Results of the 2020 Community and Corporate Greenhouse Gas (GHG) Inventories

September 2021

Executive Summary

Greenhouse gas (GHG) inventories provide a snapshot of energy use and associated emissions over a given period within the buildings, transportation, waste, and agriculture sectors. Emissions are reported in tonnes of equivalent carbon dioxide emissions (tonnes of CO_2e), which are calculated based on carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions. Inventories follow the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), which offers a consistent and robust accounting methodology that allows for comparison around the world. They are based on five principles in order to represent a true account of emissions: relevance, completeness, consistency, transparency, and accuracy.

The City of Ottawa (the City) undertakes two types of GHG inventories on an annual basis: community inventories and corporate inventories. The latest inventory results are for the 2020 calendar year.

Community inventories track emissions from activities taking place within the geographic boundaries of the city of Ottawa and are broken down into four sectors:

- *Buildings* – includes emissions from residential, commercial, institutional, and industrial sectors
- *Transportation* – includes emissions from on-road, aviation, rail, and off-road transportation
- *Waste* – includes emissions from solid waste and wastewater
- *Agriculture* – includes emissions from crop production and livestock operations

Between 2012 and 2020, community emissions decreased 15 per cent (Figure 1) and per capita emissions decreased from 7.1 tCO_2e per person in 2012 to 5.6 tCO_2e per person in 2020. Historically, this decline in emissions has been attributable to the provincial phase out of coal plants and a significant reduction in emissions from electricity generation and consumption. However, starting in 2020, the COVID-19 pandemic also played a significant role in reducing GHG emissions, particularly within the transportation sector which saw a 30 per cent drop in gasoline fuel use between 2019 and 2020. Roughly 90 per cent of community emissions are attributable to the building (primarily for building heating) and transportation sectors, a trend that has been consistent since 2012. Waste and agriculture sectors make up the other roughly 10 per cent of emissions (Figure 2). Natural gas consumption was the largest contributing source of emissions, accounting for 38 per cent of total community emissions. Gasoline and diesel consumption were the second and third largest contributors, accounting for 21 per cent and 12 per cent, respectively (Figure 3).

In order to meet Ottawa's short term and mid-term targets to reduce emissions by 43 per cent by 2025 and 68 per cent by 2030, respectively, the community will need to reduce emissions by 5 to 6 per cent a year over the next five to ten years. It is expected that the drop in community emissions due to the COVID-19 pandemic will not be sustained once

the virus is under control and that emissions will rebound if there are no additional actions or investments to achieving Ottawa's GHG emission reduction targets. In 2020, Council approved new GHG reduction targets and Energy Evolution, the action and investment framework for achieving these targets. Staff have been working on developing and launching plans, policies, and programs that will directly impact or influence emission reductions; however, given that Energy Evolution was only approved one year ago and that many of these policies, programs, and plans are still in development, it will take time for these initiatives to have an effect. Staff do not expect to see a significant reduction in the next two to three GHG inventories, particularly on the community side. This is due to the number, scale and complexity of the projects required to achieve Council's targets, as well as factors outside the City's control, including policy decisions by senior levels of government and the availability of funding and market solutions. Staff will continue to report on how Ottawa is tracking towards community and corporate GHG reduction targets and provide status updates on the Climate Change Master Plan including initiatives to reduce emissions in the community and within municipal operations.

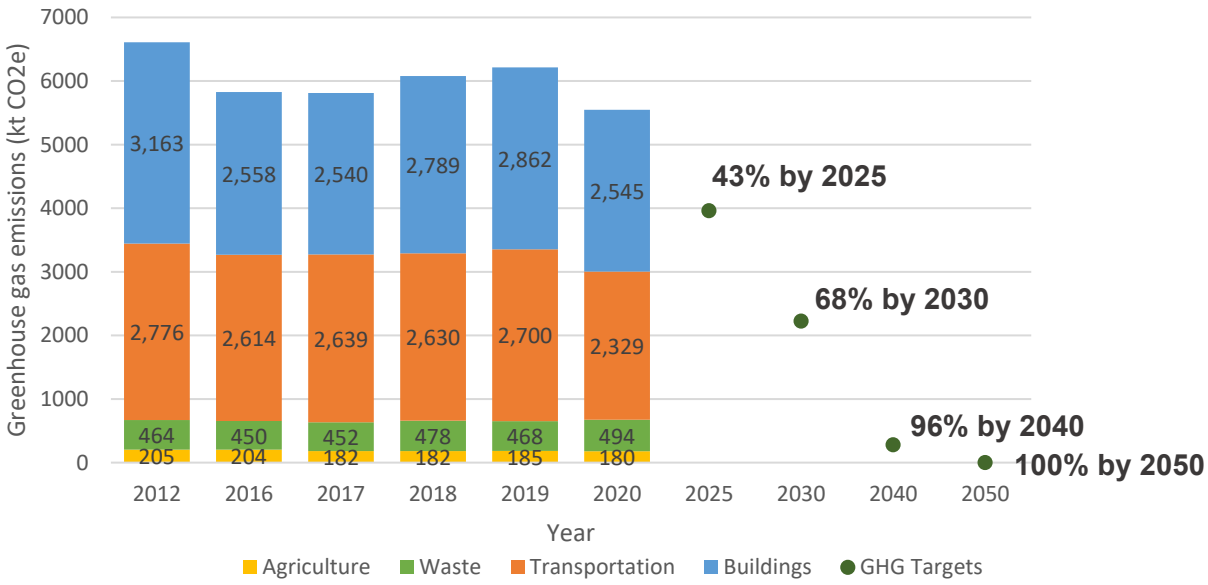

Figure 1: Annual Community GHG Emissions by Sector, 2012 and 2016-2020

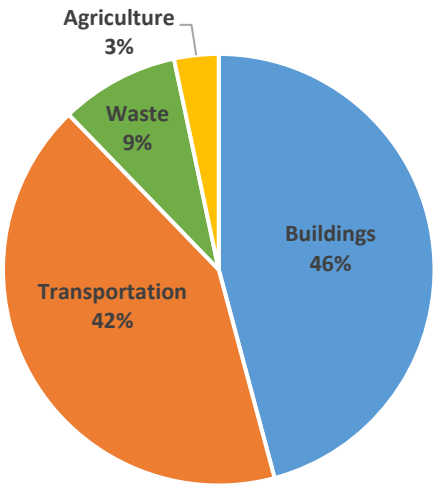

Figure 2: Community GHG Emissions by Sector (2020)

