HALTON REGION

2019 Community Greenhouse Gas Emissions Inventory

April 2022

HALTON ENVIRONMENTAL NETWORK

About Halton Environmental Network

Halton Environmental Network (HEN) propels climate action and environmental sustainability in Halton by educating and building awareness in the Halton community. As a grassroots organization which has been supporting the Halton community since 2004, HEN is recognized for its successful community programs including Greening Sacred Spaces Halton-Peel, Halton Food, Halton Green Screens, Generation Green, and OakvilleReady. HEN also serves as the backbone agency of the Halton Climate Collective (HCC).

HEN advances education about environmental issues with a focus on climate change, providing strategies and opportunities for mitigation and adaptation, educational programs, events, workshops, research, and training for the Halton community. HEN ensures that climate remains at the top of the agenda at all levels of government and with Halton's diverse community stakeholders.

About Halton Region

Halton Region is home to more than 624,000 residents in four communities. Along with its Local Municipalities (City of Burlington, the Town of Halton Hills, Town of Milton, and Town of Oakville) Halton Region is an effective two-tier government recognized for its strong financial position, safe communities, natural environment, progressive approach to urban development and citizen-focused reliable services. Halton Region worked with HEN to develop this guide to further educate and inform individuals on climate action.

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1.0 INTRODUCTION

Halton Region and Climate Change

Climate change is one of the most pressing concerns our world is facing today. Over the last few years, communities across the world have declared a Climate Emergency and have taken the initiative to plan towards a carbon-neutral community.

The Regional Municipality of Halton declared a climate emergency in 2019, setting a commitment and urgency to tackle climate change.

The climate change models for Halton indicate that we can expect more weather events with more extreme temperatures, increased precipitation and stronger winds, which can put the region at risk of flooding, freezing events, heat waves, and overall environmental damage.

The first step in tackling this is to monitor and reduce greenhouse gas (GHG) emissions through adjustments in community infrastructure and individual behaviour. These actions will not only reduce the community's overall carbon footprint, but they will help build community resilience in the face of our changing climate.

Partners for Climate Protection (PCP) program

The PCP program, supported by the Federation of Canadian Municipalities (FCM) and ICLEI-Local Governments for Sustainability, is a network of Canadian municipalities that are committed to taking action on climate change. The PCP program guides municipalities through a five-step milestone framework to take action on climate change through the reduction of GHG emissions.

The five milestones are:

Milestone 1: Create a baseline emissions inventory
Milestone 2: Set emissions reduction targets
Milestone 3: Develop a local action plan
Milestone 4: Implement the local action plan
Milestone 5: Monitor progress and report results

Halton Region became a member of the PCP program in 2005. All other lower tier municipalities within Halton have also joined the PCP program: Halton Hills in 2001, Burlington in 2002, Oakville in 2004, and Milton in 2020.

Halton Region met the corporate Milestone 1 in 2017, due to the large gap, the corporate Milestone 1 was re-established and submitted in December 2021, using 2019 as the baseline year.

Through the completion of this community greenhouse (GHG) inventory, which has been validated by FCM and ICLEI, Halton has met the community Milestone 1.

GHG Emissions Inventory

A GHG emissions inventory tracks GHG emissions generated from municipal and community sources for a given year. Community GHG emissions inventories track the GHG emissions released from the following sectors: buildings (residential, commercial and industrial), transportation, waste and agriculture.

This inventory was created following the PCP protocol, which is based on the Global Protocol for Community Scale Emissions.

A baseline year is selected for inventories as a reference year for comparison for future inventories and to set GHG reduction targets. The year 2019 was selected as the baseline year for this inventory.

This report summarises a baseline community GHG emissions inventory for Halton Region for the year 2019.

