



Figure 1. Image from VISIT Milwaukee.

Milwaukee County Climate Action 2050 Plan

Emissions Assessment Report

Achieving Net Zero Carbon Emissions While Advancing Equity, Justice, and Community Resilience



Introduction

The Milwaukee County Climate Action 2050 Plan project Emissions Assessment Report is made up of two major efforts:

1. A county emissions inventory audit, and
2. A county emissions business-as-usual (BAU) forecast based on existing ClearPath data

Energetics conducted an audit of Milwaukee County's 2019-2021 Operational GHG Inventories in ClearPath, reviewing their approach, data sources, assumptions, and methodological consistency to ensure they represent the best practices for government operations GHG Inventories. After reviewing these inventories, Energetics provided recommendations for methods and assumptions to reconcile data gaps. Following that audit, Energetics conducted an emissions modeling exercise to create a BAU emissions forecast for Milwaukee County through 2050 and developed a user-friendly scenario planning tool for carbon emissions reductions by Milwaukee County operations.

Inventories Audit Report

Overview

Energetics recently conducted an emissions inventory audit for Milwaukee County; the "Inventory Audit" task specifies:

"develop an Emissions Assessment Report for Milwaukee County. The report will conduct a 'light audit,' reviewing the approach, data sources, assumptions, and methodological consistency of the County's 2019–2021 Operational GHG [greenhouse gas] Inventories."

The County's 2019–2021 Operational GHG inventories were all completed using the Government Operations Inventories portion of ICLEI's ClearPath software. Data requirements of the software were met using data collected by Milwaukee County staff led by County Sustainability Director Gordie Bennett. Energetics' review assessed following:

- Adherence to ICLEI's guidance for using and providing data for ClearPath software;
- Completeness of data collection efforts by Milwaukee County; and
- Reasonableness of assumptions made by Milwaukee County.

In addition, Energetics was asked to:

"evaluate the 2019 - 2021 Government Operations GHG Inventories for compliance with The Climate Registry's Local Government Operations Protocol v1.1."

This memo provides the deliverables for this task.

Information Used by Energetics to Conduct this Assessment

Milwaukee County provided Energetics with a comprehensive set of files from for the following GHG inventories:

- 2019-21 County Operations Inventory: 129 files in 43 folders and subfolders
- 2018 Community Inventory: 111 Files in 26 Folders and subfolders
- 2016-18 County Operations Inventory: 176 Files in 42 Folders and subfolders
- 2005 County Operations Inventory: 87 Files in 26 Folders and subfolders

Energetics created a spreadsheet for 2019-21 County Operations (LGO) Inventory with a line for each of the 129 files with cells containing information regarding the file path within the folder structure, as well as the file name and type. Energetics opened each of the 129 files provided for the 2019-2021 inventories and created a brief summary for every file (e.g., “Gasoline and diesel usage for all park dept. equipment 2019”), as well as questions and notes for some files, as appropriate (e.g., “Unclear notes regarding vehicle identification”). Energetics used this spreadsheet as a reference to assure all files were reviewed in the assessment.

2019-2021 GHG Inventories

The methodology used for the County’s 2019-2021 LGO is the same as that documented in their report on their 2016-2018 inventories.¹ The 2019, 2020, and 2021 GHG inventories were conducted primarily over the summer of 2022 by Milwaukee Climate Action Intern Sarah Knott, a Senior at Marquette University majoring in Environmental Studies, under the supervision of Gordie Bennett, Sustainability Director.

Milwaukee County used ClearPath to calculate its greenhouse gas emissions. ClearPath is a well-established tool developed, managed, and maintained by ICLEI—Local Governments for Sustainability (USA). Milwaukee County used the Government Operations portion of ClearPath which is explicitly intended “to perform a Local Government Operations Protocol compliant greenhouse gas emissions inventory.”

ClearPath calculates emissions by using activity levels of various activities associated with GHG emissions (such as using gasoline in a vehicle or using electricity in a building) and multiplying each activity by an appropriate emissions factor (such as pounds of CO2 emitted per gallon of gasoline used in a vehicle or tons of CO2 emitted per MWh of electricity generated). The result is an amount of GHG emissions associated with each activity. These are summed to provide total emissions for a given year.

Milwaukee County Government Sectors Covered in the Inventory

The 2010 Local Government Operations Protocol² (“LGOP”) which guides Milwaukee County’s GHG inventory work, specifies that all direct emission (also known as “Scope 1” emissions) as well as indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling (“Scope 2” emissions) be quantified from the following eleven local government sectors:³

- | | |
|----------------------------------|--------------------------------------|
| Buildings and other facilities | Transit fleet |
| Streetlights and traffic signals | Power generation facilities |
| Water delivery facilities | Solid waste facilities |
| Port facilities | Wastewater facilities |
| Airport facilities | Other process and fugitive emissions |
| Vehicle fleet | |

According to the provided “2019-2021 Activity Data Tracker” spreadsheet, the following four local government sectors were targeted by Milwaukee County for analysis.

- Buildings and other facilities
- Streetlights and traffic signals
- Vehicle Fleet
- Transit Fleet

¹ *Greenhouse Gas Emissions Inventory: Milwaukee County Government Emissions. 2016-2018.* Milwaukee County Office of Sustainability. April 10, 2020.

² *Local Government Operations Protocol* [“LGOP”] For the quantification and reporting of greenhouse gas emissions inventories, Version 1.1, May 2010. Developed in partnership and adopted by: California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, and The Climate Registry.

³ Milwaukee County elected not to include optional “Scope 3” emissions in its inventory. To learn about Scope 3 emissions from local government operations see page 25 of the LGOP noted above.