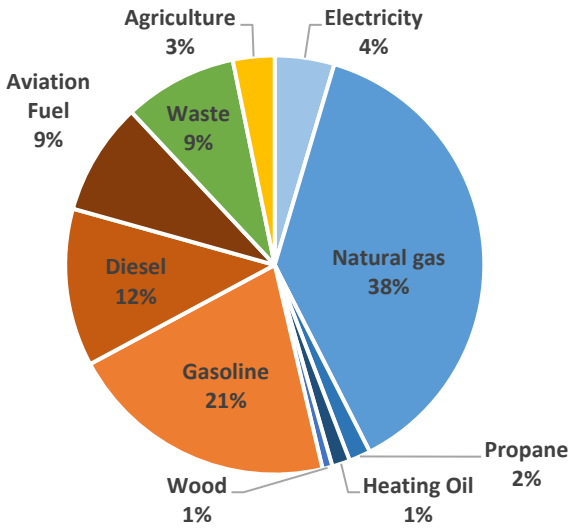

Figure 3: Community GHG Emissions by Source (2020)

Corporate inventories are used to track emissions under municipal operational control within the corporate organizational structure and are broken down into four sectors:

- *Facilities* – includes buildings, streetlights, and traffic lights
- *Fleet* – includes municipal, transit, and police fleets
- *Solid waste* – includes emissions from the Trail Road Waste Facility and the Nepean landfill
- *Wastewater* – includes emissions from the treatment of wastewater at Robert O. Pickard Environmental Centre

Between 2012 and 2020, corporate emissions decreased by 43 per cent, currently exceeding the short-term target to reduce emissions by 30 per cent below 2012 baseline levels by 2025. This decrease in emissions remains primarily due to the significant decline in emissions in the solid waste sector, of which 32 per cent of the 43 per cent total reduction can be attributed to the considerable efficiencies made at the Trail Road Waste Facility. The remaining emission reductions can be attributable to a decrease in fuel consumption within fleet, specifically transit fleet which saw a 20 per cent drop in diesel fuel consumption from busses between 2019 and 2020, and a reduction in emissions from facilities. Similar to previous inventory years, the largest contributing sector to total corporate emissions was the transit fleet sub-sector, accounting for 44 per cent of total corporate emissions. Directly related, diesel consumption was the largest contributing emission source, accounting for 51 per cent of total corporate emissions.

Given the planned acquisition of electric buses and energy efficiency improvements to City facilities in the coming years, staff expect that the corporation will stay on track and meet the 2025 target.

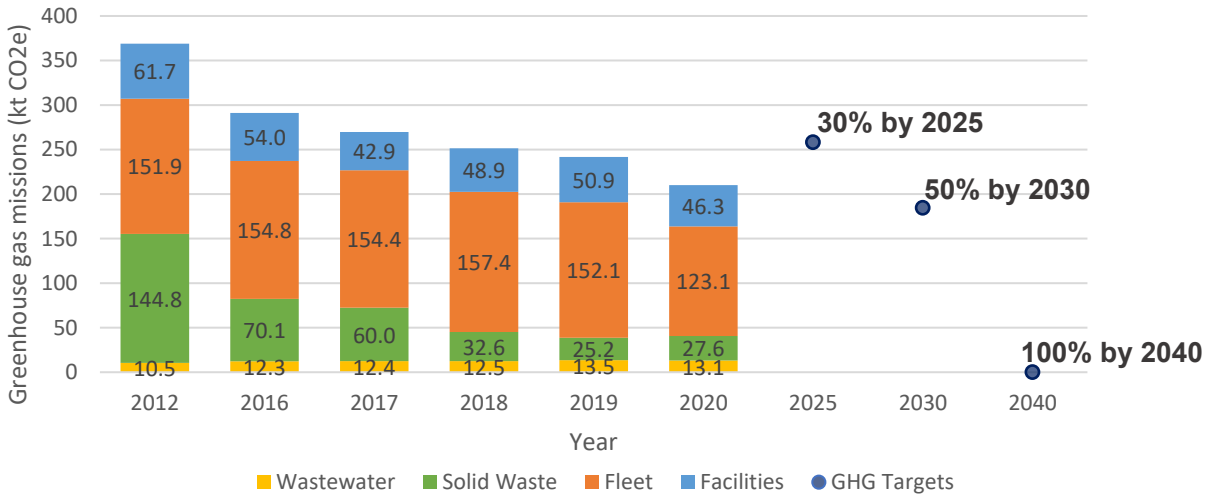

Figure 4: Annual Corporate GHG Emissions by Sector, 2012 and 2016-2020

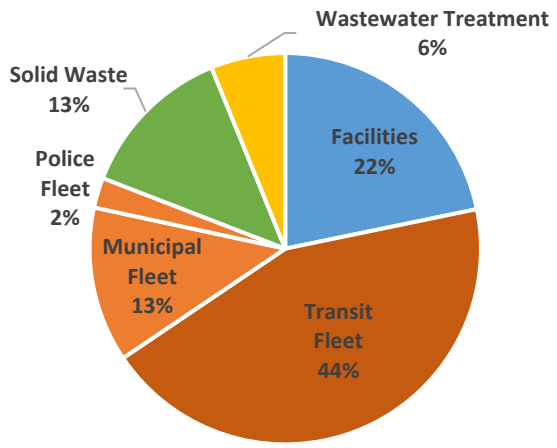

Figure 5: Corporate GHG Emissions by Sector (2020)

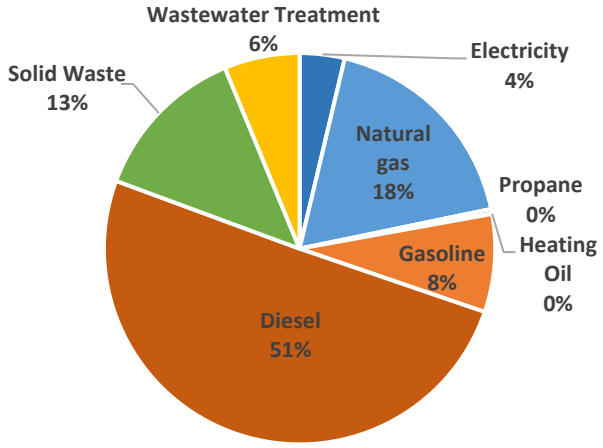

Figure 6: Corporate GHG Emissions by Source (2020)

Looking ahead, key achievements in 2021 that will have a direct impact or influence emissions in years to come include the following (for a full list of actions being taken, refer to the City's 2020 Climate Change Master Plan annual status update):

- Climate considerations embedded throughout the New Official Plan, Master Plans (including the Parks and Recreation Master Plan that was approved by Council in September 2021), and Asset Management Plans for water, wastewater, stormwater, and transportation.

- Council approved purchasing up to 450 zero emission buses by 2027 and transitioning to a fully zero emission bus fleet by 2036 (based on funding availability and operational needs).

- Council approved the Better Homes Ottawa – Loan Program whereby homeowners can access financing to pay for home energy improvements and help reduce GHG emissions (program to launch fall 2021).

- Council received Phase 2 of the Solid Waste Master Plan and approved the Plan's vision statement, guiding principles and goals which support the City's Climate Change Master Plan and associated priorities.

- The City has installed a Level 2 charging station at the renovated Lois Kemp Arena (Blackburn), is installing 12 double-headed Level 2 charging stations in the right-of-way across the city and will install a 150 kW charging station at Bob MacQuarrie Recreation Complex.