2.0 RESULTS

COMMUNITY GHG EMISSIONS INVENTORY

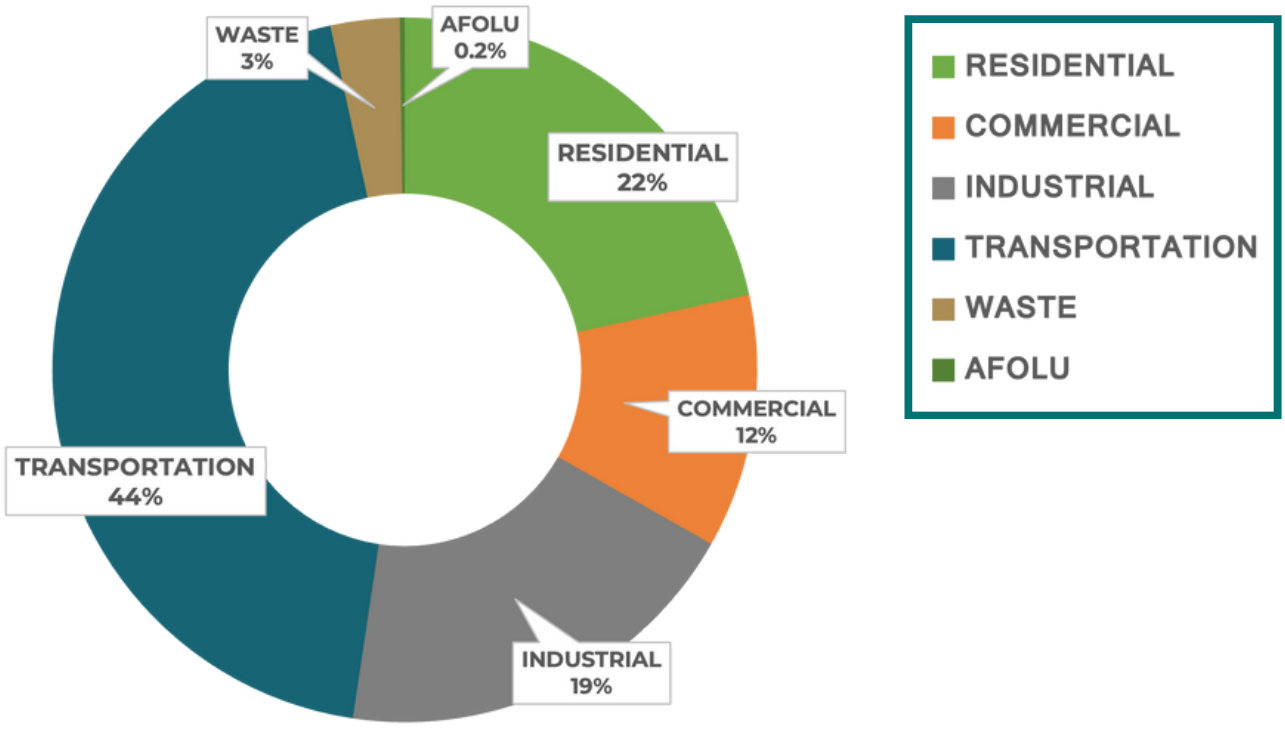
Emissions by Sector

This report identifies six sectors responsible for GHG emissions across Halton: Residential, Commercial, and Industrial Buildings; Transportation; Solid Waste; and Agriculture, Forestry, and Other Land Use (AFOLU). Building sector emissions account for just over half of all emissions, but Transportation is the largest single-sector emitter, as visible in Figure 1 below.

Table 1. Halton Community Emissions by Sector

SECTOR	CO_2E produced (Tonnes)	%
RESIDENTIAL	827,322	22
COMMERCIAL	446,659	12
INDUSTRIAL	733,918	19
TRANSPORTATION	1,696,243	44
WASTE	121,286	3
AFOLU	9,071	0.2
TOTAL	**3,834,498**	**100**

Fig. 1. Proportion of Halton Emissions Produced by Sector



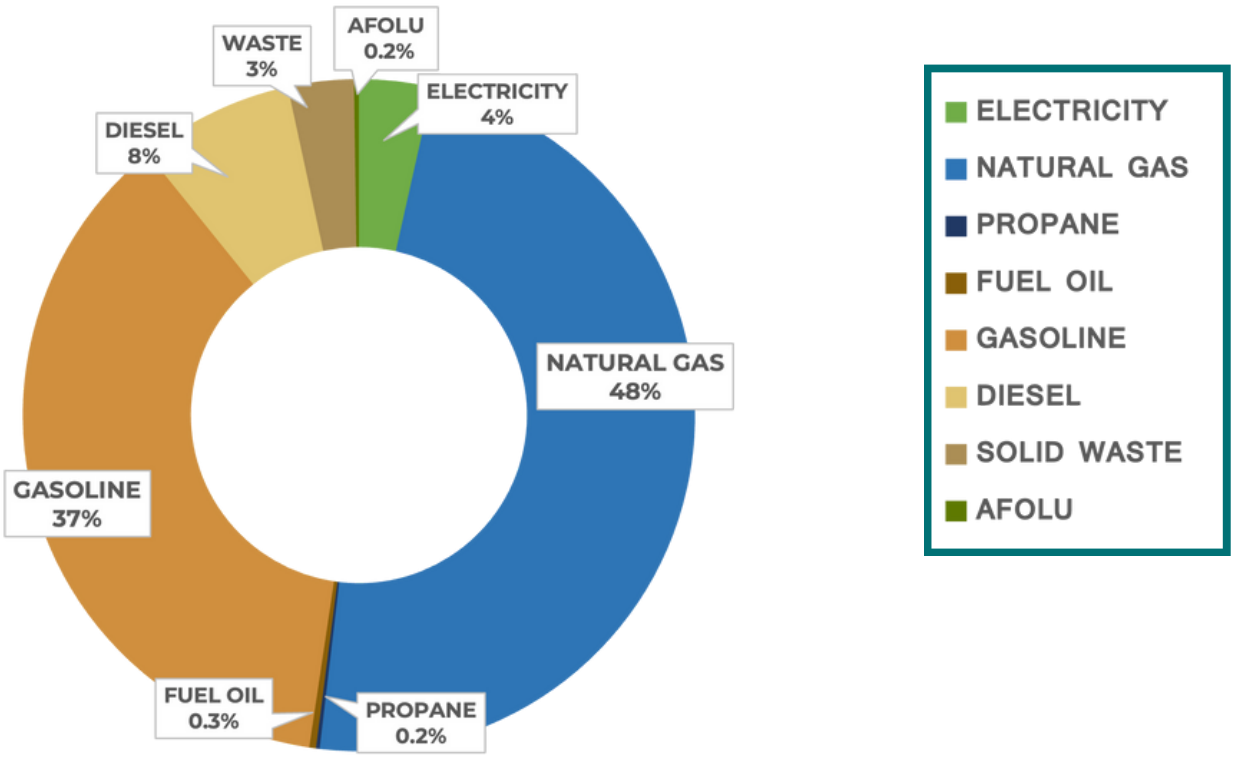
Emissions by Energy Source

Across all sectors a variety of energy sources are used in Halton. Natural gas and gasoline are responsible for the vast majority of emissions, with all other sources responsible for less than 10% each.

Table 2. Halton Community Emissions by Energy Source

ENERGY SOURCE	CO_2E produced (Tonnes)	%
ELECTRICITY	134,837	4
NATURAL GAS	1,853,938	48
PROPANE	6,794	0.2
FUEL OIL	12,329	0.3
GASOLINE	1,412,004	37
DIESEL	284,239	7
SOLID WASTE	121,286	3
AFOLU	9,071	0.2
TOTAL	**3,834,498**	**100**