Thus, seven local government sectors specified in the LGOP were not explicitly targeted for analysis by Milwaukee County in calculating its inventories. These seven sectors and the reasons for their exclusion as noted in the County’s report on their 2016-2018 inventories are provided in the table below.

Table 1: Reasons for Exclusion of Specified LGO Sectors

Local Government Operations Sector Excluded	Reason For Exclusion
Water delivery facilities	County does not operate water delivery facilities.
Port facilities	Port Milwaukee is a Department within the City of Milwaukee government. The County has no operational role.
Airport facilities	Ground operations (Milwaukee Mitchell International Airport and Timmerman Airport buildings and facilities, vehicles, and equipment) are included in the Buildings and other Facilities and Vehicle Fleet categories. Aviation emissions are not included.
Power generation facilities	The County does not operate any power generation facilities. Emergency backup generators are included in the Buildings and other Facilities category.
Solid waste facilities	Per the County’s report on their 2016-2018 inventories: “Landfill gas monitoring is only done at Milwaukee County’s Doyne and Franklin landfills, however these sites are exempt from EPA GHG emissions reporting thus emissions data is not available. Moreover, Milwaukee County does not have historic data on annual waste deposited at its other landfills.”
Wastewater facilities	The County does not operate a wastewater treatment facility.
Other process and fugitive emissions	Process emissions are not applicable to Milwaukee County’s operations. Fugitive emissions were not acquired due to communication and time constraints.

Emission Sources from Milwaukee County Government Sectors Covered in the Inventory

According to the “2019-2021 Activity Data Tracker” spreadsheet, the following sources of emissions were targeted for analysis in the sectors evaluated. The GHG emissions associated with these sources are either direct (Scope 1) emissions from on-site combustion of fossil fuel (gasoline, diesel, or natural gas), or indirect (Scope 2) emissions associated with the off-site production of electricity or steam used. In the list below, direct emissions (Scope 1) sources are in **bold text**, and indirect emissions (Scope 2) sources are in italicized text.

Buildings & Facilities

Purchased Electricity

Natural Gas

Diesel Generators

District Steam - Downtown

District Cooling - County Grounds

Transit Fleet

Buses

Non-Revenue Gasoline Vehicles & Heavy Equipment

Non-Revenue Diesel Vehicles & Heavy Equipment

Vehicle Fleet

Small Gas Equipment - Parks

Small Diesel Equipment - Parks

Diesel Vehicles & Heavy Equipment

Gasoline Vehicles & Heavy Equipment

Additional Gasoline Vehicles - Airport

CNG Buses - Airport

Streetlights & Traffic Signals

Streetlights & Traffic Signal

Direct (Scope 1) Emissions

The LGOP specifies four separate sources of Direct (Scope 1) Emissions:⁴

- *Stationary combustion* to produce electricity, steam, heat, or power using equipment in a fixed location (found in most local government sectors).
- *Mobile combustion* of fuels in fleet transportation sources (e.g., cars, trucks, marine vessels, and planes) and emissions from off-road equipment such as in construction, agriculture, and forestry (found in the Vehicle Fleet sector - see Chapter 7).
- *Process emissions* from physical or chemical processing, other than fuel combustion (e.g., from the manufacturing of cement, aluminum, adipic acid, ammonia, etc.).
- *Fugitive emissions* that are not physically controlled but result from intentional or unintentional releases, commonly arising from the production, processing, transmission, storage, and use of fuels and other substances, often through joints, seals, packing, gaskets, etc. (e.g., HFCs from refrigeration leaks, SF₆ from electrical power distributors, and CH₄ from solid waste landfills).

The analysis provided by Milwaukee County incorporates Scope 1 emissions for stationary and mobile combustion. It does not incorporate either process emissions or fugitive emissions for the reasons noted in .

Table above.

Indirect (Scope 2) Emissions

The LGOP notes the following sources of Indirect (Scope 2) Emissions:

- Electricity Use
- Steam and District Heating Purchases
- Heat and Power Purchases from a Combined Head & Power Facility
- District Cooling

The Milwaukee County analysis includes these four sources of indirect emissions.

Assessment of Scope of Milwaukee County LGO Inventory

The scope of Milwaukee County's LGO Inventory generally follows accepted practice. For future inventories, the County may wish to estimate fugitive emissions as well as emissions associated with the disposal of solid waste generated by county activities. Energetics suggests the County work with ICLEI to estimate these emissions.

Overview of Data Collected – by ClearPath Categories

Table below summarizes the Milwaukee County Government Operations emissions inventory categories and sources included in on-line ClearPath software. The data collected for the categories and sources below are the same for the 2019, 2020, and 2021 inventories.

⁴ LGOP, Section 4.3, page 23.