- Significant funding in external loans and grants was committed to support climate change mitigation efforts, including funding for zero emission buses and for the Better Homes Ottawa – Loan Program. Four additional funding applications and nine letters of support were submitted (decisions pending) to encourage private action

Additionally, a number of policies, plans, and programs are currently in development that will be brought forward to Committee and Council before the end of 2022. These include:

- High-Performance Development Standard
- Corporate Green Building Policy Update
- Personal Electric Vehicle Strategy
- Corporate Electric Vehicle Policy Update
- Update to Municipal Green Fleet Plan
- Draft Solid Waste Master Plan
- Part 1 of Transportation Master Plan Update (Policy)
- Carbon Accounting Tool Framework

1. Introduction

Greenhouse gas (GHG) inventories provide a snapshot of energy use and associated emissions over a given period within the buildings, transportation, waste, and agriculture sectors, and are based on the best data available at the time. Variables such as population, weather, regulatory and technology changes, price and availability of energy, carbon content of energy, and consumer behaviours can all influence emissions. Emissions are reported in tonnes of equivalent carbon dioxide emissions (tonnes of CO_2e), which are calculated based on carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions. Inventories follow the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), which offers a consistent and robust accounting methodology that allows for comparison around the world. They are based on five principles in order to represent a true account of emissions: relevance, completeness, consistency, transparency, and accuracy.

The City of Ottawa (the City) undertakes two types of greenhouse gas (GHG) emissions inventories: community inventories and corporate inventories.

Community inventories track emissions from activities taking place within the geographic boundaries of the city of Ottawa. Data collection and analysis is typically more resource intensive than corporate inventories, often requiring the use of data and assumptions from other organizations. Data from City departments, local and provincial utilities, Statistics Canada, Natural Resources Canada, and Environment Canada was collected to inform the community inventory.

The community inventory is broken down into four sectors:

- *Buildings* – includes emissions from residential, commercial, institutional, and industrial sectors
- *Transportation* – includes emissions from on-road, aviation, rail, and off-road transportation
- *Waste* – includes emissions from solid waste and wastewater
- *Agriculture* – includes emissions from crop production and livestock operations

Corporate inventories are used to track emissions under municipal operational control within the corporate organizational structure. These inventories are generally considered to be more precise than community inventories as municipalities have more direct control over their emissions and better access to reliable data. Data used to calculate corporate emissions primarily came from observed data from City departments.

The corporate inventory is broken down into four sectors:

- *Facilities* – includes buildings, streetlights, and traffic lights
- *Fleet* – includes municipal, transit, and police fleets
- *Solid waste* – includes emissions from the Trail Road Waste Facility and the Nepean landfill

- *Wastewater* – includes emissions from the treatment of wastewater at Robert O. Pickard Environmental Centre (ROPEC)

Starting in 2019, community and corporate inventories are to be undertaken on an annual basis per Council direction. Prior to, they were undertaken every four years. The latest inventory results are for the 2020 calendar year. Additionally, the City is a member of four different programs that work towards greater emission reductions: Federation of Canadian Municipalities' Partners for Protection Program, Global Covenant of Mayors for Climate and Energy, EnviroCentre's Carbon 613 Program, and Cities Race to Zero. To learn more about these programs, refer to Annex A.

2. GHG Emission Reduction Targets

In January 2020, Council approved short, mid and long-term GHG emission reduction targets as part of the Climate Change Master Plan to reduce community emissions by 100% by 2050 and corporate emissions by 100% by 2040 (Figures 7 and 8). These targets align with the Intergovernmental Panel on Climate Change's target to limit global warming increases to 1.5 degrees Celsius.

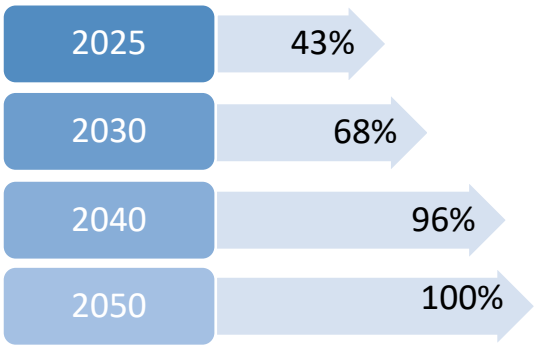

Figure 7: Short, Mid and Long-term Community Targets to Reach 100% by 2050 Target

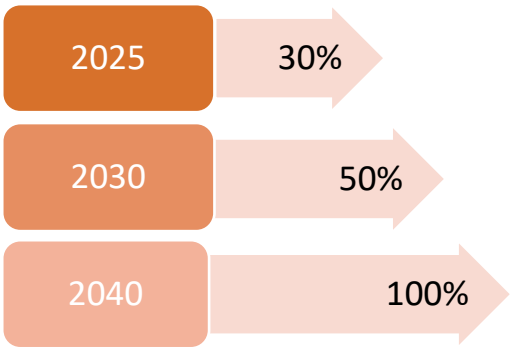

Figure 8 Short, Mid and Long-term Corporate Targets to Reach 100% by 2040 Target

3. Population Growth, Employment and Weather

Population growth and the number of employed residents factor into GHG inventories. Ottawa's population has been steadily growing over the years, increasing by 7.6 per cent since 2012.

Table 1: Population of Ottawa[1]

	2012	2016	2017	2018	2019	2020
Population	935,255	968,580	979,173	991,429	1,006,211	1,022,604

[1] City of Ottawa Annual Development Reports.

Similarly, Ottawa's employment has been steadily growing over the years, increasing by 3.3 per cent since 2012.

Table 2: Employed Residents in Ottawa[2]

	2012	2016	2017	2018	2019	2020
Employed Residents	539,100	543,400	546,700	557,600	590,100	557,100

Weather also plays a factor in how much energy is consumed in a given year. Heating and cooling degree days can indicate how much energy may be required to heat or cool a building. Colder weather also impacts vehicle fuel consumption which is higher in colder conditions. Heating degree days are equal to the number of degrees Celsius a given day's mean temperature is less than 18ºC. For example, if the daily mean temperature is 10ºC, then the heating degree day value for that day is 8ºC. The heating degree day value for the day is zero if the mean temperature is above 18ºC. The opposite is applied for cooling degree days whereby cooling degree days are equal to the number of degrees Celsius where a given day's mean temperature is above 18ºC and zero if less than 18ºC. Figure 9 highlights the annual heating and cooling degree days since 2012.