Fig. 2. Proportion of Halton Emissions Contribution by Energy Source



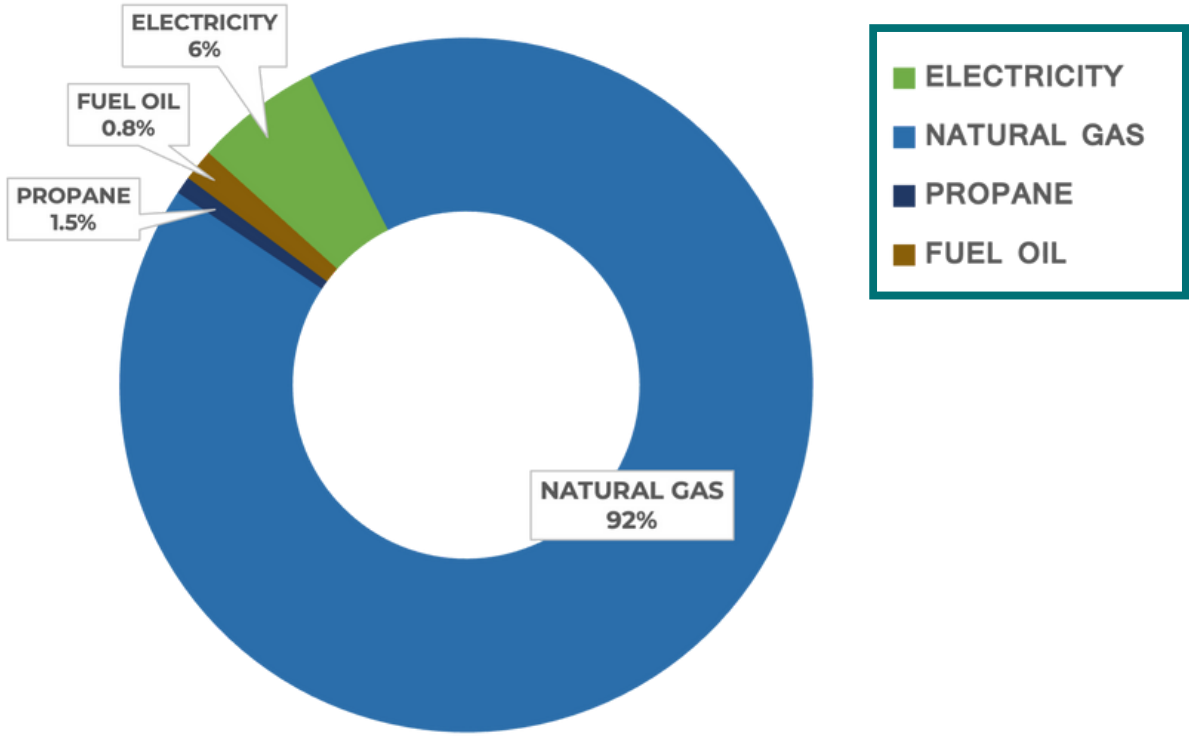
2.1 Residential Buildings

Residential building energy use accounts for just over 24% of all CO_2E emissions in Halton, the majority of which is produced by natural gas energy use as it contributes to 92% of total residential emissions. Electricity usage, propane, and fuel oil account for the other 8% of residential emissions.

Table 3. Halton Residential Emissions by Energy Source

ENERGY SOURCE	CONSUMPTION	CO_2E produced (Tonnes)	%
ELECTRICITY	1,597,691,484 kWh	48,686	6
NATURAL GAS	399,879,091 m^3	759,512	92
PROPANE	4,388,994 L	6,794	0.8
FUEL OIL	4,474,561 L	12,329	1.5
TOTAL	- -	827,321	100

Fig. 3. Proportion of Halton Residential Emissions by Energy Source



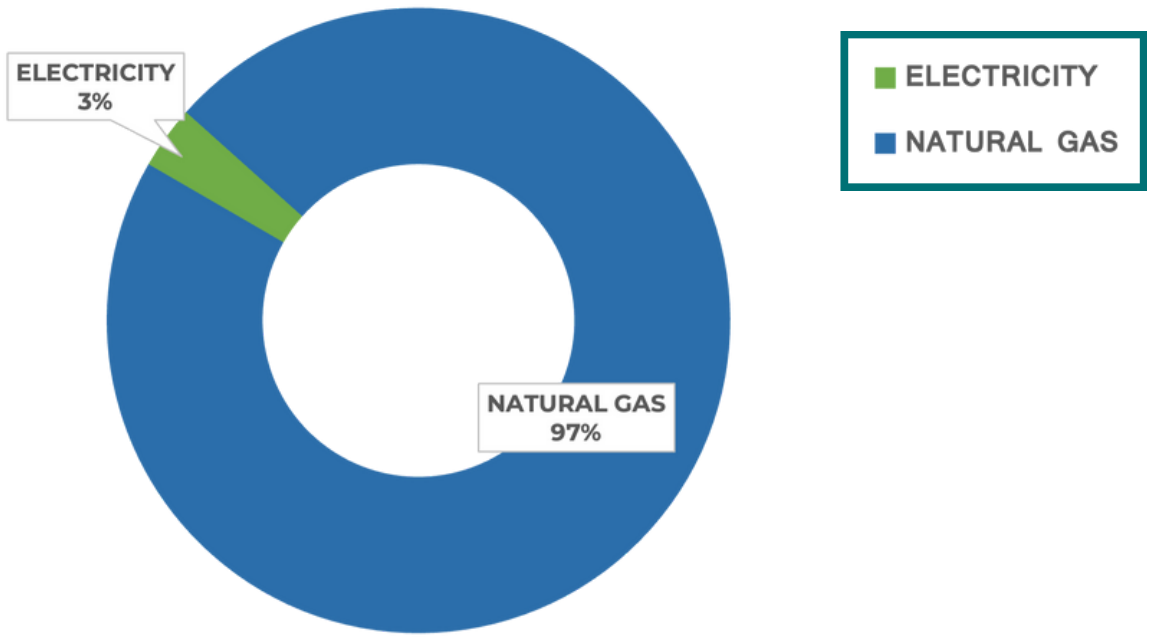
2.2 Commercial Buildings

Commercial building energy use makes up approximately 12% of all emissions in Halton Region. Like residential buildings, natural gas comprises the vast majority of commercial energy sources, with a small proportion of buildings using electricity.