Table 2: Overview of Data Collected

ClearPath Category and Source	Data Collected
Buildings & Facilities	
Buildings	Purchased Electricity Natural Gas District Steam District Cooling
Diesel Generators	Fuel Used
Streetlights & Traffic Signals	
Street Lights & Traffic Signals	Purchased Electricity
Vehicle Fleet	
Highway Vehicles – Diesel (includes Parks)	Fuel use Annual Miles Traveled (VMT)
Highway Vehicles – Gasoline (includes Parks)	Fuel use Annual Miles Traveled (VMT)
Agricultural Vehicles - Diesel	Fuel use
Agricultural Vehicles - Gasoline	Fuel use
Construction Vehicles - Diesel	Fuel use
Construction Vehicles - Gasoline	Fuel use
Airport Buses - CNG	Fuel use Annual Miles Traveled (VMT)
Airport Vehicles - Gasoline	Fuel use Annual Miles Traveled (VMT)
Parks Small Equipment - Diesel	Fuel use
Parks Small Equipment - Gasoline	Fuel use
Transit Fleet	
Buses - Diesel	Fuel use Annual Miles Traveled (VMT)
Heavy Duty Trucks - Diesel	Fuel use Annual Miles Traveled (VMT)
Light Duty Trucks - Diesel	Fuel use Annual Miles Traveled (VMT)
Heavy Duty Trucks - Gasoline	Fuel use Annual Miles Traveled (VMT)
Light Duty Trucks - Gasoline	Fuel use Annual Miles Traveled (VMT)
Passenger Vehicles - Gasoline	Fuel use Annual Miles Traveled (VMT)
Employee Commute – NOT INCLUDED	
Electric Power Production – NOT INCLUDED	
Solid Waste Facilities – NOT INCLUDED	
Water & Wastewater Treatment – NOT INCLUDED	
Process & Fugitive Emissions – NOT INCLUDED	

Data Collection and Emissions Calculations: Details and Assessment

As noted in its report on its 2016-2018 inventories, the County uses the standard method to quantify emissions, as summarized in the following equation:

$$\text{Activity Data (usage)} \times \text{Emission Factor (MTCDE/usage)} = \text{Emissions from Activity (MTCDE)}$$

The files provided to Energetics by Milwaukee County give detailed information on data used for each of the items in Table 2 above. This section summarizes and provides a brief assessment of the quality of the data used.

Buildings & Facilities

Buildings

Purchased Electricity

Data Source and Entry into ClearPath

Total annual electricity use by Milwaukee County's buildings and facilities was provided as a single number in kWh for each year (2019, 2020, and 2021). This information is provided as a summary report from what appears to be Milwaukee County's EnergyCAP account. The report for each of the three years notes that it is for building groups "MCTS, Disposed, Occupied, Mothballed." Definitions for those building groups were not provided. This information was entered correctly into *ClearPath*.

Assessment

- The total annual electricity use was determined for all facilities rather than for each facility. However, this does not affect the total electricity use.
- Tracking facility-level electricity usage would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the county to reduce electricity use and associated GHG emissions on a building level.
- Milwaukee County documented the Grid Electricity emissions factor it used for each year both in a spreadsheet and in the Emissions Factors portion of the *ClearPath* tool.

Natural Gas

Data Source and Entry into ClearPath

Total annual natural gas use by Milwaukee County was provided as a single number in Therms for each year (2019, 2020, and 2021). This information is provided as a summary report from what is apparently Milwaukee County's EnergyCAP account. The report for each three years notes that it is for building groups "MCTS, Disposed, Occupied, Mothballed." Definitions for those building groups were not provided. The County's report on its 2016-2018 inventories indicates this category also included natural gas used for natural-gas fired emergency generators.

This information was entered correctly into the *ClearPath* software for all three years.

Assessment

- The total annual natural gas use was determined for all facilities rather than for each facility. However, this does not affect the total natural gas use.

- Tracking facility-level natural gas usage would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce natural gas use and associated GHG emissions on a building level.
- Milwaukee County appears to have used the default emissions factor for natural gas provided by the *ClearPath* tool.

District Steam

Milwaukee County uses district steam produced in two different manners. One portion is generated as part of a combined heat and power (CHP) operation. This is referred to by the County as “District Steam – Downtown” in the inventory analysis. The rest is generated solely for district steam by the Milwaukee Regional Medical Center Thermal Plant (MRMC). This is referred to by the County as “District Steam - County Grounds.” These are discussed separately below.

District Steam – Downtown

Data Sources and Entry into ClearPath

Because the energy used in a combined heat and power facility produces both electricity and district steam, the associated emissions need to be allocated correctly to avoid double counting. The *ClearPath* tool provides a calculator explicitly for this purpose. The calculator requires the following inputs:

- [Milwaukee County] heat purchases from the CHP facility
- Fuel type
- Fuel consumption
- Total electricity produced
- Total useful heat produced
- Efficiency of steam production
- Efficiency of electricity production

Assessment

- The total heat purchased from the CHP facility was used for the inventory calculations rather than for each facility. However, this does not affect the total emissions associated with this source.
- Tracking facility-level heat purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce heat purchases and associated GHG emissions on a building level.
- The remaining inputs match those in the file “Valley Power Plant Energy Prod & Efficiency, 2016-2021.pdf.”
One concern: *ClearPath* requires *Total Energy Produced* as an input. Milwaukee County used *Net Electricity Production*. Similarly, *ClearPath* requires *Total Useful Heat Produced* as an input. The data from the “Valley Power Plant Energy Prod & Efficiency, 2016-2021.pdf” file provides values for both *Total Steam Exported to District Energy* and *Total District Energy Heat Flow*. Milwaukee County used *Total District Energy Heat Flow*. It is not clear whether this is the correct choice for that input. ICLEI may be able to provide further guidance.