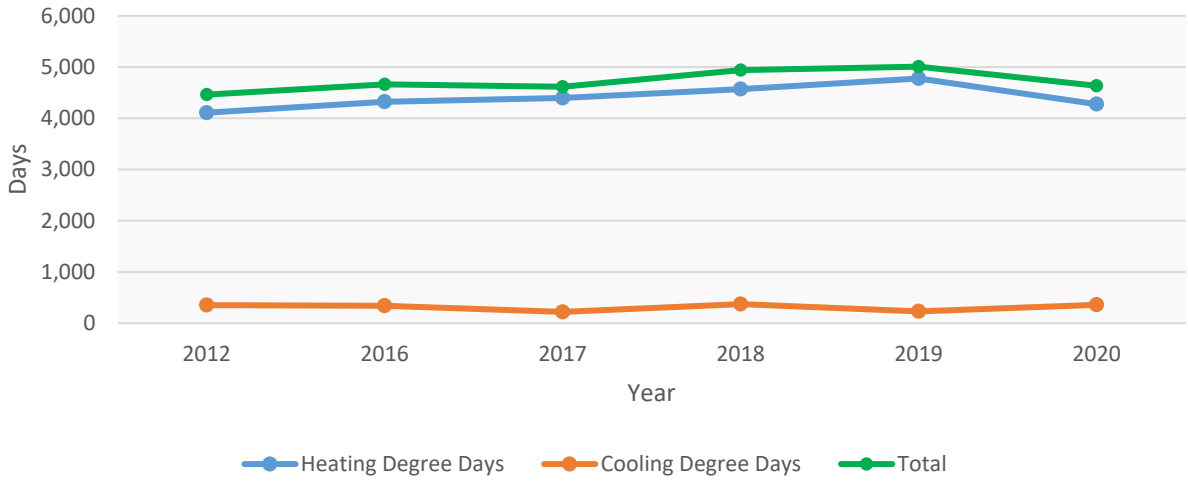

Figure 9: Annual Heating and Cooling Degree Days in Ottawa (2012, 2016-2020)[3]

4. Community Inventory Results (2020)

The 2020 community inventories are based on emissions from activities within the geographic boundary of the city of Ottawa for a 12-month period from January 1, 2020 to December 31, 2020. Between 2012 and 2020, community emissions decreased by 15 per cent and per capita emissions decreased from 7.1 tCO_2e per person in 2012 to 5.6 tCO_2e per person in 2020. Historically, this decline in emissions has been attributable to the provincial phase out of coal plants and a significant reduction in emissions from

[2] Ibid.
[3] Ottawa (Kanata-Orléans) www.ottawa.weatherstats.ca

electricity generation and consumption. However, starting in 2020, the COVID-19 pandemic also played a significant role in reducing GHG emissions, particularly within the transportation sector which saw a 30 per cent drop in gasoline fuel use between 2019 and 2020. Almost 90 per cent of community emissions are attributable to the buildings (primarily for building heating) and transportation sectors, a trend that has been consistent since 2012. The waste and agriculture sectors make up the roughly other 10 per cent of emissions. Natural gas consumption was the largest contributing source of emissions, accounting for 38 per cent of total community emissions. Gasoline and diesel consumption were the second and third largest contributors, accounting for 21 per cent and 12 per cent, respectively.

In order to meet Ottawa's short term and mid-term targets to reduce emissions by 43 per cent by 2025 and 68 per cent by 2030, respectively, the community will need to reduce emissions by 5 to 6 per cent a year over the next five to ten years. It is expected that the drop in community emissions due to the COVID-19 pandemic will not be sustained once the virus is under control and that emissions will rebound if there are no additional actions or investments to achieving Ottawa's GHG emission reduction targets. In 2020, Council approved new GHG reduction targets and Energy Evolution, the action and investment framework for achieving these targets. Staff have been working on developing and launching plans, policies, and programs that will directly impact or influence emission reductions; however, given that Energy Evolution was only approved one year ago and that many of these policies, programs, and plans are still in development, it will take time for these initiatives to have an effect. Staff do not expect to see a significant reduction in the next two to three GHG inventories, particularly on the community side. This is due to the number, scale and complexity of the projects required to achieve Council's targets, as well as factors outside the City's control, including policy decisions by senior levels of government and the availability of funding and market solutions. Section 5 identifies initiatives that are currently in development by the City that will impact or influence GHG emissions, and staff will continue to report on how Ottawa is tracking towards GHG reduction targets and provide status updates on the Climate Change Master Plan including initiatives to reduce emissions in the community.

The following tables and figures provide an overview of the community inventory results by sector, emissions source, and energy use, as well as indicates what percent contribution the sector is making towards achieving the GHG emission reduction targets. Please note that some results may not add up exactly due to rounding. Additionally, some data sources were not yet available for the 2020 calendar year and will be revised when the data becomes available, as required. A more detailed overview of each of the four sectors (buildings, transportation, waste, and agriculture) is outlined in the following sections. For the full list of data sources and the calculation methodology behind the results, refer to Annex B and Annex C, respectively.

Of note, revisions were made to some of the previous inventories. These include:

- Electricity emissions were recalculated for 2016-2019 due to the availability of more accurate data.
- Wood sourced heating was found to be included in the 2012 inventory but was determined to be over evaluated. It has been recalculated for 2012 and included in the 2016-2020 inventories for consistency.

Table 3: Annual Community GHG Emissions by Sector Since 2012

Sector	GHG emissions (tonnes of CO_2e) ('000s)						Change between 2012 and 2020 (%)	Contribution to achieving GHG targets (%)
	2012	2016	2017	2018	2019	2020		
Buildings	3,163	2,558	2,540	2,789	2,862	2,588	-18%	-9%
Transportation	2,776	2,614	2,639	2,630	2,700	2,329	-16%	-7%
Waste	464	450	452	478	468	494	7%	0%
Agriculture	205	204	182	182	185	180	-10%	0%
Total	**6,608**	**5,826**	**5,813**	**6,080**	**6,215**	**5,591**	**-15%**	**-15%**

