

## Technical Appendix: Mid-Hudson Municipal Building Electrification Coalition

### 1. GHG Reduction Estimate Method:

ClearPath, a leading online platform for greenhouse gas inventories and forecasting, measures GHG emissions data and reduction estimates. It enables the calculation, tracking and management of greenhouse gas emissions at the government operations and community scales. The GHG inventory provides the basis for long term emissions forecasting. Developed and maintained by ICLEI, a non-profit organization supporting local governments, ClearPath aligns with major reporting requirements such as the US Community Protocol, and major governmental reporting requirements<sup>1</sup>. The Global Warming Potential values used were from the 2013 IPCC AR5 Fifth Assessment Report 100-year values.<sup>2</sup>

Each of the municipalities in the Mid-Hudson Municipal Building Electrification Coalition used ClearPath to create their government operations GHG emissions inventories. The Global Warming Potential values used in the inventories are from the 2013 IPCC AR5 Fifth Assessment Report 100-year values.<sup>3</sup>

### 2. Models/Tools Used:

**Baseline year.** All the CAPI Coalition municipalities began by creating an inventory in ClearPath with a baseline of 2019, the most recent pre-covid year for which data was readily accessible. They next created a business-as-usual (BAU) forecast to determine what emissions would be if they were to do nothing. To do so, they created growth rates for grid decarbonization, and developed their GHG emissions reduction estimates.

**Business as Usual Forecast.** After completing their individual inventories in ClearPath, the municipalities created a forecast out to 2030, and began to create and apply growth rates to establish a BAU forecast. This was necessary to understand where GHG emissions level would be in 2030 were the municipality to not take any measures to reduce emissions.

**Reduction Measure Modeling.** The next step was to model reduction measures, by entering growth rates and leveraging preset growth rate factor sets. Reduction measures were modeled out to 2030. These projections were used as input for prioritizing potential actions to include in their science-based municipal climate action plans. ICLEI and HVRC worked with municipalities to create these forecasts. Both [Dutchess County guidance](#) and [Westchester County guidance](#) was provided.<sup>45</sup>

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<sup>1</sup> ICLEI (2019). US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. <https://icleiusa.org/us-community-protocol/>

<sup>2</sup> ICLEI (2024). ClearPath. <https://icleiusa.org/clearpath/>

<sup>3</sup> ICLEI (2024). ClearPath. <https://icleiusa.org/clearpath/>

<sup>4</sup> HVRC (2023). CAPI Government Operations GHG Inventory Forecasting and Planning Wizard Tool Directions for Westchester County CAPI Cohort. <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fhudsonvalleyregionalcouncil.org%2Fwp-content%2Fuploads%2F2024%2F01%2F231215-Wizard-Guidance-for-Westchester-for-ClearPath-Forecasting-V2-1.docx&wdOrigin=BROWSELINK>

<sup>5</sup> HVRC (2023). CAPI Government Operations GHG Inventory Forecasting and Planning Wizard Tool Directions for Dutchess County CAPI Cohort. <https://hudsonvalleyregionalcouncil.org/wp-content/uploads/2023/09/Wizard-Guidance-for-Dutchess-ClearPath-Forecasting-Final.docx.pdf>

**Grid Decarbonization Rate for Westchester County.** In 2020, NYPA reported that more than 80% of NYPA-produced electricity was sourced from clean renewable hydropower and the 2019 emissions intensity showed an even cleaner NYPA grid than in 2020.<sup>6</sup> Considering that this is higher than the CLCPA goal of 70% renewable by 2030, it was assumed that the grid’s emissions intensity will not change significantly by 2030.

**Grid Decarbonization Rate for Dutchess County.** The Dutchess communities calculated the grid decarbonization rate using the 2019 NYUP values from EPA eGRID. In 2019, NYUP included electricity resource mix of 41% renewables.<sup>7</sup> Note: Nuclear is not included in this value because NY’s Clean Energy Standard does not include this in their definition of renewable.<sup>8</sup> Also see NYSERDA’s Story of Our Grid web page for future grid scenarios that exclude nuclear.<sup>9</sup>

**Employee Count Projection / Growth Rate.** Communities estimated employee growth rate based on employee count projection. If they were not able to obtain municipal employee count projection data, they based projections off the of the regional population growth rate. For the population growth rate, they leveraged County projections.