District Steam – County Grounds

Data Sources and Entry into ClearPath

ClearPath provides a calculator for emissions associated with District Steam purchases. The calculator requires the following inputs:

- [Milwaukee County] heat purchases from the steam facility
- Fuel type
- Fuel consumption

- Boiler efficiency
- Transport losses

Assessment

- The total heat purchased each year from the MRMC facility was used for the inventory calculations rather than for each facility. However, this does not affect the total emissions associated with this source.
- Tracking facility-level heat purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce heat purchases and associated GHG emissions on a building level.
- The remaining inputs match those in the files provided in the "District Steam – County Ground[s]" subfolder. **One concern:** The fuel type selected for this facility in *ClearPath* is "Natural Gas." The file "2020 eGRID Summary - County Grounds Thermal Plant.docx" notes that in 2020 the facility used 11,899 gallons of Distillate Fuel Oil No. 2 in addition to natural gas. The document notes that the combustion of this fuel resulted about 122 MT CO₂e. This is a very small amount relative to the total emissions of over 42,000 MT CO₂e. However, it may merit noting.

District Cooling

Data Source and Entry into ClearPath

Total annual chilled water use by Milwaukee County was provided as a single number in ton-hours for each year (2019, 2020, and 2021). This information is from a summary report from Milwaukee County's EnergyCAP account. Chilled water is provided by the MRMC Thermal Plant noted above. The report for each of the three years notes that it is for building groups "MCTS, Disposed, Occupied, Mothballed." Definitions those building groups were not provided. This information was entered correctly into the *purchased cooling* calculator of the *ClearPath* software for all three years.

The Coefficient of Performance (COP) for the chiller was provided by the MRMC Plant for each of the three inventory years.

Assessment

- The total annual chilled water use was determined for all facilities rather than for each facility. However, this does not affect the total chilled water use.
- Tracking facility-level cooling purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce cooling purchases and associated GHG emissions on a building level.
- **One concern:** for each year, the *ClearPath* calculator for presents the following warning: "There are some outputs that can not be calculated. This is likely due to a missing factor set." It is unclear what, if any, impact this has on the inventories. ICLEI may be able to provide further guidance.

Diesel Generators

Fuel Used

Data Source and Entry into ClearPath

The information reviewed indicates that Milwaukee County operates diesel generators at five sites (Mitchell Park Horticultural Conservatory [Domes], Courthouse, Airport, Behavioral Health Division, and House of Correction). Files in the "Diesel Generators" subfolder contain information on fuel use for each of these sites for each of the inventory years. This information was summarized in a single Excel workbook ("2019-21 Diesel Generators fuel use data (CP).xlsx"), and then a single gallon total for each year was entered correctly into the *ClearPath* tool.

Assessment

- The total annual fuel use for all generators was used rather than separate information for each generator site. However, this does not affect the fuel use for generators.
- Tracking generator-level fuel use would allow Milwaukee County insight into how much each generator is being used, and potentially allow it to reduce usage of generators.
- **Two concerns:**
 - The County’s report on its 2016-2018 inventories indicates that there may be a diesel emergency generator located at Administrative Services.
 - The “Data” tab of the “2019-21 Diesel Generators fuel use data (CP).xlsx” Excel workbook notes the Courthouse as a generator site, and notes that the data for fuel use for that site is contained in files in the “Diesel Generators” subfolder. However, that data is not contained in the “Summary” tab of that spreadsheet, and thus is not included the generator fuel use data entered into *ClearPath*.

Streetlights and Traffic Signals

Purchased Electricity

Data Source and Entry into ClearPath

Annual electricity use by Milwaukee County for streetlights and traffic signals was provided as a single number in kWh for each year (2019, 2020, and 2021). This information is provided as a summary report from what is apparently Milwaukee County’s EnergyCAP account. The report for each three years notes that it is for “Meter Group equals Street & Traffic Lights.”

This information was entered correctly into the *ClearPath* software for all three years.

Assessment

- The total annual electricity use for streetlights and traffic signals appears to be complete.
- Milwaukee County appropriately used the same grid electricity emissions factors as used for other electricity use calculations.
- **One concern:** The source of the building electricity use discussed on page 8 above does not note the application of a meter group filter. To assure double counting did not occur, Milwaukee County may wish to confirm that the filter excluding the Street & Traffic Lights Meter Group was applied to that source.

Vehicle Fleet

Milwaukee County’s vehicle fleet is comprised of over 1,000 vehicles plus other equipment, ranging from mowers to excavators to air compressors. 5 below lists the categories and fuel types of Milwaukee County vehicles and equipment included in the inventory analysis.

Table 3: Milwaukee County Vehicles and Equipment

Category	Fuel Type
Highway Vehicles	Diesel
Highway Vehicles	Gasoline
Agricultural Vehicles	Diesel
Agricultural Vehicles	Gasoline
Construction Vehicles	Diesel
Construction Vehicles	Gasoline
Airport Buses	CNG
Airport Vehicles	Gasoline
Parks Small Equipment	Diesel

Parks Small Equipment	Gasoline
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Energetics evaluated the vehicle fleet analysis as a group.

Fuel Use

Data Source and Entry into ClearPath

Information from the County's FleetAnywhere® system provided diesel and gasoline fuel usage for all vehicles and equipment in gallons. Milwaukee Mitchell International Airport provided CNG fuel usage for the airport shuttle bus fleet in gasoline gallon equivalent units.

The Office of Sustainability skillfully combined the data from several disparate systems to summarize fuel data and allocate it to the various categories. Some of this analysis required making estimates to fill gaps or misalignments in available information.

This information was entered correctly into the appropriate calculators in the *ClearPath* software except for the fuel use for Gasoline Highway Vehicles and Gasoline Construction Vehicle where the data in ClearPath differed from that in the "2 - Fuel Use by Equip Type & Class (CP).xlsx" spreadsheet by a very small amount (< 1%) for all years. Energetics was not able to identify the source of this discrepancy.