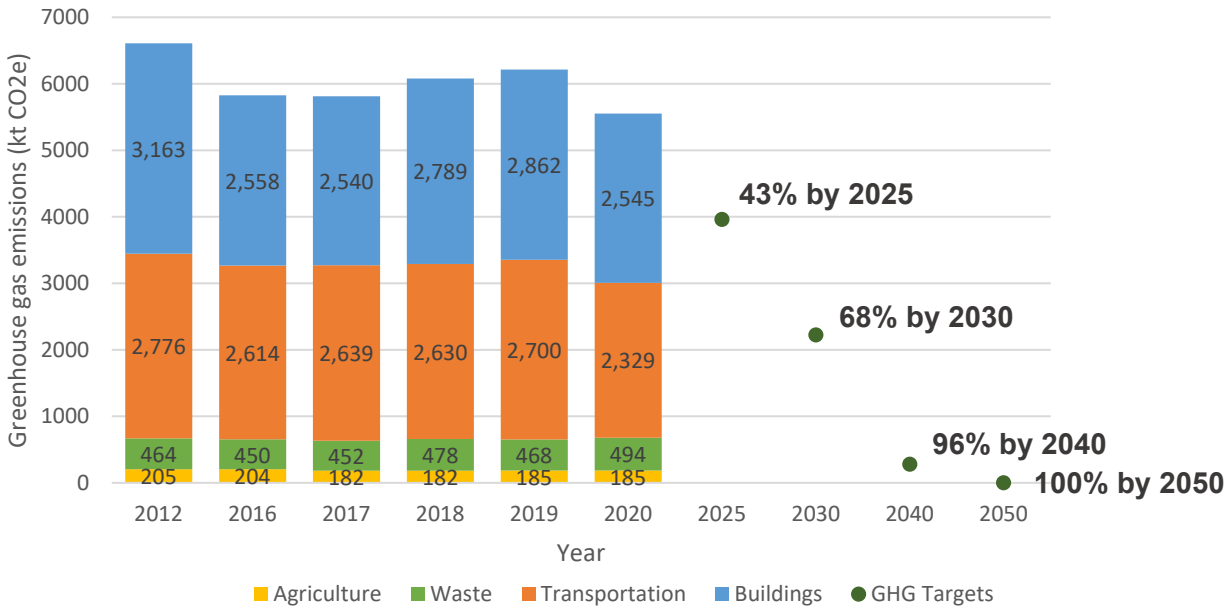

Figure 10: Annual Community GHG Emissions by Sector, 2012 and 2016-2020

Table 4: Annual Community Energy and GHG Emissions by Source (2020)

Energy and Emissions Source	Gigajoules ('000s)	GHG emissions (tonnes of CO_2e) ('000s)
Electricity	28,336	257
Natural gas	43,476	2,117

Energy and Emissions Source	Gigajoules ('000s)	GHG emissions (tonnes of CO_2e) ('000s)
Propane	1.5	93
Heating Oil	1	77
Wood	0.8	43
Gasoline	17,573	1,163
Diesel	10,142	680
Aviation Fuel	7,031	486
Solid Waste	N/A	457
Wastewater	N/A	37
Agriculture	N/A	180

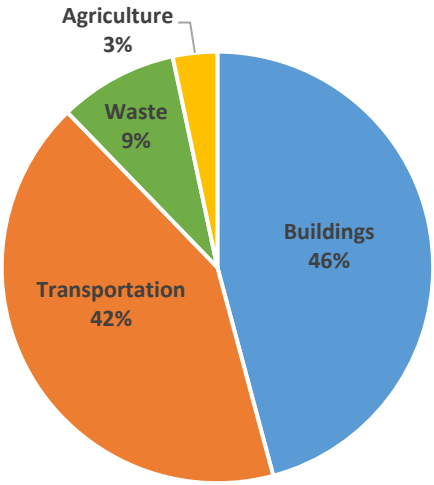

Figure 11: Community GHG Emissions by Sector (2020)

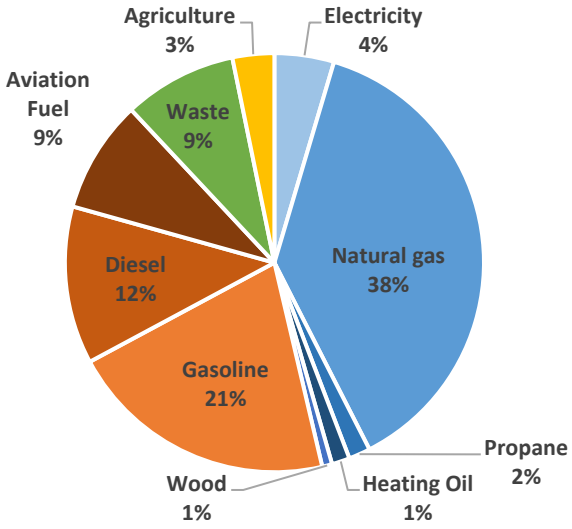

Figure 12: Community GHG Emissions by Source (2020)

Buildings Sector

The buildings sector accounts for emissions generated through the combustion of fossil fuels (electricity, natural gas, propane, and heating oil) and wood created in the process of generating, delivering, and consuming forms of energy. Energy is primarily consumed for space heating, cooling, appliances, and lighting in residential, apartment, industrial, commercial, and institutional buildings. The transmission and distribution losses from grid-supplied electricity are also included in the emissions totals.

In 2020, the buildings sector accounted for 46 per cent of total community emissions. Between 2012 and 2020, there was an 18 per cent drop in emissions within the buildings

sector. Historically, this decline in emissions was primarily attributable to the provincial phase out of coal plants (the last one was decommissioned in 2014) and Ontario having one of the cleanest electricity systems in North America, as well as decline in overall electricity consumption. In 2020, the pandemic also impacted electricity emissions as there was a considerable drop in electricity consumption in the industrial, commercial, and institutional sector. However, emissions from provincial electricity generation are expected to increase as a result of increased production from natural-gas fired electricity generation due to an increased demand and reduced nuclear production.

Table 5: Electricity Generation Intensity in Ontario

Greenhous Gas Intensity	2005	2013	2014	2015	2016	2017	2018	2019
Ontario electricity generation intensity (gCO2e/kWh)[4]	230	70	40	40	40	20	30	30

Despite that, emissions from electricity consumption remain far below emissions associated with the consumption of fossil fuels such as natural gas[5]. While there was a drop in natural gas consumption between 2019 and 2020, which could be partly due to the pandemic as well as 2020 having one of the lowest total heating degree days in recent years (Figure 9), the total natural gas consumption in 2020 remains higher than what was consumed in 2012.

Breaking it down by sub-sector, there was a small difference in the total emissions generated between residential buildings and institutional, commercial, and industrial (ICI) buildings in 2020. Natural gas was the biggest source of emissions within the buildings sector, accounting for 83 per cent of total sector emissions and 38 per cent total community emissions.

Table 6: Emissions from Buildings – By Sub-Sector

Sub-Sector	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Residential Sector	1,590	1,447	1,336	-4%
Industrial, Commercial, and Institutional Sector[6]	1,574	1,415	1,252	-5%

[4] Environment and Climate Change Canada. *National Inventory Report 1990-2019: Greenhouse Gas Sources and Sinks in Canada.* Part 3, Table A13-7 Electricity Generation and GHG Emission Details for Ontario.

[5] Independent Electricity Systems Operator. *Annual Planning Outlook: A view of Ontario's electricity system needs.* January 2020. https://www.ieso.ca/en/Sector-Participants/Planning-and-Forecasting/Annual-Planning-Outlook

[6] Prior to the 2019 GHG inventory, natural gas emissions from apartments were captured under Industrial, Commercial, and Institutional Buildings. Starting in the 2019 inventory, natural gas emissions from apartments were captured under Residential Buildings. This was due to a change in how account classes are categorized.

Table 7: Emissions from Buildings – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Electricity	828	265	257	-10%
Natural Gas	2,026	2,351	2,117	2%
Propane	146	127	93	-1%
Heating Oil	110	70	77	-1%
Wood	53	49	43	0%

Transportation Sector

The transportation sector includes emissions from the mobile combustion of gasoline and diesel and is broken down into the following sub-sectors:

- On-road transportation
- Aviation
- Rail
- Off-road transportation

Gasoline consumption is attributed to on-road transportation only. Emissions from electric vehicles are captured under electricity within the buildings sector.