**Population Projection / Population Growth.** If communities did not have their individual municipal populations growth data or rates, they instead based this on the Dutchess County growth rate from the document, “Dutchess County Population Projection to 2030\_Moving Dutchess Forward”<sup>10</sup>. Westchester communities based their numbers on a regional transportation forecast plan.<sup>11</sup>

**Applying Growth Rates.** Lastly, the coalition municipalities appropriately applied growth rates towards each sector with close guidance from ICLEI. They aligned their reduction goals with NY State’s CLCPA goals to see how their BAU forecast compared. (Note – for those that adhered to NY State’s CLCPA goals, we calculated from NY State reports that we have already reduced emissions 7%, so the goal was reduced to 33% (40-7=33).

- [See ClearPath Wizard Guidance for ClearPath Forecasting Tool for Westchester CAPI Coalition](#)
- See [ClearPath Guidance for Dutchess CAPI Coalition](#)

### 3. Measure Implementation Assumptions:

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<sup>6</sup> NYPA. (2020). Sustainability Report. <https://nypa.gov/-2/media/nypa/documents/document-library/esg-sustainability/nypa-sustainabilityreport.pdf>

<sup>7</sup> EPA. eGRID Summary Tables 2019. [https://www.epa.gov/sites/default/files/2021-02/documents/egrid2019\\_summary\\_tables.pdf](https://www.epa.gov/sites/default/files/2021-02/documents/egrid2019_summary_tables.pdf)

<sup>8</sup> NYSERDA. Clean Energy Standard. <https://www.nyserdera.ny.gov/All-Programs/Clean-Energy-Standard>

<sup>9</sup> NYSERDA. Story of our Grid. <https://www.nyserdera.ny.gov/About/Publications/Energy-Analysis-Reports-and-Studies/Electric-Power-Transmission-and-Distribution-Reports/Electric-Power-Transmission-and-Distribution-Reports---Archive/New-York-Power-Grid-Study/Story-of-Our-Grid#:~:text=Combined%20with%20the%20existing%20baseline,come%20from%20renewables%20in%202030>

<sup>10</sup> Dutchess County Transportation Council. Moving Dutchess Forward. <https://movingdutchessforward.com/>

<sup>11</sup> NYMTC. Appendix C: 2030 Demographic and Socioeconomic Forecasts. [https://www.nymtc.org/portals/0/pdf/SED/Appendic%20C\\_2030%20Forecasts.pdf](https://www.nymtc.org/portals/0/pdf/SED/Appendic%20C_2030%20Forecasts.pdf)

**Modeling Emissions Reductions.** The next step was for the municipalities to model emissions reduction measures on the BAU forecast to quantify the impact each measure would have on overall emissions out to 2030.

**Modeling Reductions for Buildings.** For heat pump conversions, a heat pump performance factor (HSPF) of 8.2 BTU/watt-hr was used, which is the current [minimum federal requirement](#) for air source heat pumps.<sup>12</sup> For geothermal heat pumps, the minimum coefficient of performance of 3.1 was used, which is equivalent to a HSPF of 10.6. For furnaces, the coalition was directed to ask facilities/maintenance staff (or others in local government) if they know this for each (or most) of the buildings to get an average. They were given the option of electing to use the default of 80%. For all calculators, the IPCC's 5th Assessment 100-year values were used.

**Other assumptions.** The following Emissions Factors for Electricity Consumption were used for Dutchess and Westchester Counties.

Table 1: Dutchess County: NPCC Upstate NY (NYUP) eGRID 2019

Year	CO <sub>2</sub> (lbs./MWh)	CH <sub>4</sub> (lbs./GWh)	N <sub>2</sub> O (lbs./GWh)
2019	232.305	17	2

Table 2: Westchester County: NYPA, 2019

Year	CO <sub>2</sub> (lbs./MWh)	CH <sub>4</sub> (lbs./GWh)	N <sub>2</sub> O (lbs./GWh)
2019	110.010538	21	2

In consultation with ICLEI staff, the municipalities decided to utilize NYPA's emissions factor for their GHG Inventories and Climate Action Plans since NYPA is their electricity supplier.