Assessment

- Energetics spent several hours reviewing the analysis carried out by the Office of Sustainability to combine and summarize the many sources of information gathered to arrive at the inputs to the *ClearPath* software and did not find any issues that raised concerns.
- While the data discrepancy noted above is *de minimus*, the Office of Sustainability may wish to determine its source.
- The information used would have been easier to combine and summarize with a more unified vehicle-and equipment-level tracking system for tracking fleet fuel use. Such a system would also help the County's fleet management officials better communicate the impacts of any initiatives to increase fuel efficiency in the County fleet.

Vehicle Miles Traveled (VMT)

The *ClearPath* tool uses VMT to provide indicators such as mile per gallon for specified vehicle classes. These can be used for internal or external benchmarking to track progress over time or to compare with peers. VMT does not affect *ClearPath's* emissions calculations.

Data Source and Entry into ClearPath

VMT information was summarized in a manner like that used for fuel use data, using information from the County's FleetAnywhere® system and from Milwaukee Mitchell International Airport. The Office of Sustainability again skillfully combined the data from several disparate systems to arrive at VMT and allocate it to the various categories. Some of this analysis required making estimates to fill gaps or misalignments in available information.

This information was entered correctly into the appropriate calculators in the *ClearPath* software.

Assessment

- Energetics spent several hours reviewing the analysis carried out by the Office of Sustainability to combine and summarize the many sources of information gathered to arrive at the inputs to the *ClearPath* software and did not find any issues that raised concerns.
- As with fuel use, the information used would have been easier to combine and summarize with a more unified vehicle-and equipment-level tracking system for tracking fleet mileage. Such a system would also

help the County’s fleet management officials better communicate the impacts of any initiatives to reduce VMT in the county fleet.

Transit Fleet

The Milwaukee County Transit System (MCTS) operates both buses in revenue service and non-revenue vehicles to support the system. Table below lists the categories and fuel types for MCTS vehicles included in the inventory analysis.

Table 4: Milwaukee County Transit System Vehicles

Category	Revenue Service?	Fuel Type
Buses	Yes	Diesel
Heavy Duty Trucks	No	Diesel
Light Duty Trucks	No	Diesel
Heavy Duty Trucks	No	Gasoline
Light Duty Trucks	No	Gasoline
Passenger Vehicles	No	Gasoline

Energetics evaluated the transit fleet analysis in two groups: Revenue Vehicle (Buses) and Non-revenue Vehicles.

Revenue Vehicle (Buses)

Fuel Use and Annual Miles Traveled

Data Source and Entry into ClearPath

MCTS provided Information on diesel fuel usage and annual miles traveled by revenue service buses.

This information was entered correctly into the ClearPath software for all three years.

Assessment

Energetics found no issues of concerns related to the analysis for MCTS buses.

Non-Revenue Vehicle

Fuel Use and Annual Miles Traveled

Data Source and Entry into ClearPath

MCTS provided information on gasoline and diesel fuel usage for all five categories of non-revenue vehicles. The Office of Sustainability used this information along with ClearPath’s default vehicle fuel efficiency factors to estimate VMT for all five vehicle categories.

This information was entered correctly into the ClearPath software for all three years.

Assessment

Energetics found no issues of concerns related to the analysis for MCTS buses.

Compliance of Inventories with The Climate Registry’s LCOP

Energetics was asked to “evaluate the 2019 - 2021 Government Operations GHG Inventories for compliance with The Climate Registry’s Local Government Operations Protocol v1.1 [LGOP].”

As noted, ICLEI’s ClearPath software is intended to produce an inventory that is compliant with the LGOP. To confirm this, Energetics contacted Eli Yewdall, Senior Program Officer at ICLEI, Local Governments for Sustainability. He responded as follows:

The ClearPath government track is based on the LGO protocol, so (if used correctly) should align very well. One possible caveat is around wastewater treatment process emissions (not sure if this applies to Milwaukee County). I think there may be a method or two - maybe on anaerobic digesters - where the US Community Protocol has a more up-to-date method that hasn't been updated in the LGO protocol, and ClearPath uses the US Community Protocol method. Otherwise everything aligns with LGO protocol.⁵

Based on this information, Energetics' evaluation of Milwaukee County's 2019-2021 Local Government Operations indicates it was performed in compliance with The Climate Registry's Local Government Operations Protocol v1.1.

Summary of Concerns and Recommendations for Improvements

As noted, Energetics' evaluation indicates that the County's 2019-2021 Local Government Operations was performed in compliance with The Climate Registry's Local Government Operations Protocol v1.1.

However, throughout the evaluation above there are several concerns and recommendations for improvements. For the County's convenience, Energetics has summarized these below.

Assessment of Scope of Milwaukee County LGO Inventory

The scope of Milwaukee County's LGO Inventory generally follows accepted practice. For future inventories the County may wish to estimate fugitive emissions as well as emissions associated with the disposal of solid waste generated by county activities. Energetics suggests the County work with ICLEI to estimate these emissions.

Buildings & Facilities

Buildings

Purchased Electricity

- Tracking facility-level electricity usage would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce electricity use and associated GHG emissions on a building level.

Natural Gas

- Tracking facility-level natural gas usage would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce natural gas use and associated GHG emissions on a building level.

District Steam

District Steam – Downtown

- Tracking facility-level heat purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce heat purchases and associated GHG emissions on a building level.
- The remaining inputs match those in the file "Valley Power Plant Energy Prod & Efficiency, 2016-2021.pdf." **One concern:** *ClearPath* requires *Total Energy Produced* as an input. Milwaukee County used *Net Electricity Production*. Similarly, *ClearPath* requires *Total Useful Heat Produced* as an input. The data from the "Valley Power Plant Energy Prod & Efficiency, 2016-2021.pdf" file provides values for both *Total Steam Exported to District Energy* and *Total District Energy Heat Flow*. Milwaukee County used *Total District Energy Heat Flow*. It is not clear whether this is the correct choice for that input. ICLEI may be able to provide further guidance.