In 2020, the transportation sector accounted for 42 per cent of total community emissions. Between 2012 and 2020, emissions decreased by 16 per cent within the transportation sector. This is primarily attributed to the decrease in transportation activity due to the COVID-19 pandemic whereby there was an observed 30 per cent decrease in gasoline fuel use between 2019 and 2020. This is likely due to a large portion of Ottawa residents that were required to either work or learn from home as well as an increase in on-line activities which replaced the need for physical travel. Additionally, starting in 2020, fuel suppliers are required to maintain at least an annual average of 10 per cent renewable content in the gasoline they sell in Ontario[7], an increase from an average of 5 per cent. Of note, the most recent data availability for aviation, rail and off-road transportation is from 2018 and therefore does not reflect any impacts due to the pandemic.

[7] Cleaner Transportation Fuels. Queen's Printer for Ontario 2012-21. https://www.ontario.ca/page/cleaner-transportation-fuels

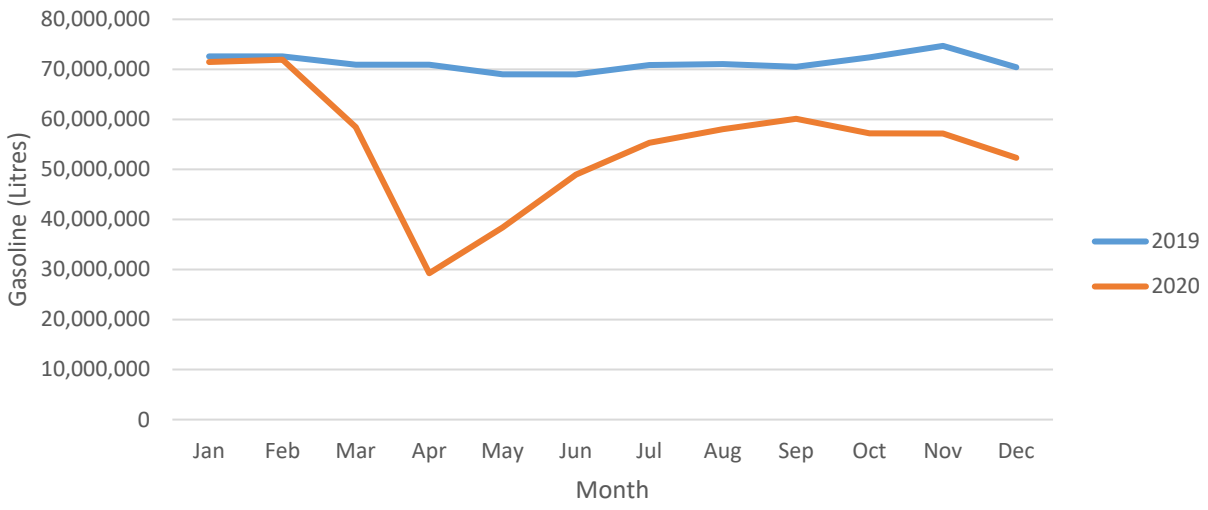

Figure 13: Monthly Consumption of Gasoline in Ottawa, 2019 vs 2020

On-road transportation was the highest emitting sub-sector in 2020, contributing roughly 65 per cent of emissions within the transportation sector, while gasoline consumption accounted for roughly 50 per cent of total sector emissions.

Table 8: Emissions from Transportation – By Sub-Sector

Sub-Sector	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
On-Road Transportation	2,172	1,948	1,513	-10%
Aviation	317	435	486	3%
Rail	101	99	107	0%
Off-Road Transportation[8]	186	217	224	1%

Table 9: Emissions from Transportation – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Gasoline	1,579	1,580	1,163	-6%
Diesel	880	684	680	-3%
Aviation Fuel	317	435	486	3%

[8] Per Natural Resources Canada, off-road transportation includes vehicles not registered for on-road such as ATVs and snowmobiles.

Waste Sector

The waste sector includes emissions from solid waste in private and public landfills and emissions from wastewater treatment and septic tanks. Of note, the most recent data for the solid waste sector at the time of the inventory was for 2019; the solid waste numbers will be revised when the 2020 data is available. The waste sector accounted for 9 per cent of total community emissions. Between 2012 and 2020, the waste sector increased by 7 per cent due to small increases in emissions in the solid waste sector.

Table 10: Emissions from Waste – By Sub-Sector

Sub-Sector	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Solid Waste	430	432	457	0%
Wastewater	28	32	37	0%

Agriculture Sector

Emissions from agricultural practices are only tracked through the community inventory and include emissions from the biological processes involved in agricultural production. The main sources include agricultural soils, enteric fermentation[9] in ruminant animals and manure management.

In 2020, the agricultural sector accounted for 3 per cent of total community emissions, the smallest percentage of all sectors. Between 2012 and 2020, agricultural emissions decreased by 12 per cent. However, there is low confidence in these results as it is based primarily on census data in which the latest census data was for 2016, the most up-to-date information available.

Table 11: Emissions from Waste – By Sector

Sector	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Agriculture	205	185	180	0%

5. Corporate Inventory Results (2020)

The 2020 corporate inventory calculated emissions from municipal operations within the corporate organizational framework for a 12-month period from January 1, 2020 to December 31, 2020.

[9] Enteric fermentation occurs in the rumen (stomach) of certain animals (cattle, sheep) as part of their digestive processes. Typically this process results in methane emissions releases as eructation (burping) or flatulence. These emissions are sometimes controlled or reduced through changes in diet for ruminant animals.

Between 2012 and 2020, corporate emissions decreased by 43 per cent, currently exceeding the short-term target to reduce emissions by 30 per cent below 2012 baseline levels by 2025. This decrease in emissions remains primarily due to the significant decline in emissions in the solid waste sector, of which 32 per cent of the 43 per cent total reduction can be attributed to the considerable efficiencies made at the Trail Road Waste Facility. The remaining emission reductions can be attributable to a decrease in fuel consumption within fleet, specifically transit fleet which saw a 20 per cent drop in diesel fuel consumption from busses between 2019 and 2020, and a reduction in emissions from facilities. Like previous inventory years, the largest contributing sector to total corporate emissions was the transit fleet sub-sector, accounting for 44 per cent of total corporate emissions. Directly related, diesel consumption was the largest contributing emission source, accounting for 51 per cent of total corporate emissions. Corporate emissions accounted for roughly 4 per cent of total community emissions in 2020.

Given the planned acquisition of electric buses and energy efficiency improvements to City facilities in the coming years, staff expect that the corporation will stay on track and meet the 2025 target. Section 5 identifies initiatives that are currently in development by the City that will impact or influence the GHG emissions, and staff will continue to report on how Ottawa is tracking towards GHG reduction targets and provide status updates on the Climate Change Master Plan including initiatives to reduce emissions within municipal operations.