Table 4. Halton Commercial Emissions by Energy Source

ENERGY SOURCE	CONSUMPTION	CO_2E produced (Tonnes)	%
ELECTRICITY	480,195,921 kWh	14,633	3
NATURAL GAS	227,459,067 m^3	432,026	97
TOTAL	- -	446,659	100

Fig. 4. Proportion of Halton Commercial Emissions by Energy Source



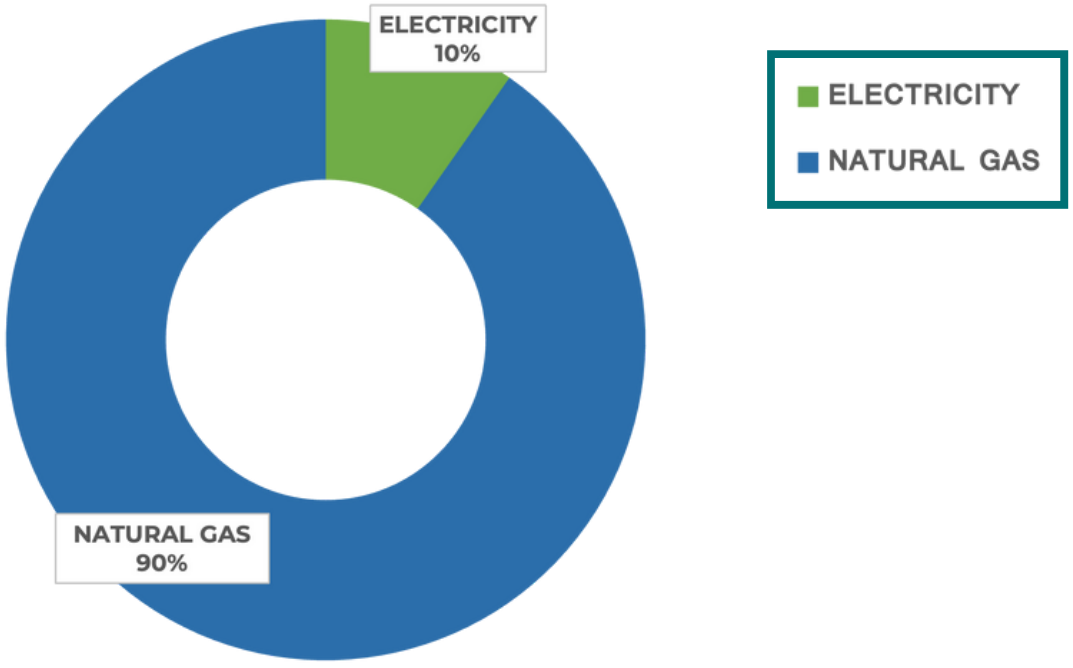
2.3 Industrial Buildings

Industrial building energy use makes up 19% of Halton's total GHG emissions. Like other building sectors in the region, most industrial buildings use natural gas, with less than 10% coming from electricity.

Table 5. Halton Industrial Emissions by Energy Source

ENERGY SOURCE	CONSUMPTION	CO_2E produced (Tonnes)	%
ELECTRICITY	2,346,908,157 kWh	71,517	10
NATURAL GAS	348,750,239 m^3	662,401	90
TOTAL	- -	733,918	100

Fig. 5. Proportion of Halton Industrial Emissions by Energy Source



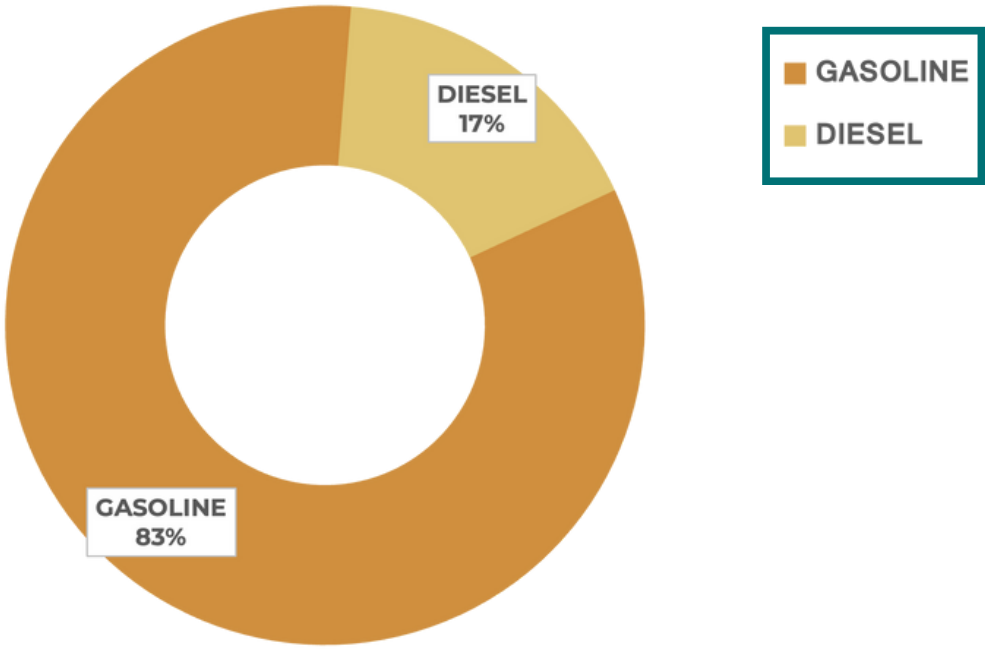
2.4 Transportation

Transportation accounts for 44% of all Halton GHG emissions. Gasoline and diesel are the two known transportation fuel sources in the region and based on fuel sale consumption data, gasoline vehicles account for 83% and diesel vehicles for 17% of the emissions produced by transportation in the region.

Table 6. Halton Transportation Emissions by Consumption and Fuel Source

FUEL SOURCE	CONSUMPTION (L)	CO_2E produced (Tonnes)	%
GASOLINE	624,518,314	1,412,004	83
DIESEL	60,563,645	284,239	17
TOTAL	685,081,959	1,696,243	100

Fig. 6. Proportion of Halton Transportation Emissions by Fuel Source



2.5 Solid Waste

In 2019, 74,868 tonnes of solid waste were generated across the region of Halton. The emissions produced from this waste are calculated to be 121,287 tonnes of CO_2 and other equivalent greenhouse gases.