District Steam – County Grounds

- Tracking facility-level heat purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce heat purchases and associated GHG emissions on a building level.

⁵ Email from Eli Yewdall, Senior Program Officer at ICLEI, Local Governments for Sustainability. February 1, 2023.

- The remaining inputs match those in the files provided in the “District Steam – County Ground” subfolder. **One concern:** The fuel type selected for this facility in *ClearPath* is “Natural Gas.” The file “2020 eGRID Summary - County Grounds Thermal Plant.docx” notes that in 2020 the facility used 11,899 gallons of Distillate Fuel Oil No. 2 in addition to natural gas. The document notes that the combustion of this fuel resulted about 122 MT CO₂e. This is a very small amount relative to the total emissions of over 42,000 MT CO₂e. However, it may merit noting.

District Cooling

- Tracking facility-level cooling purchases would allow Milwaukee County to assess how each of its buildings is performing relative to similar buildings and track the effectiveness of changes implemented by the County to reduce cooling purchases and associated GHG emissions on a building level.
- **One concern:** for each year, the *ClearPath* calculator for presents the following warning: “There are some outputs that cannot be calculated. This is likely due to a missing factor set.” It is unclear what, if any, impact this has on the inventories. ICLEI may be able to provide further guidance.

Diesel Generators

Fuel Used

- Tracking generator-level fuel use would allow Milwaukee County insight into how much each generator is being used, and potentially allow it to reduce usage of generators.
- **Two concerns:**
 - The County’s report on its 2016-2018 inventories indicates that there may be a diesel emergency generator located at Administrative Services.
 - The “Data” tab of the “2019-21 Diesel Generators fuel use data (CP).xlsx” Excel workbook notes the Courthouse as a generator site, and notes that the data for fuel use for that site is contained in files in the “Diesel Generators” subfolder. However, that data is not contained in the “Summary” tab of that spreadsheet, and thus is not included the generator fuel use data entered into *ClearPath*.

Streetlights and Traffic Signals

Purchased Electricity

- **One concern:** The source of the building electricity use discussed on page 8 above does not note the application of a meter group filter. To assure double counting did not occur, Milwaukee County may wish to confirm that the filter excluding the Street & Traffic Lights Meter Group was applied to that source.

Vehicle Fleet

Fuel Use

- While the data discrepancy noted in the Fuel Use *Data Source and Entry into ClearPath* section on page 12 above is *de minimus*, the Office of Sustainability may wish to determine its source.
- The information used would have been easier to combine and summarize with a more unified vehicle-and equipment-level tracking system for tracking fleet fuel use. Such a system would also help the county’s fleet management officials better communicate the impacts of any initiatives to increase fuel efficiency in the County fleet.

Vehicle Miles Traveled (VMT)

- As with fuel use, the information used would have been easier to combine and summarize with a more unified vehicle-and equipment-level tracking system for tracking fleet mileage. Such a system would also help the County’s fleet management officials better communicate the impacts of any initiatives to reduce VMT in the county fleet.

Emissions Inventory Updates

Milwaukee County made some changes in their emissions inventories based on the recommendations made in the Inventory Audit, which resulted in decreased carbon emissions.

Emissions Forecasting Methodology

Business-as-Usual (BAU) Forecast

Energetics calculated a business-as-usual emissions forecast for Milwaukee County by carrying out a linear projection of the trend indicated by the County ClearPath inventories from 2016-2021. Energetics reviewed the capabilities of ClearPath to determine its usefulness for this BAU forecast. Since ClearPath did not meet the requirements of the forecast, the forecasting was completed in Excel. Energetics calculated this forecast for total carbon emissions and for emissions by sector out to 2050. The four emissions sectors included buildings and facilities, streetlights and traffic signals, vehicle fleet, and transit fleet.

Forecast of Government Emissions under a BAU Scenario

Energetics calculated a business-as-usual emissions forecast for Milwaukee County by carrying out a linear projection of the trend indicated by the County ClearPath inventories from 2016-2021. The trend line calculated through this methodology indicates that if the County were able to maintain the average annual change in emissions from 2016 through 2021 going forward, the County would achieve zero carbon emissions by 2037.

The County's sustainability manager noted that in the period 2016-2021, the County made several changes to its operations that drove the reduction in emissions. These include airside HVAC retro-commissioning at MKE Mitchell International Airport to save 660,000 kWh of electricity and 200,000 therms of natural gas per year, implementing \$9.2 million in energy efficiency improvements at 82 County facilities under several performance contracts, and converting 100% of traffic signals to LEDs.

Some of these operational changes were made with the explicit goal of reducing emissions. These include converting MCTS buses to ultra-low sulfur diesel fuel to improve fuel efficiency and reduce emissions from transit operations and deploying 11 battery-electric buses along a new Bus Rapid Transit route. Others were made primarily to achieve other operational objectives but resulted in reduced emissions. These include implementing temperature setpoints in county buildings in 2008 and reducing the County's building portfolio by approximately 10 percent (1.5M gross square feet) from 2005 to 2022. Additionally, it should be noted that changes in the carbon intensity of Milwaukee County's purchased electricity have subsequently contributed to emission reductions. In 2015/2016, We Energies converted the Valley Power Plant in downtown Milwaukee from coal to natural gas.