**4. GHG Reduction Estimate Assumptions:** Coalition member municipalities used ClearPath to model the potential emissions reductions of their building decarbonization projects. Converting facilities from various fuel types such as natural gas, or fuel oil or space heating to heat pumps are reduction strategies in ClearPath's planning module. Municipalities input the global warming potential, and the data – how much natural gas for example the current building uses and expects to use after the heat pumps are installed, the efficiency of the old equipment such as the furnace or boiler, and the heat pump performance factor. Outputs can be manipulated corresponding to the table below. Other reduction measure calculators in ClearPath include but are not limited to retro-commissioning -- the process of fine-tuning building systems to ensure a building is running at its optimal performance (efficiency measures in buildings, such as window/insulation upgrades), Low Power Computing, and install Lighting

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<sup>12</sup> Dept. of Energy. (2014) Explaining Central Air Conditioner and Heat Pump Standards.  
<https://www.energy.gov/sites/prod/files/2015/11/f27/CAC%20Brochure.pdf>

Occupancy Sensors and more. ClearPath then provides the corresponding GHG emission reductions from the action, for the chosen time period. ICLEI noted in their [ClearPath user guide](#), “Calculations performed in this tool are not intended to replace investment grade analysis of specific pieces of equipment or related feasibility studies that should be performed prior to implementing an emissions reduction measure. The application is designed to help users understand the scope of effort required to meet emissions reduction targets they may be considering and to identify those measures that are good candidates for deeper analysis and review prior to a final decision to implement those measures.”<sup>13</sup> All the inputs to Clearpath are detailed in GHGCalcs\_HVRC-HP.

On the following page is an example from the City of Peekskill.

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<sup>13</sup> ICLEI. ClearPath User Guide. [https://s3.amazonaws.com/ClearPath-ICLEI/content/index.html#/lessons/m5\\_LNOMVRXsFwg9CBSadLTSLI8hEr8w3](https://s3.amazonaws.com/ClearPath-ICLEI/content/index.html#/lessons/m5_LNOMVRXsFwg9CBSadLTSLI8hEr8w3)

Table 3: Inputs to ClearPath for City of Peekskill Police Station Decarbonization Project.

Name	Police Station Heat Pumps		
Global warming potential	IPCC 5th Assessment 100 Year Values		

### Inputs

	Value	Units
<b>Mode of Action</b>	Select the affected Forecast Series that the reduction will apply to. In this case, the fuel type which will be affected.If the action affects electricity, note whether it affects the quantity of electricity used or the carbon intensity of grid electricity.	
Affected Forecast Series	Distillate Fuel Oil No. 2	
<b>Level of Implementation</b>	If this action is one that scales with a level of implementation, you can use the Primary Driver field to easily multiply the Unit Savings and explore the potential impact of scaling up this custom measure. If you do not wish to use this function leave the default value of 1.	
Primary Driver	1	Units
<b>Measure Impact</b>	Use the following fields to specify the unit energy savings (per unit of the primary driver) or percent change in carbon intensity where relevant for electricity measures.Note that you will also need to specify your own Effective Useful Life and Cumulative behavior for this measure as appropriate for the action you are representing with this record.	
Unit Energy Savings	3969.6	Gallons / Year

### Outputs

Name	Value	Effective Useful Life	Cumulative
Electricity Reduction (MMBtu / Year)	0	1	<input type="checkbox"/>
Change in Grid Energy Carbon Intensity (% / Year)		50	<input type="checkbox"/>
Natural Gas Reduction (MMBtu / Year)	0	1	<input type="checkbox"/>
Propane Reduction (MMBtu / Year)	0	1	<input type="checkbox"/>
LPG Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Butane Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Kerosene Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Gasoline Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Distillate Fuel Oil No. 2 Reduced (MMBtu / Year)	-547.80	1	<input type="checkbox"/>
Residual Fuel Oil No. 5 Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Residual Fuel Oil No.6 Reduced (MMBtu / Year)	0	1	<input type="checkbox"/>
Uncommon Fuel Reduction (MMBtu / Year)	0	1	<input type="checkbox"/>
Steam Heat Purchased CHP Reduction (MMBtu / Year)	0	1	<input type="checkbox"/>
District Cooling Purchased - Electric Compressor (MMBtu / Year)	0	1	<input type="checkbox"/>