Table 7. Halton Solid Waste Emissions Generated in 2019

Solid Waste Generated (Tonnes)	CO_2E produced (Tonnes)
74,868	121, 287

2.6 Agriculture, Forestry and Other Land Use (AFOLU)

In 2019, agricultural land uses contributed to about 0.3% of Halton's total CO_2E emissions. The two main sources of GHG emissions directly resulting from the livestock are the processes of enteric fermentation and manure management. The primary byproduct of these processes is methane (CH_4) which was used to convert to CO_2E emissions. As seen in the figures below, enteric fermentation produces about 85% of emissions in this sector while manure management gives rise to the remaining 15%.

Table 8. Halton Agricultural Emissions by Source

SOURCE	CH_4 produced (Kg)	CO_2E produced (Tonnes)	%
ENTERIC FERMENTATION	285,026	7,753	85
MANURE MANAGEMENT	48,469	1,318	15
TOTAL	333,495	9,071	100

Fig. 7. Proportion of Halton Agricultural Emissions by Source

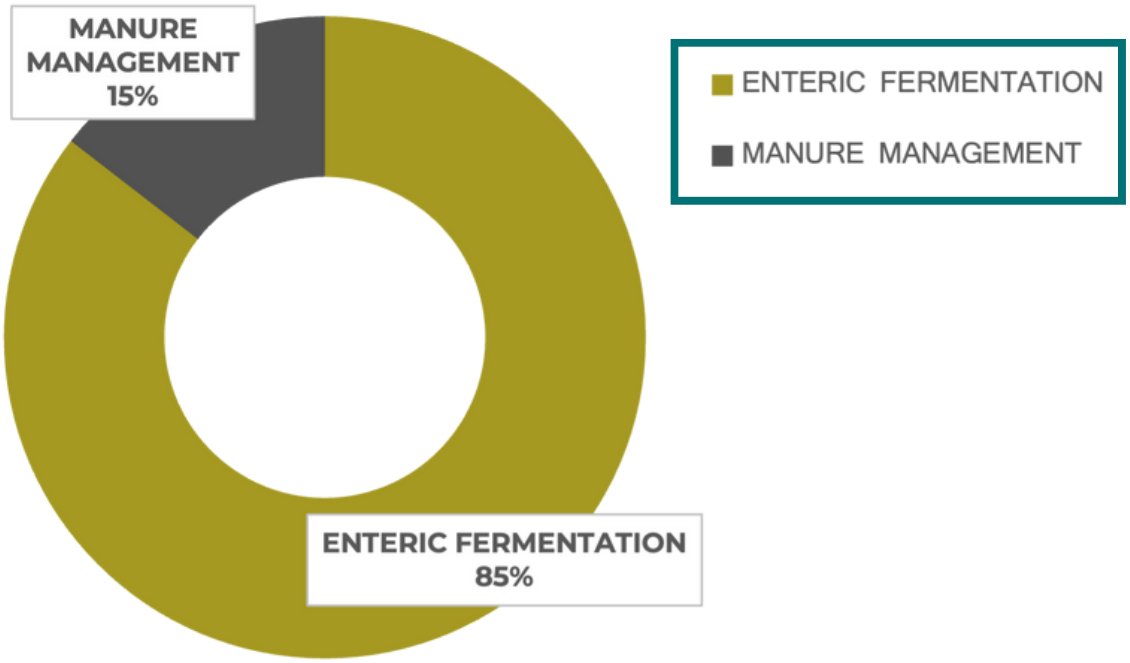


Table 9. Enteric Fermentation Emissions by Livestock Type

LIVESTOCK	NO. OF LIVESTOCK	CH_4 produced (Kg)	CO_2E produced (t)
DAIRY COWS	389	55, 316	1,505
DAIRY HEIFERS	272	20,835	567
BULLS	60	7,440	202
BEEF COWS	842	101,293	2,755
BEEF HEIFERS	185	16,835	458
HEIFERS FOR SLAUGHTER	342	18,434	501
STEERS	371	33	494
CALVES	766	52	911
PIGS	34	13,168	1
SHEEP & LAMBS	1,646	13,168	160
CHICKENS & HENS	162,456	N/A	N/A

Table 10. Manure Management Emissions by Livestock Type

LIVESTOCK	NO. OF LIVESTOCK	CH_4 produced (Kg)	CO_2E produced (t)
DAIRY COWS	389	15,171	413
DAIRY HEIFERS	272	4,624	126
BULLS	60	288	8
BEEF COWS	842	3,789	103
BEEF HEIFERS	185	592	16
HEIFERS FOR SLAUGHTER	342	752	20
STEERS	371	742	20
CALVES	766	2,298	63
PIGS	34	275	7
SHEEP & LAMBS	1,646	443	7
CHICKENS & HENS	162,456	19,495	530

3.0 BUSINESS AS USUAL FORECAST

A Business As Usual (BAU) forecast is a projection of future GHG emissions if no actions are taken to reduce GHG emissions.

A BAU forecast for the year 2051 was calculated based on population forecasts from the 2020 regional growth plan *A Place to Grow: Growth Plan for the Greater Golden Horseshoe.* Between 2016 and 2051 the population of Halton Region is expected to increase from 548,435 to 1,100,000, with an annual growth rate of 2.9%.

If Business As Usual continues in Halton, GHG emissions are projected to increase to 9,571,953 tonnes CO_2E by 2051. Using 2019 emissions levels as the baseline year, that is a 150% increase in the next 30 years. The chart below breaks down the emissions increase forecast by sector.

Fig. 8. Business As Usual (BAU) Emissions Forecast for Halton Region

4.0 METHODOLOGY

Residential, Commercial and Industrial Buildings

Natural Gas emissions for the building sectors were calculated by the PCP Tool using 2019 natural gas consumption data provided by Enbridge Inc. to the Region of Halton.

