



Town Of Concord, MA 2019 Greenhouse Gas (GHG) Inventory Report

Methodology: Global Protocol for Cities
Tool: MAPC's Greenhouse Gas Inventory Tool
Completed: March 2021 by Kate Hanley
Boundary: Town of Concord, MA

Note: This report summarizes the third GHG inventory for the Town of Concord following the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)* completed by Kate Hanley in March 2021 using MAPC's Greenhouse Gas Inventory Tool. GHG inventories for 2008 (baseline) and 2016 were developed by Kim Lundgren Associates (KLA) in January 2019. Previous inventory reports and addenda, as well as other sustainability and GHG reports, are available at concordma.gov/sustainability.

Introduction

Background

In 2017, Concord set goals of 80% reduction in community-wide GHG emissions by 2050 and 25% reduction by 2030. The baseline year is 2008. To measure progress, Concord follows the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) to complete community-wide greenhouse gas inventories.

2019 GHG Inventory

The 2019 Concord community greenhouse gas (GHG) was prepared by Kate Hanley using MAPC's tool following the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC). The GPC is adopted by communities around the world to ensure that GHG reports are relevant, complete, consistent, transparent, and accurate. The GPC provides guidance on what activities need to be included in the inventory and a framework for how to calculate the GHG emissions associated with various activities.

Table 1: Community-wide Emissions Summary by Sector & Scope (2019)				
Sector	Total Emissions (MT CO2e)	Scope 1 Emissions (MT CO2e)	Scope 2 Emissions (MT CO2e)	Scope 3 Emissions (MT CO2e)
Stationary Energy	123,680	100,561	21,987	1,131
Transportation	59,527	59,280	228	20
Waste	8,685	0	0	8,685
All	191,892	159,841	22,215	9,836

Methodology and Data Sources

The annual GHG inventory is based on a combination of direct data and estimates for data that cannot be obtained directly. Data sources include town records, utility reports, information from state and federal agencies.

GHG emissions are calculated by scopes. Scope 1 emissions physically occur within the geographic boundary, scope 2 emissions occur as a result of grid-supplied electricity used within the boundary, and scope 3 emissions occur outside of the geographic boundary but are driven by activities within the boundary.

What's included?

- Energy used by buildings; fugitive emissions from natural gas distribution
- Fuel used by vehicles registered in Concord and public transportation trips within the town limits
- Emissions generated by solid waste disposal and wastewater treatment

What's not included?

- Emissions generated outside of the town boundaries to produce goods or services
- Carbon sequestration

Community-wide Emissions by Sector (MT CO2e)

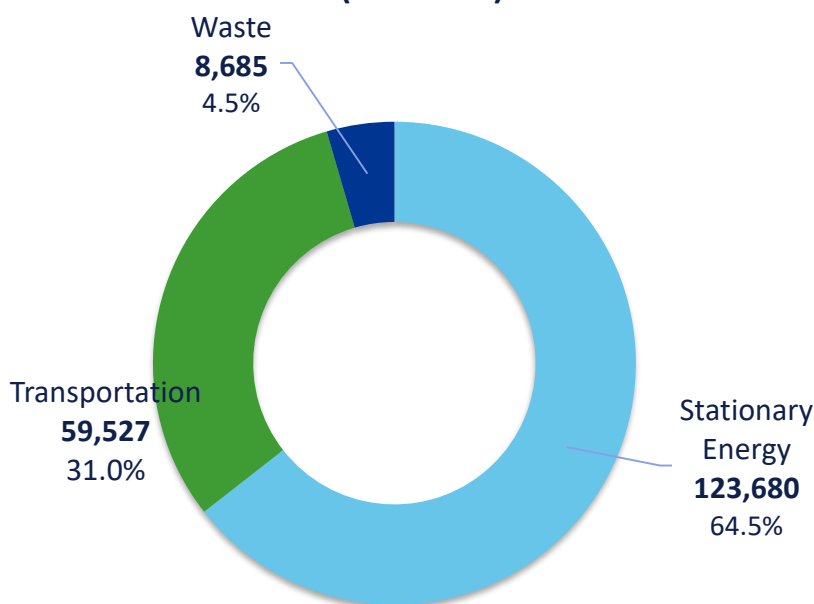


Figure 1: Community-wide Emissions (MT CO2e) by Sector

2019 Emissions

In 2019, the Concord community emitted 191,892 total MT CO2e of greenhouse gases (GHG). Energy used in buildings contributed 64.5% of total emissions. Fuel used in transportation accounted for 31% of total emissions. Emissions generated by solid waste disposal and wastewater treatment accounted for 4.5% of total emissions.