The following tables and figures provide an overview of the corporate inventory results by sector, emissions source, and energy use, as well as indicates what percent contribution the sector is making towards achieving the GHG emission reduction targets. Please note that some results may not add up exactly due to rounding. A more detailed overview of each of the four sectors (facilities, fleet, solid waste, and wastewater) is outlined in the following sections. For the full list of data sources and the inventory calculation methodology, refer to Annex B and Annex C, respectively.

Of note, there were revisions made to some of the previously completed inventories. These include:

- Electrical accounts that cover both the light rail transit fleet and stations are now captured under the transit fleet sub-sector.

Table 12: Annual Corporate GHG Emissions by Sector Since 2012

Sector	GHG Emissions (tonnes of CO_2e) ('000s)						Change between 2012 and 2020 (%)	Contribution to achieving GHG targets (%)
	2012	2016	2017	2018	2019	2020		
Facilities	61.7	54.0	42.9	48.9	50.9	46.3	-25%	-4%
Fleet	151.9	154.8	154.4	157.4	152.1	123.1	-19%	-8%
Solid Waste	144.8	70.1	60.0	32.6	25.2	27.6	-81%	-32%

Sector	GHG Emissions (tonnes of CO_2e) ('000s)						Change between 2012 and 2020 (%)	Contribution to achieving GHG targets (%)
	2012	2016	2017	2018	2019	2020		
Wastewater	10.5	12.3	12.4	12.5	13.5	13.1	25%	1%
Total	**368.9**	**291.2**	**269.8**	**251.4**	**241.7**	**210.1**	**-43%**	**-43%**

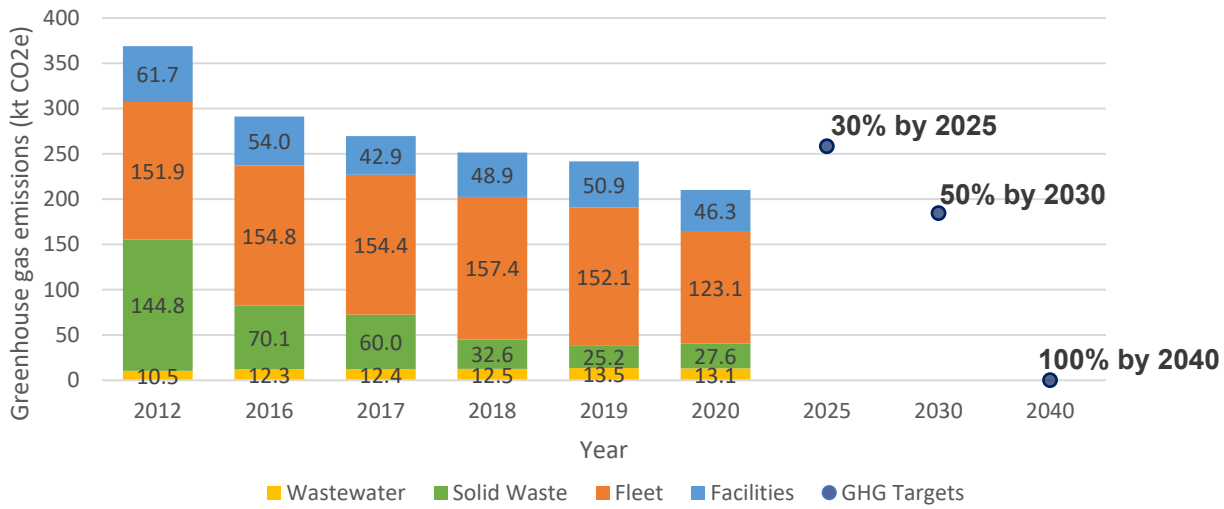

Figure 14: Annual Corporate GHG Emissions by Sector (2012 and 2016-2020)

Table 13: Total Corporate Energy Use and GHG Emissions by Source (2020)

Energy and Emissions Source	Gigajoules ('000s)	GHG emissions (tonnes of CO_2e) ('000s)
Electricity	943	7.8
Natural gas	778	37.9
Propane	11	0.7
Heating Oil	0.9	0.06
Gasoline	249	17.1
Diesel	1,471	105.9
Solid Waste	N/A	27.6
Wastewater	N/A	13.1

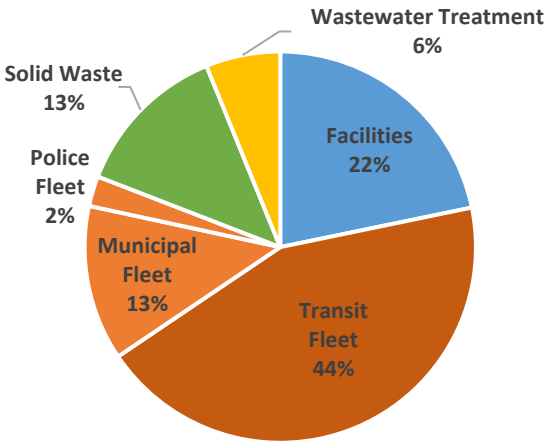

Figure 15: Corporate GHG Emissions by Sector (2020)

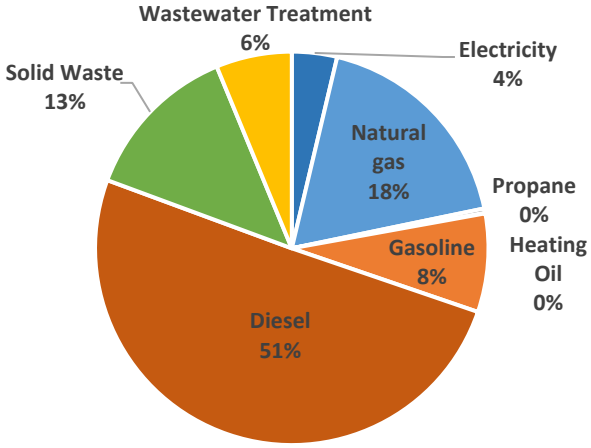

Figure 16: Corporate GHG Emissions by Source (2020)

Facilities Sector

Emissions from facilities includes emissions from buildings, pumping stations, streetlights and traffic lights. Electricity consumption for the operation of the light rail transit network, including trains and stations, is captured under the Transit Fleet. A summary of energy usage by City facilities is posted to the City of Ottawa's website on an annual basis as mandated by Ontario's Electricity Act.

In 2020, municipal facilities accounted for 22 per cent of total corporate emissions. Between 2012 and 2020, there was a 25 per cent drop in emissions from facilities. Historically, this decline in emissions was primarily attributable to the provincial phase out of coal plants (the last one was decommissioned in 2014) and Ontario having one of the cleanest electricity systems in North America (Table 5), as well as increase in energy efficiency and overall decrease in electricity consumption at City facilities. In 2020, the pandemic also impacted emissions as facilities were intermittently shut down throughout the year and there was a decline in both electricity and natural gas usage between 2019 and 2020, noting that the latter was also influenced by the lowest number of heating degree days experienced in recent years.

