalf of any customer or entity in the Company territory, and incremental to any mandatory obligation under the Clean Energy Standard.[23] Each VREC will be converted to an annualized avoided kg CO_2e using the latest eGRID statewide New York kg CO_2e / MWh figure available at the time the EAM metric targets are determined.

[22] http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/2017_Power_Trends.pdf

[23] Case 15-E-0302, *Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard*, Order Adopting a Clean Energy Standard (issued August 1, 2017).

Some Collaborative parties expressed a preference for VREC resources in or near the Company's service territory. The Collaborative parties agree that location is an important consideration, but local REC supplies are limited and the local REC market is generally illiquid. Confining this measurement to only local resources at the current time would reduce the potential positive impact of this aspect of the Emissions EAM metric both regionally and locally over the longer term. But to the extent possible, the parties agreed that Company should track VREC resource origin locality using the New York Generation Attribute Tracking System ("NYGATS") to inform service territory proximity, and determine if and when locational granularity should inform the VRECs emissions calculations.

Some parties expressed concerns regarding who would bear costs related to VREC purchases, but the Collaborative agreed that VRECs, as developed for the purposes of this EAM, would refer to VREC acquisitions made directly by or on behalf of willing customers; i.e., customers who have voluntarily decided to make such purchases or have another entity make purchases on their behalf. Further, to additionally maintain transparency, the Company will identify and explain activity related to VRECs that contribute to the EAM, in its annual EAM filing. Additionally, to the extent the Company is directly involved in any VREC purchases on behalf of willing customers, the Collaborative parties agree that the pricing related to such VREC purchases should be transparent to the customer.

c. Broad Approach

i. Discussion

The second design option discussed is a broad approach initially based on the annually-published New York City GHG Inventory ("Inventory"). The Collaborative agreed that the broad approach has merit by its focus on more holistic, territory-wide emissions reductions. However, the broad approach was not selected as the EAM metric due to the complexities of developing a territory-wide emissions inventory and establishing targets that can meaningfully measure achievements isolated from other macro-effects impacting emissions.

ii. Measurement

An Inventory-based scorecard metric would measure actual net kg CO_2e emission reductions associated with electric energy consumption by customers in Con Edison's service territory. The broad nature of this design is meant to capture holistic emissions impacts beyond emissions benefits of specific technologies alone. This more holistic approach can support broad territory-wide efforts to facilitate reduction of emissions over time, including a broad portfolio of mitigation measures including energy efficiency, distributed generation, beneficial electrification, and distribution of less carbon-intensive electricity, without limiting focus to a few technology-specific categories of emissions mitigation efforts.

For such a broad-based metric to be appropriate, it would need to be normalized for exogenous factors such as economic growth, employment, natural catastrophic incidents such as hurricane related disruptions, retirement or introduction of major new generating facilities, and demographic trends. This would generally require a highly sophisticated modeling methodology that goes beyond the already complex inventory development to identify causation factors to a degree of precision and accuracy that

has hitherto not been available. Another significant challenge to the broad approach measurement is the lag associated with the complex process of inventory development and publication. This lag prevents timely analysis of any territory-wide efforts even if models were to become available. Another concern is that, to the knowledge of the Collaborative parties, there is not a regularly updated inventory or other similar data source for GHG emissions in Westchester County.

Because of the above issues the broad approach measurement will, at this time, be tracked as a scorecard metric for RY2 and RY3, and will include the Inventory's stationary energy and transportation values. The Collaborative agreed that this design has significant merit but requires further investigation for potential use in the future, and should account for net avoided emissions from beneficial electrification activities in addition to efforts resulting in direct CO_2e emission reductions, based on applicable emission factors.

4. Reporting

The Order requires a compliance filing on March 31, 2018, 2019, and 2020 for reporting EAM achievements.[24] For 2018, the Company intends to file a scorecard for the Emissions-related EAM metric that provides separate information for the targeted approach and broad approach by March 31, 2019. The Company will file the 2019 EAM achievements consistent with the EAM collaborative discussions for 2019 and any applicable Commission directives by March 31, 2020.

[24] Order, Appendix A - Joint Proposal, p. 80.

Appendix A

Attachment “Con_Edison_Emissions_EAM_Targeted_Technologies_Calculations” contains additional targeted approach technology measurement details.