Location-based and Market-based Approach

The Global Protocol allows communities to use a location-based or market-based approach to calculate emissions from grid-supplied electricity. In the location-based approach, emissions from electricity are determined based on average annual emissions from electricity generation in the region. The market-based approach allows communities to use utility-specific emissions factors based on their energy portfolio and contractual purchases. The MAPC tool uses the market-based approach for determining electricity emissions factors in accordance with Section 6.5 of the Global Protocol. Concord's 2019 Inventory uses the market-based approach in alignment with the previous GHG Inventories for years 2008 and 2016. However, for comparison and full transparency, we show in Table 2 below the community-wide emissions using the location-based approach with an average MA electricity emissions factor.

Table 2: Location-based Emissions Factor Results for Community-wide Emissions by Sector & Scope (2019)

Sector	Total Emissions (MT CO2e)	Scope 1 Emissions (MT CO2e)	Scope 2 Emissions (MT CO2e)	Scope 3 Emissions (MT CO2e)
Stationary Energy	146,799	100,561	43,974	2,263
Transportation	59,755	59,280	455	20
Waste	8,685	0	0	8,685
All	215,238	159,841	44,430	10,968

Table 3: Comparison of Emissions Summary (2019) Using Location-based and Market-based Emissions Factors

Sector	Location-Based Total Emissions (MT CO2e)	Market-Based Total Emissions (MT CO2e)
Stationary Energy	146,799	123,680
Transportation	59,755	59,527
Waste	8,685	8,685
All	215,238	191,892

Table 3 to the left compares the total emissions resulting from the location-based method and the market-based method. The location-based method results in 11% higher total emissions. Because Concord's electricity provider, CMLP, provides a higher percentage of carbon-free electricity than the average MA electricity, electricity emissions factors vary between the two methods. Stationary emissions are lower in the market-based approach due to the lower emissions factor of CMLP-provided electricity. Transportation emissions are slightly lower since electric vehicles are powered by electricity.

Note: All other 2019 GHG Inventory figures in this report and 2019 Progress Report are results of the market-based approach used in previous inventories and recommended by MAPC in their 2020 GHG Inventory Tool.

2019 Emissions compared to 2008 baseline and 2016

Table 4: Community-wide Emissions Summary by Sector & Scope: 2008 - 2019

Sector	2008 Total Emissions (MT CO2e)	2016 Total Emissions (MT CO2e)	2019 Total Emissions (MT CO2e)	Change from 2008 -> 2019
Stationary Energy	159,779	140,072	123,680	-23%
Transportation	80,100	63,829	59,527	-26%
Waste	7,011	8,126	8,685	24%
All	246,890	212,027	191,892	-22%

For details on how emissions have changed since 2008, see the 2019 Community GHG Emissions Progress Report.

2019 Emissions by Sector and Scope

Table 5: Community-wide Emissions Summary by Sector, Subsector, & Scope (2019)					
Sector	Subsector	Total Emissions (MT CO ₂ e)	Scope 1 Emissions (MT CO ₂ e)	Scope 2 Emissions (MT CO ₂ e)	Scope 3 Emissions (MT CO ₂ e)
Stationary Energy	Residential Buildings	62,648	52,783	9,383	482
	C&I Buildings & Manufacturing Industries	61,032	47,778	12,605	650
	Construction	0	0	0	0
Transportation	On-road	56,970	56,722	228	20
	Railways	2,557	2,557	0	0
Waste	Solid Waste Disposal	6,595	0	0	6,595
	Biological Treatment of Waste	0	0	0	0
	Incineration and Open Burning	0	0	0	0
	Wastewater Treatment and Discharge	2,090	0	0	2,090
All Sectors & Subsectors		191,892	159,841	22,215	9,836

Table 5 and Figure 2 show 2019 community-wide emissions by sector, subsector and scope. Residential buildings, commercial buildings, and on-road transportation each contribute around 30% of community-wide emissions. Solid waste disposal contributes 3.4% of emissions and railways and wastewater each contribute about 1%.