## 5. Reference Case Scenario (GHG Emissions or Activity Level):

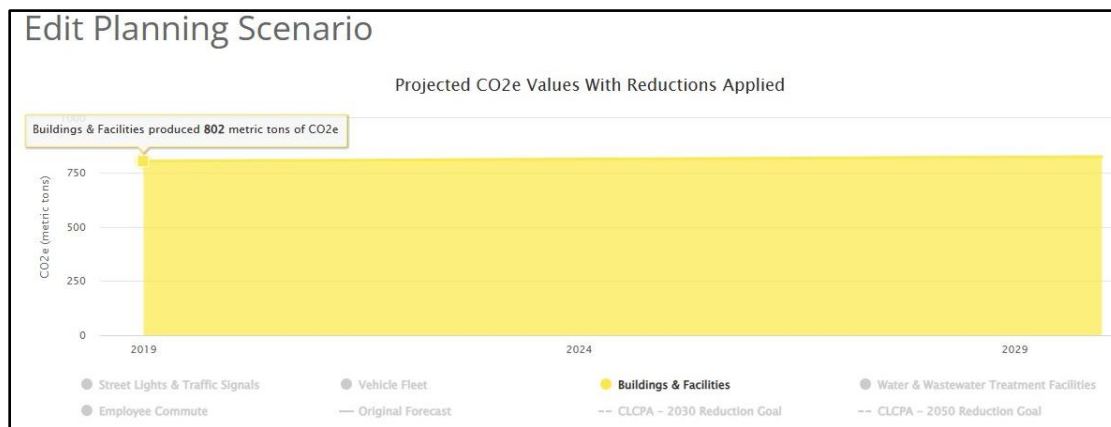
ClearPath gives guidance for how to forecast a business-as-usual scenario. However, they note, “Indicators for forecasting government operations emissions are less clear. For short-term forecasts or communities that are built out with little change, it may be appropriate to assume zero growth for government operations. If there are specific plans for new buildings, these can be accounted for as a percent increase in total building square footage. For faster growing communities or longer term forecasts the best approach is often to assume that government services (and the buildings and vehicles needed to deliver them) will grow proportionally to community population.”<sup>14</sup>

In creating the forecasts for their Government Operations Climate Action Plan, coalition member municipalities used their own data to create a business-as-usual scenario. Below is the City of Peekskill’s Business-As-usual projection, which shows a slight increase in emissions between 2019-2030.

- Base year: 2019
- Sector: Buildings and Facilities
- Business as usual projection for 2030:
  - Start year 2019: 802 MT CO<sub>2</sub>e
  - End year 2030: 823 MT CO<sub>2</sub>e

Table 4: Pre-BAU Forecast for City of Peekskill

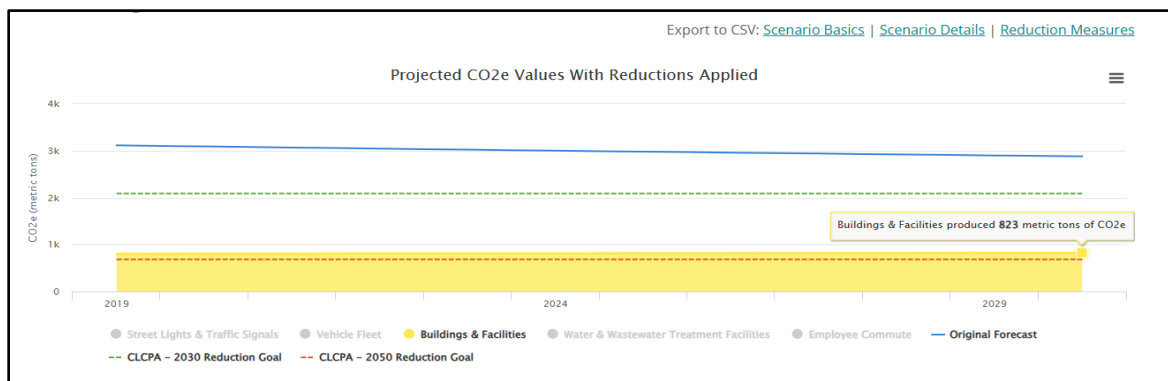
With no BAU forecast, the City of Peekskill’s emissions would be 802 MTCO<sub>2</sub>e.



To create a BAU forecast, the City created 4 growth rates, for a final BAU emissions in 2030 of 823 MTTcO<sub>2</sub>e.

<sup>14</sup> <https://s3.amazonaws.com/ClearPath-ICLEI/content/index.html#/lessons/uyA1knde-SpmfLC-aL4qVFTcC9fQcbO8>

**Table 5: BAU Forecast for City of Peekskill**



Below are details of inputs to create the BAU forecast for the City. These are representative examples to show how all the municipalities created BAU forecasts.