The County recognizes that maintaining the rate of decrease in emissions achieved in the 2016-2021 period may get increasingly more difficult. As less expensive emission reduction measures are exhausted, increasingly expensive changes in County operations would be required to achieve the same level of emissions reduction.

Figures 2 and 3 below show total forecasted carbon emissions through 2050 and forecasted emissions by sector, respectively. Tables of data for each figure are detailed in Appendix A.

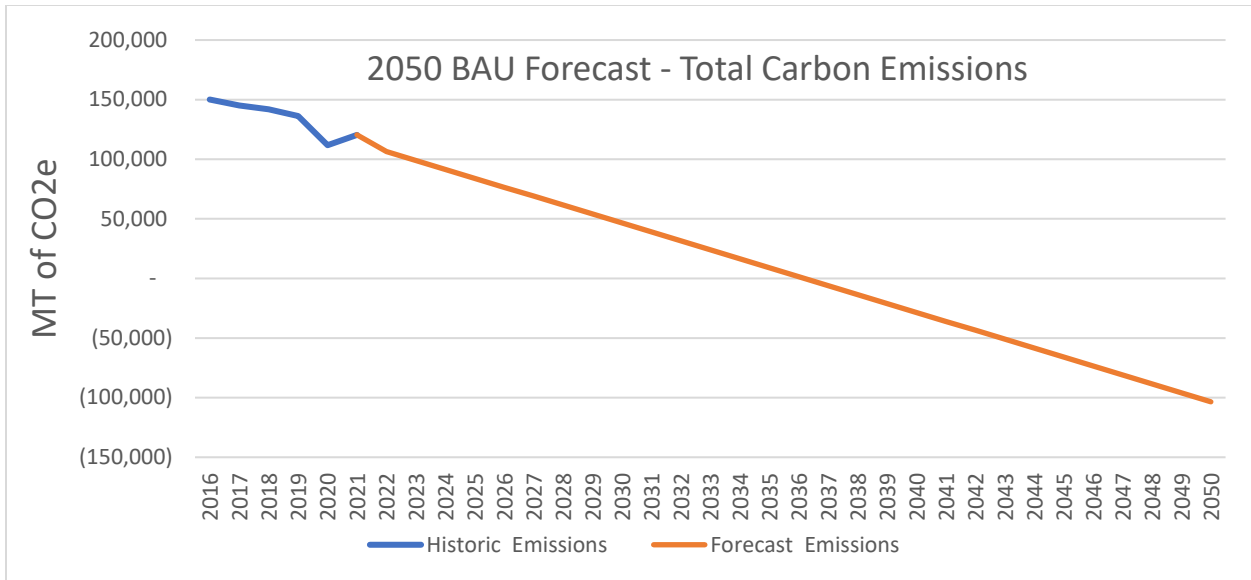


Figure 2. Total Carbon Emissions Forecast by 2050 in a BAU Scenario.

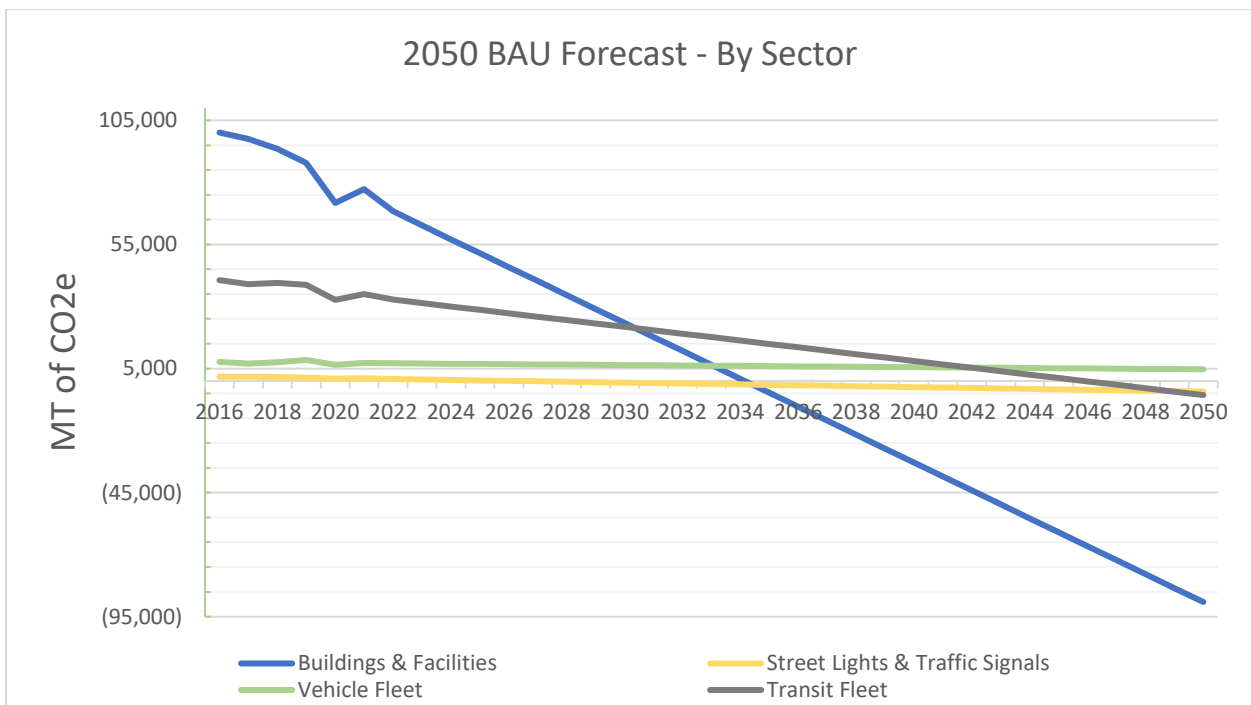


Figure 3. Carbon Emissions by Sector Forecast by 2050 in a BAU Scenario.