Percent of Total Community-wide Emissions by Subsector

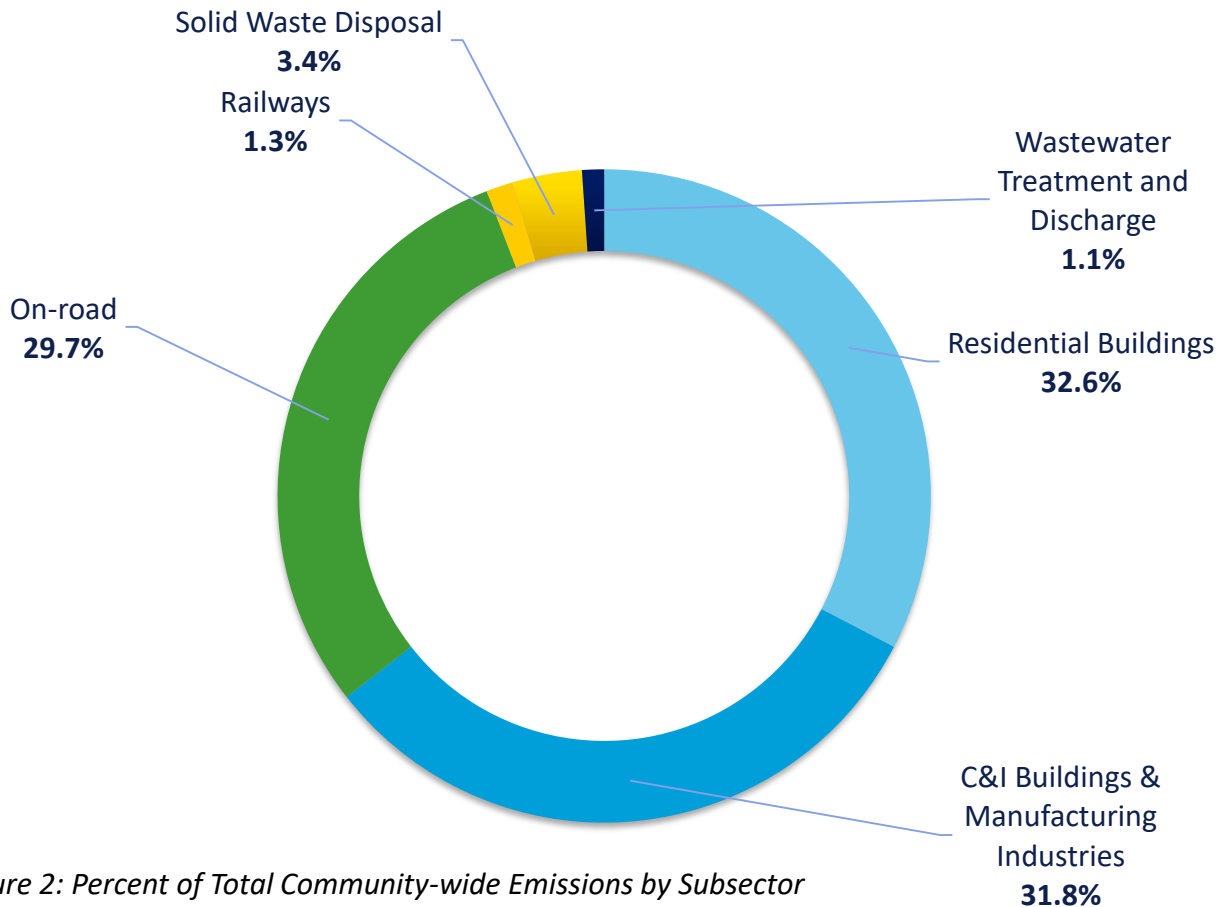


Figure 2: Percent of Total Community-wide Emissions by Subsector

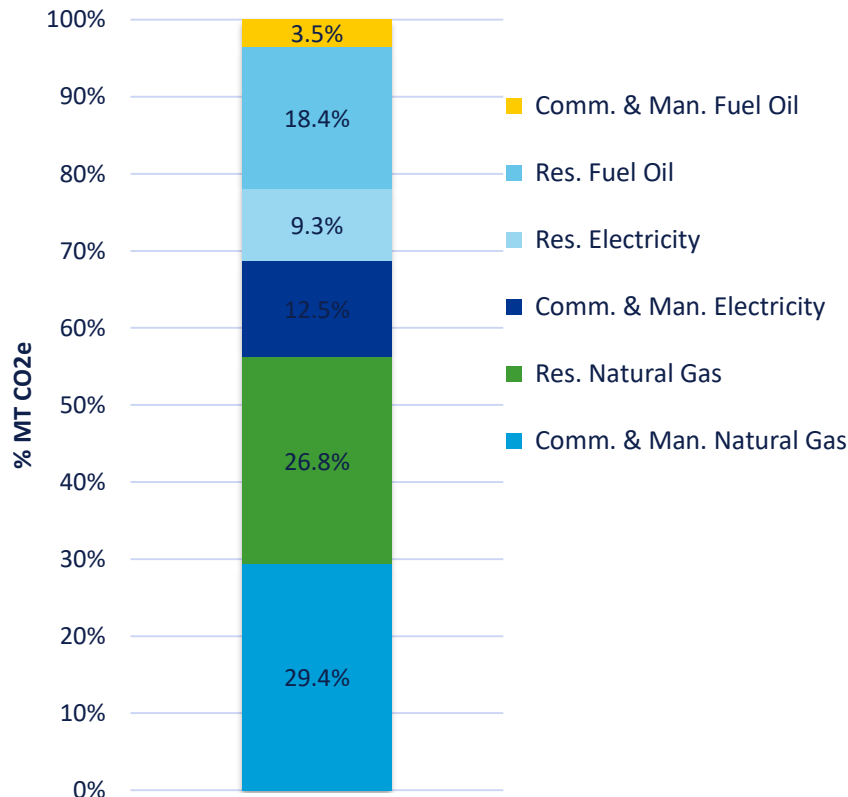
Energy and Emissions from Buildings

Table 6: Community-wide Summary of Building Energy Use and Emissions by Sector and Source (2019)

Subsector	Source	Consumption (mmBtu)	Emissions (MTCO ₂ e)	% of Total Energy Emissions
Residential Buildings	Res. Electricity	243,385	9,383	9.3%
	Res. Natural Gas	508,554	26,984	26.8%
	Res. Fuel Oil	249,101	18,484	18.4%
Commercial & Institutional Buildings and Facilities + Manufacturing Industries*	Comm. & Man. Electricity	326,956	12,605	12.5%
	Comm. & Man. Natural Gas	556,232	29,514	29.4%
	Comm. & Man. Fuel Oil	47,990	3,561	3.5%
All Buildings	Electricity	570,341	21,987	21.9%
	Natural Gas	1,064,787	56,498	56.2%
	Fuel Oil	297,091	22,045	21.9%