**Table 6: The City created 4 growth rates:**

1. [Create Forecast](#) 2. **Create Growth Rates** 3. [Apply Growth Rates](#) 4. [Set Reduction Goals](#) 5. [Model Reduction Measures](#) 6. [View Results](#)

**Forecast Growth > Growth Rates > Create**

Add New Growth Rate Profiles for Forecasting

Grid Decarbonization - No Growth	<a href="#">Edit</a>	<a href="#">Delete</a>
Employee Count Projection	<a href="#">Edit</a>	<a href="#">Delete</a>
Population Projection - Westchester County	<a href="#">Edit</a>	<a href="#">Delete</a>
No Growth	<a href="#">Edit</a>	<a href="#">Delete</a>

[+ Add New Growth Rate](#)

**Table 7 and Table 8: Employee count and Population projections were based on data for Westchester County.**

**Forecast Growth > Edit Growth Rate**

\* Name

Employee Count Projection

Notes

Population growth rate from the following link (see page 10):  
[https://www.nymtc.org/portals/0/pdf/SED/Appendix%20C\\_2030%20Forecasts.pdf](https://www.nymtc.org/portals/0/pdf/SED/Appendix%20C_2030%20Forecasts.pdf)

What type of data do you have?

Total Population

Initial Value (in 2019-01-01)

985800

\* Note that changing this field will not change the inventory data

End Year

2030

Value

1011466

[+ Add End Year Value](#)

[Cancel](#) [Save](#)

Forecast Growth > Edit Growth Rate

Name

Population Projection - Westchester County

Notes

Population growth rate from the following link (see page 10):  
[https://www.nymtc.org/portals/0/pdf/SED/Appendix%20C\\_2030%20Forecasts.pdf](https://www.nymtc.org/portals/0/pdf/SED/Appendix%20C_2030%20Forecasts.pdf)

What type of data do you have?

Total Population

Initial Value (in 2019-01-01)

985800

Note that changing this field will not change the inventory data

End Year

2030

Value

1011466

[+ Add End Year Value](#)

Cancel

Save

For the Grid decarbonization growth date, the City assumed no growth since, in 2020, NYPA reported that more than 80% of NYPA-produced electricity was sourced from clean renewable hydropower and the 2019 emissions intensity showed an even cleaner NYPA grid than in 2020. Considering that this is higher than the CLCPA goal of 70% renewable energy by 2030, it is assumed that the grid’s emissions intensity will not change significantly by 2030.

**Table 8: Grid decarbonization Rate**

Forecast Growth > Edit Growth Rate

Name

Grid Decarbonization - No Growth

Notes

In 2020, NYPA reported that more than 80% of NYPA-produced electricity was sourced from clean renewable hydropower and the 2019 emissions intensity showed an

What type of data do you have?

Other

Initial Value (in 2019-01-01)

1

End Year

2030

Value

1

[+ Add End Year Value](#)

Cancel

Save

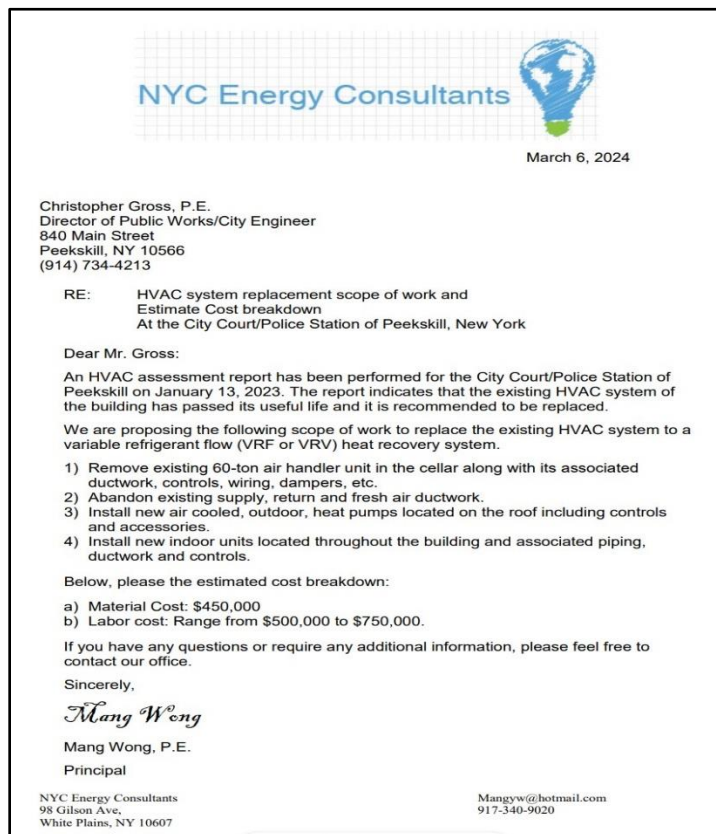
## 6. Measure-Specific Activity Data:

Each municipality participating in the coalition received a quote for the work they plan to have done as part of this project. The quotes contain the units of equipment installed. They then modeled the decarbonization project in ClearPath.

An example from the quote received by the City of Peekskill is below:



Table 9: Quote from NYC Energy Consultants to City of Peekskill for converting Police Station to heat pumps.



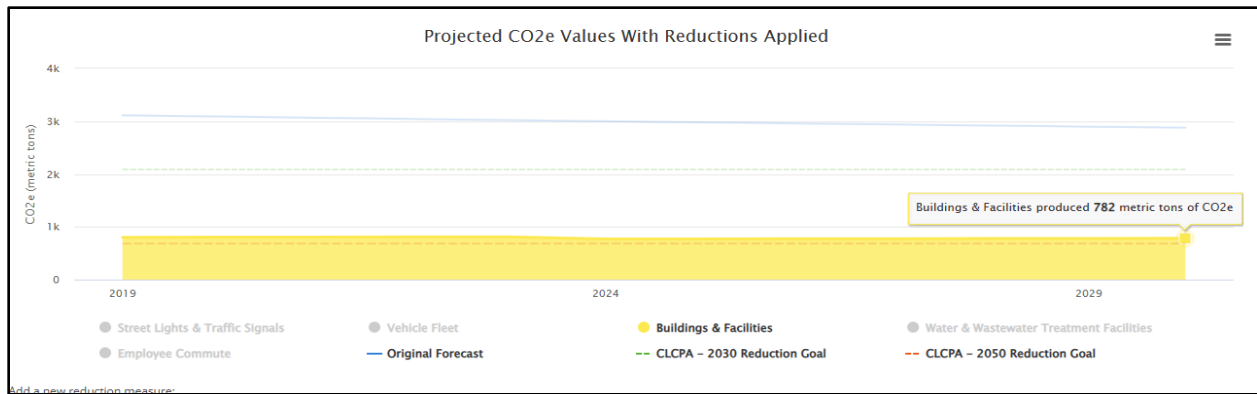
## 7. Emissions Reduced:

GHG emission reduction estimates for each municipal building decarbonization project are in the GHGCalcs\_HVRC-HP spreadsheet and cumulative emissions are included in the Workplan narrative. An example of emission reductions for one project is seen in the table below.

**Example:** Peekskill Police Station and Courthouse Heat Pump Conversion Project: the transition from distillate fuel oil #2 to total electrification through heat pumps. This project is projected to begin reducing emissions in 2027.

- Starting Emissions 2019: 802 MTCO<sub>2</sub>e
- BAU Emissions 2030: 823 MTCO<sub>2</sub>e
- Emissions with reductions incorporated: 782 MTCO<sub>2</sub>e
- 1-year emissions reductions: 41 MTCO<sub>2</sub>e
- Emissions Reductions 2026-2030: 164 MTCO<sub>2</sub>e
- Ending value 2050: 984 MTCO<sub>2</sub>e

Table 10: ClearPath Reduction Scenario incorporating City of Peekskill police station heat pump project.



**Table 11: Emissions totals for 2030 and 2050, based on a project completion date of 2027.**

#3c Emissions Reductions/Year	
Year	MT CO2e
2026	0
2027	41
2028	41
2029	41
2030	41
2031	41
2032	41
2033	41
2034	41
2035	41
2036	41
2037	41
2038	41
2039	41
2040	41
2041	41
2042	41
2043	41
2044	41
2045	41
2046	41
2047	41
2048	41
2049	41
2050	41
Emissions Reductions 2026-2030	164
Emissions Reductions 2026-2050	984