Assumptions and Limitations:

- Natural Gas consumption data cannot be disaggregated by building type or use (eg. single-family homes, apartment or condo buildings); they are grouped together under each building sector.

Electricity emissions were calculated by the PCP Tool using data obtained from the Ontario Energy Board Yearbook of Electricity Distributors 2019/2020. From this yearbook report, metered electricity consumption data from Burlington Hydro, Halton Hills Hydro, Milton Hydro, and Oakville Hydro were extracted.

Assumptions and Limitations:

- Electricity consumption data cannot be disaggregated by building type or use (eg. single-family homes, apartment or condo buildings); they are grouped together under each building sector.
- Commercial users were assumed to be users that use <50kW and industrial users were assumed to be users that use >50kW.

Propane and Fuel Oil use was estimated using a variety of sources including Canadian census data, Ontario energy use data, and data provided by Enbridge Inc. This provided the estimated volume of each fuel used in the region which were entered into the PCP Tool to calculate the associated emissions.

Assumptions and Limitations:

- Propane and fuel oil is limited by the use of the last available census data (2016), and by the downscaling of Provincial level data
- All buildings using propane or fuel oil were assumed to be rural and so estimates were only produced for Milton and Halton Hills as the number of rural dwellings outside these municipalities was deemed to be insignificant.
- Average fuel use per home was estimated based on the median size of single-detached homes in Ontario

Transportation

We worked with The Atmospheric Fund to obtain emissions data for transportation. Emissions were calculated using gasoline and diesel fuel sales data from retail gas stations within Halton, from Kent Group Limited.

Assumptions and Limitations:

- Ontario's renewable fuel standard requires at least 5% of gasoline sold to be from a renewable source so it was assumed that 5% of gasoline sales were ethanol
- Due to the Greener Diesel regulation, 4% of diesel sales were assumed to be bio-based
- Fuel sales data excludes diesel from heavy commercial trucks.

Agriculture

Livestock data was collected from the agricultural profiles provided by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Methane emissions from enteric fermentation and manure management were calculated and converted into carbon dioxide equivalent emissions through the PCP tool.

Assumptions and Limitations:

- Livestock data for turkeys, as well as other land use data, was unavailable.
- Most recent poultry data is from 2016.
- Chickens and hens have different emissions factors, however, the higher one was chosen to calculate emissions since the data grouped chickens and hens together.
- Pigs of different sizes have different emissions factors, however, the highest one was chosen to calculate emissions since the data grouped all pigs together without differentiating their sizes.
- Fuel use emissions from high energy farm vehicles were not accounted for due to lack of data.
- For manure management, other emissions, such as N_2O, are not being accounted for due to lack of data.

Solid Waste

Solid waste data was obtained from Halton Region. The data includes tonnes of waste generated in Halton in 2019 that is disposed in the landfill located at the Halton Waste Management Site.
As emissions from waste deposited in a landfill are released over the period of the waste's decomposition, the PCP Protocol provides different methods to calculate associated emissions. We used the methane commitment approach; this approach estimates the downstream CH_4 emissions attributable to the inventory year the solid waste was generated and disposed at the landfill. To calculate emissions, the tonnes of waste generated was inputted into the PCP Tool and the methane commitment model was selected.

Assumptions and Limitations:

- The PCP Protocol states when calculating solid waste emissions, the CO_2 emissions released from the combustion of the organic waste are considered to be of biogenic origin and are excluded from the GHG inventory.

4.1 Emission Factors

Corresponding emission coefficient values were applied to each energy source to calculate GHG emissions. These values are listed below in Table 11.

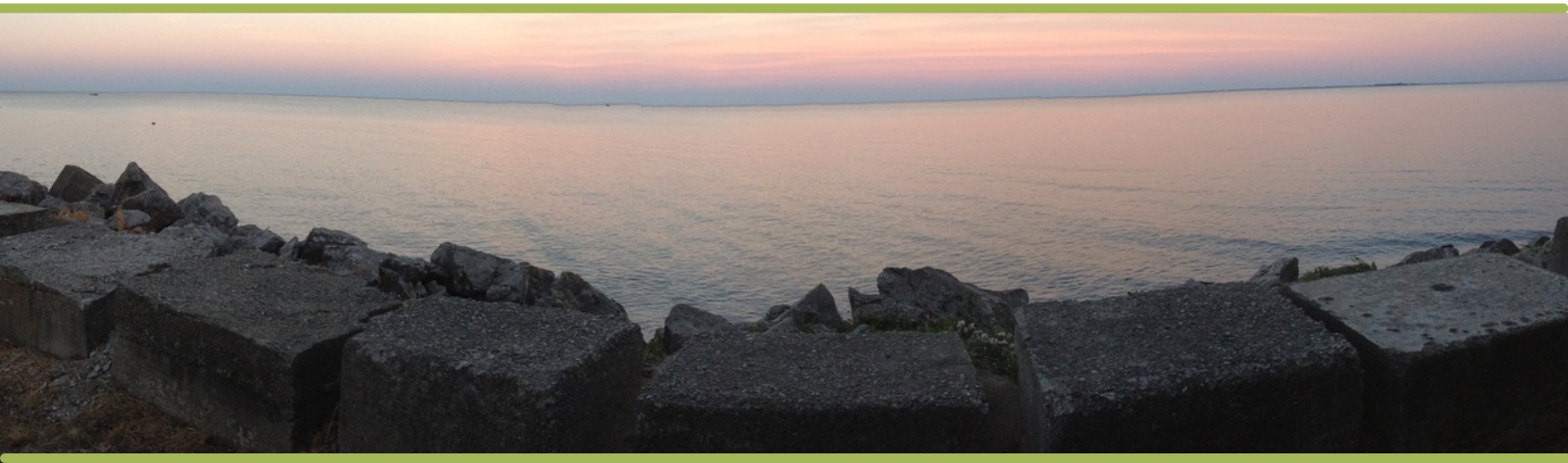
Table 11. Summary of Emission Coefficient Values