Milwaukee County Scenario Planning Tool

To help county leaders and staff better visualize and present to others the potential impacts on emissions reduction of various policies, Energetics developed a user-friendly scenario planning tool for carbon emissions reductions by Milwaukee County operations. The tool will allow users to explore the impact of various broad sector-level policies that affect carbon emissions to help understand the relative impact of each of those broad policies. The tool is intended to help the user gain a feel for which policies are likely to have the greatest effect on reducing emissions. This will in turn help the County direct its resources to deeper investigation into the potential cost of various policy options, such as electrifying portions of the County's vehicle fleet, or purchasing electricity with a lower carbon content.

The tool was designed with a graphical interface, allowing the user to see in real time the direction and magnitude of the change in carbon emissions associated with various policies. Not only will this be helpful in identifying the most effective policy levers, but it is also helpful in identifying policies that may have little impact on carbon emissions associated with County operations.

Appendix A – Milwaukee County Emissions Forecasting Data

Table 5: Total Carbon Emissions Forecast by 2050 in a Linear BAU Scenario

Year	Historic Emissions (MT of CO ₂ e)	Forecast Emissions (MT of CO ₂ e)
2016	150,100	-
2017	145,228	-
2018	141,979	-
2019	136,347	-
2020	111,789	-
2021	120,476	120,476
2022	-	106,505
2023	-	99,007
2024	-	91,508
2025	-	84,010
2026	-	76,511
2027	-	69,013
2028	-	61,514
2029	-	54,016
2030	-	46,517
2031	-	39,019
2032	-	31,520
2033	-	24,022

2034	-	16,524
2035	-	9,025
2036	-	1,527
2037	-	(5,972)
2038	-	(13,470)
2039	-	(20,969)
2040	-	(28,467)
2041	-	(35,966)
2042	-	(43,464)
2043	-	(50,963)
2044	-	(58,461)
2045	-	(65,960)
2046	-	(73,458)
2047	-	(80,957)
2048	-	(88,455)
2049	-	(95,954)
2050	-	(103,452)

Table 6: Carbon Emissions by Sector Forecast by 2050 in a Linear BAU Scenario

Year	Total Emissions (MT of CO ₂ e)	Buildings & Facilities	Street Lights & Traffic Signals	Vehicle Fleet	Transit Fleet
2016	150,100	100,085	1,742	7,659	40,614
2017	145,228	97,492	1,716	7,062	38,958
2018	141,979	93,468	1,571	7,501	39,439
2019	136,347	87,901	1,282	8,442	38,722
2020	111,789	71,757	941	6,483	32,608
2021	120,476	77,290	1,008	7,218	34,960
2022	108,912.93	68,324.13	748.27	7,094.07	32,746.47
2023	101,653.82	62,702.79	568.72	7,008.32	31,373.98
2024	94,394.70	57,081.45	389.18	6,922.58	30,001.50

2025	87,135.59	51,460.10	209.64	6,836.84	28,629.01
2026	79,876.48	45,838.76	30.10	6,751.10	27,256.52
2027	72,617.36	40,217.42	(149.45)	6,665.35	25,884.04
2028	65,358.25	34,596.08	(328.99)	6,579.61	24,511.55
2029	58,099.13	28,974.73	(508.53)	6,493.87	23,139.07
2030	50,840.02	23,353.39	(688.08)	6,408.12	21,766.58
2031	43,580.90	17,732.05	(867.62)	6,322.38	20,394.10
2032	36,321.79	12,110.70	(1,047.16)	6,236.64	19,021.61
2033	29,062.68	6,489.36	(1,226.70)	6,150.90	17,649.12
2034	21,803.56	868.02	(1,406.25)	6,065.15	16,276.64
2035	14,544.45	(4,753.32)	(1,585.79)	5,979.41	14,904.15
2036	7,285.33	(10,374.67)	(1,765.33)	5,893.67	13,531.67
2037	26.22	(15,996.01)	(1,944.88)	5,807.92	12,159.18
2038	(7,232.90)	(21,617.35)	(2,124.42)	5,722.18	10,786.70
2039	(14,492.01)	(27,238.70)	(2,303.96)	5,636.44	9,414.21
2040	(21,751.12)	(32,860.04)	(2,483.50)	5,550.70	8,041.72
2041	(29,010.24)	(38,481.38)	(2,663.05)	5,464.95	6,669.24
2042	(36,269.35)	(44,102.72)	(2,842.59)	5,379.21	5,296.75
2043	(43,528.47)	(49,724.07)	(3,022.13)	5,293.47	3,924.27
2044	(50,787.58)	(55,345.41)	(3,201.68)	5,207.72	2,551.78
2045	(58,046.70)	(60,966.75)	(3,381.22)	5,121.98	1,179.30
2046	(65,305.81)	(66,588.10)	(3,560.76)	5,036.24	(193.19)
2047	(72,564.92)	(72,209.44)	(3,740.30)	4,950.50	(1,565.68)

2048	(79,824.04)	(77,830.78)	(3,919.85)	4,864.75	(2,938.16)
2049	(87,083.15)	(83,452.12)	(4,099.39)	4,779.01	(4,310.65)
2050	(94,342.27)	(89,073.47)	(4,278.93)	4,693.27	(5,683.13)