Energy used in buildings is the largest contributor to community-wide GHG emissions, making up over 60% of total emissions in 2019. Table 6 and Figures 3 and 4 show the energy consumed in buildings and the associated GHG emissions by sector and fuel. Natural gas is responsible for 56% of building emissions, while electricity and fuel oil each make up 22%.

Percent of Total Building Energy Emissions by Customer Type and Fuel



Percentage of Building Energy Emissions by Source Energy

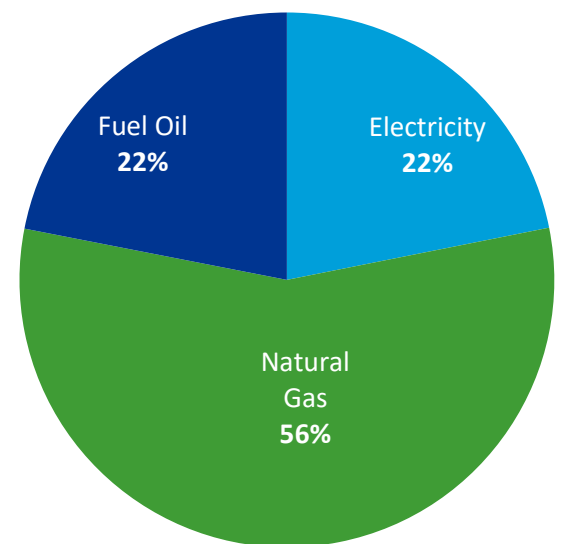


Figure 4: Percentage of Building Energy Emissions by Source Energy

Figure 3: Percent of Total Building Energy Emissions by Customer Type and Fuel

Emissions from Municipal Operations

Community members often ask about how emissions from municipal operations factor into community-wide emissions. Table 6 and Figure 5 below disaggregate municipal emissions generated from buildings and transportation from the other community-wide emissions. Municipal buildings are responsible for 1.6% of community-wide emissions and municipal vehicles contribute 0.8%.