EMISSIONS SOURCE	EMISSIONS COEFFICIENT
ELECTRICITY	0.000030 T CO_2/kWh
NATURAL GAS	0.001888 T CO_2/m^3
HEATING OIL	2,753 G/L
PROPANE	1,151 G/L
GASOLINE	0.0023 T CO_2e/L
ETHANOL	0.001519 T CO_2e/L
DIESEL	0.0027 T CO_2e/L
BIODIESEL	0.00189 T CO_2e/L
DAIRY COWS	142.2 kg CH_4/head/year
DAIRY HEIFERS	76.6 kg CH_4/head/year
BULLS	124 kg CH_4/head/year
BEEF COWS	120.3 kg CH_4/head/year
BEEF HEIFERS	91 kg CH_4/head/year
HEIFERS FOR SLAUGHTER	53.9 kg CH_4/head/year
STEERS	49 kg CH_4/head/year
CALVES	43.7 kg CH_4/head/year
BOARS AND SOWS	1.5 kg CH_4/head/year
PIGS	1.5 kg CH_4/head/year
SHEEP AND LAMBS	8 kg CH_4/head/year

Table 12. Summary of Emission Coefficient Values for Livestock Manure Management

MANURE SOURCE	EMISSIONS COEFFICIENT
DAIRY COWS	39 kg CH_4/head/year
DAIRY HEIFERS	17 kg CH_4/head/year
BULLS	4.8 kg CH_4/head/year
BEEF COWS	4.5 kg CH_4/head/year
BEEF HEIFERS	3.2 kg CH_4/head/year
HEIFERS FOR SLAUGHTER	2.2 kg CH_4/head/year
STEERS	2 kg CH_4/head/year
CALVES	3 kg CH_4/head/year
BOARS AND SOWS	7 kg CH_4/head/year
PIGS < 20 kg	2.1 kg CH_4/head/year *
PIGS 20-60 kg	4.2 kg CH_4/head/year *
PIGS > 60 kg	9.2 kg CH_4/head/year
SHEEP	0.33 kg CH_4/head/year
LAMBS	0.22 kg CH_4/head/year
CHICKENS	0.03 kg CH_4/head/year *
HENS	0.12 kg CH_4/head/year
TURKEYS	0.1 kg CH_4/head/year

*Emissions coefficient not used in calculations due to unavailable data



5.0 NEXT STEPS

Halton Region has achieved PCP Milestone 1 through the completion of this baseline community GHG emissions inventory. This inventory presents a reference for measuring the progress the Region makes to reduce GHG emissions. In 2019 Halton's total GHG emissions were 3,834,498 tonnes CO_2e, with buildings and transportation being the largest contributors to total GHG emissions.

It is recommended that the Region continue working through the other milestones of the PCP program. This includes setting emission reduction targets (Milestone 2). Considering targets set by other municipalities may help establish a reduction target, a summary of emission targets set by other lower tier municipalities in Halton are shown in Table 13.

Once emission targets are set, the recommended next step will be to develop a community climate action plan (Milestone 3), with climate actions addressing natural gas and transportation emissions. The community climate action plan should be developed with engagement with stakeholders and the community.

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Table 13. Original PCP Community GHG emission reduction targets for municipalities in Halton

	GHG Emission Reduction Targets	Year Reduction Target Set	Baseline Year	Baseline Emissions (Tonnes CO_2e)	Updated Emissions Reduction Target
Burlington	6.8 to 5 tonnes by 2030 on a per capita basis	2014	2011	1,184,146	• Net Zero by 2050 • Updated in 2019 in the Climate Action Plan
Halton Hills	35% reduction in per capita emissions by 2031	2015	2011	618,465	• Net Zero by 2030 • Set in 2019 after the declaration of Climate Emergency
Milton	6% reduction by 2030	2020	2017	556,642	--
Oakville	6% reduction by 2014	2008	2004	990,183	• 50% below 2016 levels by 2041 • Set in 2020 Community Energy Strategy

APPENDIX A

GHG EMISSIONS BY LOWER TIER MUNICIPALITY

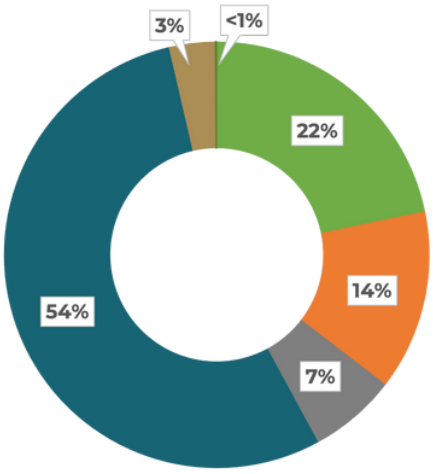
GHG emissions were separated for the lower tier municipalities in Halton; Burlington, Halton Hills, Milton and Oakville

- Emissions from the AFOLU sector were broken down by municipality using the proportion of agricultural land to the region for each municipality, provided by the Ontario Land Cover Compilation (OLCC) from Land Information Ontario.
- Emissions for the waste sector were broken down per capita for each municipality.
- Transportation emissions were proportioned using Vehicle Kilometers Travelled proportions provided by the Transportation Tomorrow Survey.

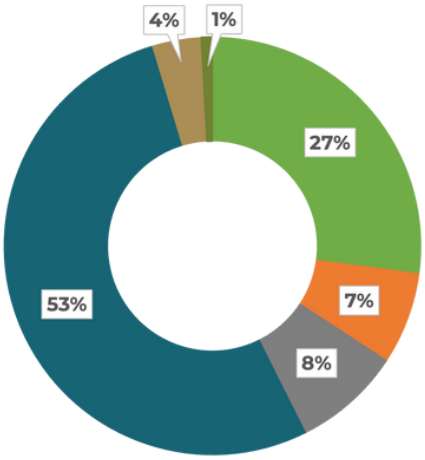
Note: The total will not match the Regional emissions, as natural gas data included unknown and non-FSA postal codes which could not be identified in the municipal breakdown.