Table 7: Community-wide Emissions Summary by Sector, Subsector, & Scope (with municipal emissions disaggregated)		
Sector	Subsector	Total Emissions (MT CO ₂ e)
Stationary Energy	Residential Buildings	62,648
	C&I Buildings & Manufacturing Industries*	57,921
	Municipal Buildings	3,111
	Construction	0
Transportation	Passenger Vehicles	51,736
	Commercial Vehicles	3,609
	Municipal Vehicles	1,625
	On-road Buses and Trolleys	0
	Railways	2,557
Waste	Solid Waste Disposal	6,595
	Biological Treatment of Waste	0
	Incineration and Open Burning	0
	Wastewater Treatment and Discharge	2,090
All Sectors & Subsectors		191,892

**Percent of Total Community-Wide Emissions by Subsector
(with Municipal Emissions Disaggregated)**

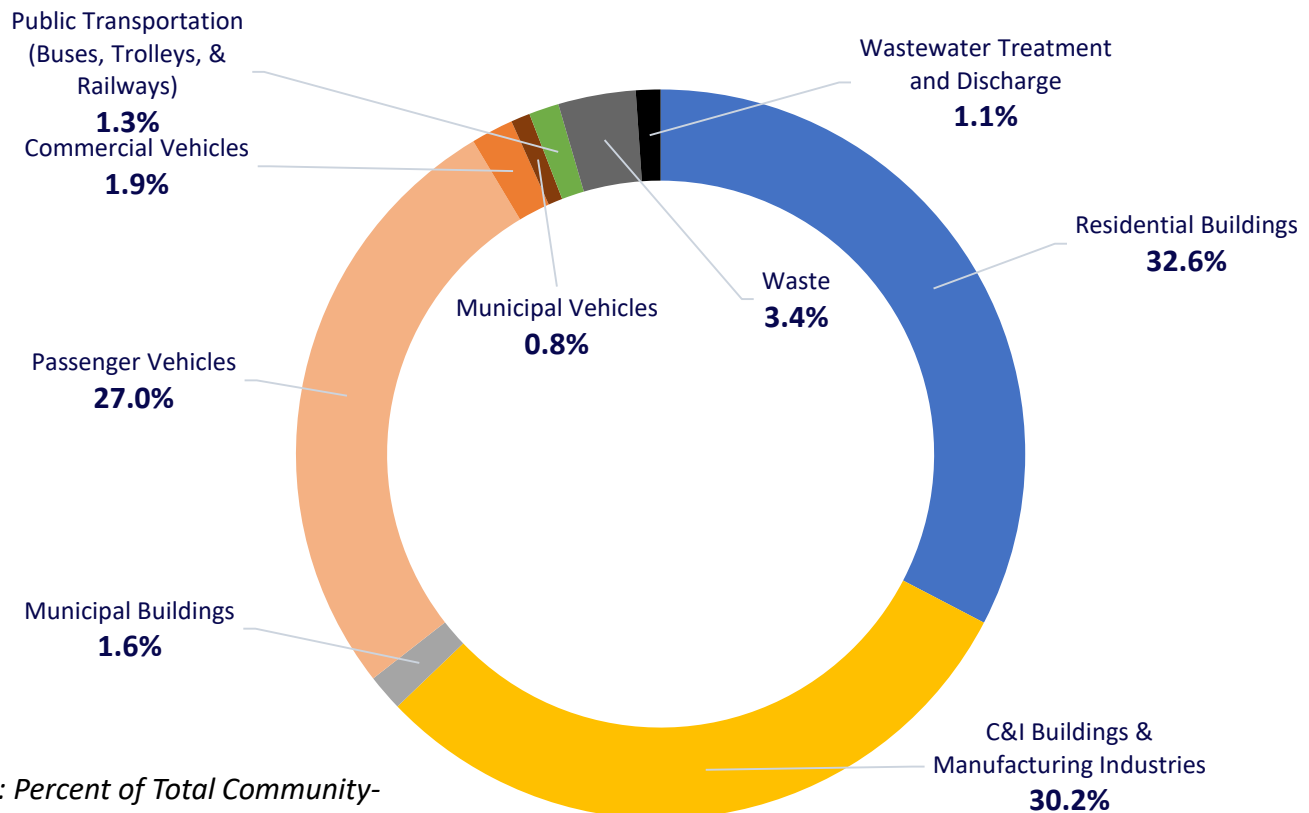


Figure 5: Percent of Total Community-Wide Emissions by Subsector (with Municipal Emissions Disaggregated)