Emissions By Sector Per Municipality

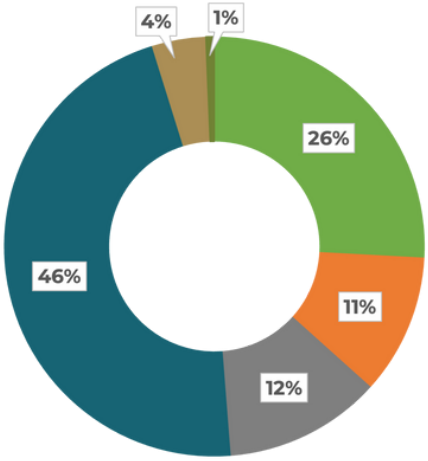
Burlington



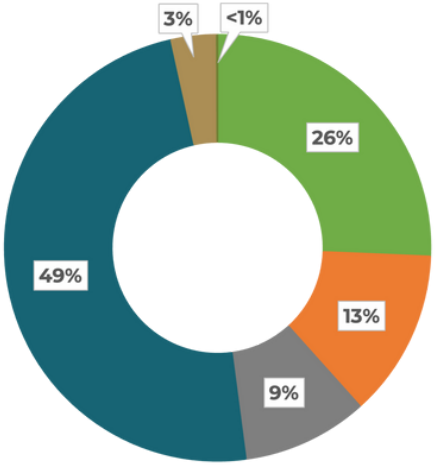
Halton Hills



Milton



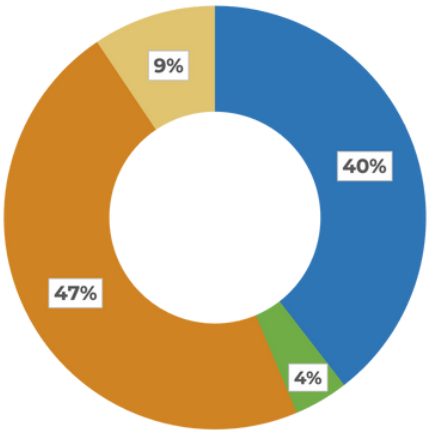
Oakville



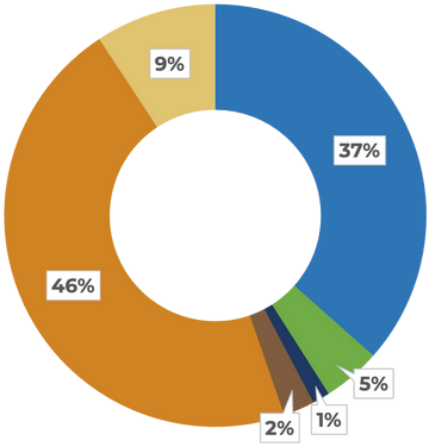
Halton Municipal Emissions by Sector 2019 (Tonnes CO2e)				
	HALTON HILLS	MILTON	BURLINGTON	OAKVILLE
RESIDENTIAL	95,840	151,075	251,150	322,516
COMMERCIAL	25,257	63,219	158,147	159,460
INDUSTRIAL	29,689	70,762	77,216	119,954
TRANSPORTATION	186,587	271,399	627,610	610,647
WASTE	13,526	24,355	40,540	42866
AFOLU	3,084	3,810	1,361	816
TOTAL	*353,983*	*584,620*	*1,156,023*	*1,256,259*

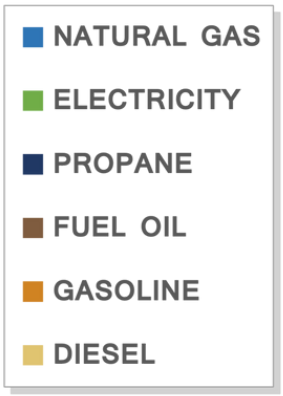
Emissions By Energy Source Per Municipality

Burlington

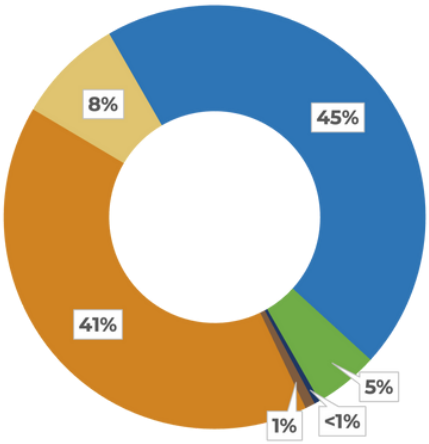


Halton Hills

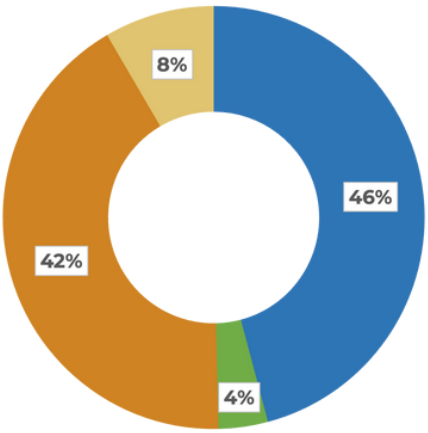




Milton



Oakville



Halton Municipality Emissions by Energy Source 2019 (Tonnes CO2e)				
	HALTON HILLS	MILTON	BURLINGTON	OAKVILLE
NATURAL GAS	123,253	250,917	440,140	556,016
ELECTRICITY	14,986	27,563	46,374	45,914
PROPANE	4,458	2,336	--	--
FUEL OIL	8,090	4,239	--	--
GASOLINE	155,320	225,921	522,442	508,322
DIESEL	31,266	45,478	105,168	102,326
TOTAL	*337,372*	*556,454*	*1,114,124*	*1,212,579*

APPENDIX B

SOURCE LIST

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