Table 14: Emissions from Facilities – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Electricity	30.5	8.7	7.8	-11%
Natural Gas	30.7	41.5	37.9	3%
Propane	0.3	0.6	0.6	0%
Heating Oil	0.2	0.08	0.06	0%

Fleet Sector

Fleet emissions are generated from the mobile combustion of fossil fuels (gasoline, diesel, and propane) from corporate fleet vehicles. Corporate fleet vehicles are broken down by:

- Municipal fleet, which includes service areas such as by-law, solid waste, paramedics, fire, roads, etc.
- Transit fleet, which includes OC Transpo, O-Train (diesel and electric trains), and Para Transpo
- Police fleet

In 2020, fleet emissions accounted for 59 per cent of total corporate emissions, of which transit fleet accounted for 44 per cent, municipal fleet accounted for 13 per cent and police fleet accounted for 2 per cent. Diesel consumption accounted for roughly 51 per cent of total corporate emissions.

2020 was a unique year for OC Transpo in that it was the first full year that O-Train Line 1 was operational, but which also coincided with adjustments to bus service due to the COVID-19 pandemic. Conventional bus service also replaced O-Train Line 2, which shut down for expansion work starting in May 2020. For the second year in a row, emissions from conventional buses decreased, with total diesel fuel consumption falling by 20 per cent between 2019 and 2020. January and February were the only full months in 2020 where O-Train Line 1 was operational, but the pandemic had yet to impact ridership and bus service levels. Compared to January and February 2019, when O-Train Line 1 was not yet operational, there was a 13 per cent decrease in total fuel consumption.

Table 15: Emissions from Fleet - By Sub-Sector

Sub-Sector	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Transit Fleet	116.8	115.3	93.2	-6%
Municipal Fleet	29.5	31.5	27.3	-1%
Police Fleet	5.6	5.2	5.3	0%

Table 16: Emissions from Fleet – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Gasoline	14.7	18.2	17.1	1%
Diesel	131.5	133.8	105.9	-7%
Propane	0.3	0.3	0.1	0%

Solid Waste Sector

The solid waste sector includes emissions from the Trail Road Waste Facility (currently operational) and the Nepean landfill (closed), both under municipal operations control. In addition to landfill operations, three flares and six landfill gas fuelled generator sets are operated on site at the Trail Road Waste Facility. The City annually reports on emissions from the Trail Road Waste Facility in accordance with Ontario Regulation 390/18: Greenhouse Gas Emissions: Quantification, Reporting and Verification, which are made publicly available on the Provincial government's website. Emissions from privately owned landfills and facilities are accounted for within the community inventory; emissions from solid waste collection vehicles are tracked under the corporate municipal fleet.

In 2020, the solid waste sector accounted for 13 per cent of total corporate emissions. Between 2012 and 2020, emissions from the Trail Road Waste Facility decreased by 81 per cent. The significant reduction in emissions can be attributed to the efficiencies made at the Trail Road Waste Facility, where an 89.2 per cent landfill gas collection efficiency rate was observed as a result of the landfill gas capture system in place. However, in 2020, there was a small increase in emissions since 2019 due to more landfill gas being flared and a lower gas collection rate compared to 2019.

As mentioned under the community waste sector, since the beginning of the COVID-19 global pandemic, there has been a notable shift in residual waste and recyclable materials from the IC&I sector to the residential sector as a result of many individuals working from home. The City has seen an increase of 10 per cent in total waste collected (garbage, recycling, organics and leaf and yard waste) from 2020, compared to 2019. Industry data has concluded similar experiences by other municipalities in Ontario. With more people spending more time in their homes, comes with it more waste being produced from the residential sector. Some waste from the IC&I sector (ex. typically generated in office buildings, in restaurants and schools) which is often sent to privately managed landfills and processing facilities, is now being generated in the home and sent to the Trail Waste Facility Landfill. It is unknown whether the trend of working from home will continue once the pandemic is over and whether the City will be permanently dealing with additional quantities and types of waste in the future, making this an area the City will have to continually monitor and adapt to. However, despite this, the City's overall diversion rate increased 3% between 2019 and 2020. Furthermore, 15% more organic waste was generated and collected through the City's green bin and leaf and yard waste programs in 2020 compared to 2019 and was successfully diverted from the Trail Road Facility Landfill.

Additionally, it is expected that starting in 2021 the City will observe an increase in emissions at the Trail Road Waste Facility given the increasing amount of waste in place and due to operations moving into an active waste cell (an uncapped portion of the landfill open to precipitation). Moisture is the largest driver in the waste decomposition process and therefore landfill gas generation and an active cell will not realize the same landfill

gas collection efficiency as the recently closed cells with final cover which have full infrastructure coverage and vacuum.

Table 17: Emissions from Solid Waste – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Solid Waste	144.8	25.2	27.6	-32%

Wastewater Sector

Emissions for wastewater are estimated based on data collected from the Robert O. Pickard Environmental Centre, Ottawa's wastewater treatment facility.

The reported emissions account for CH_4 and N_2O only and do not include energy-derived emissions, which are accounted for under corporate facilities. The wastewater sector was responsible for a small percentage of corporate emissions in 2020, accounting for 6 per cent of the total. Although wastewater emissions decreased from 2019, this is due to normal year-to-year variation in the measurement of these emissions, and it is expected that emissions will increase each year proportionate with population growth. In addition, the current treatment process results in the minimum emission rate. Enhanced treatment to remove ammonia will cause a net increase in the emission rate.

Table 18: Emissions from Wastewater – By Source

Emissions Source	GHG emissions (tonnes of CO_2e) ('000s)			Contribution to achieving GHG targets (%)
	2012	2019	2020	
Wastewater	10.5	13.5	13.1	1%

6. Beyond 2020

Looking ahead, key achievements in 2021 that will have a direct impact or influence emissions in years to come include the following (for a full list of actions being taken, refer to the City's 2020 Climate Change Master Plan annual status update):

- Climate considerations embedded throughout the New Official Plan, Master Plans (including the Parks and Recreation Master Plan that was approved by Council in September 2021), and Asset Management Plans for water, wastewater, stormwater, and transportation.

- Council approved purchasing up to 450 zero emission buses by 2027 and transitioning to a fully zero emission bus fleet by 2036 (based on funding availability and operational needs).

- Council approved the Better Homes Ottawa – Loan Program whereby homeowners can access financing to pay for home energy improvements and help reduce GHG emissions (program to launch fall 2021).

- Council received Phase 2 of the Solid Waste Master Plan and approved the Plan's vision statement, guiding principles and goals which support the City's Climate Change Master Plan and associated priorities.

- The City has installed a Level 2 charging station at the renovated Lois Kemp Arena (Blackburn), is installing 12 double-headed Level 2 charging stations in the right-of-way across the city and will install a 150 kW charging station at Bob MacQuarrie Recreation Complex.

- Significant funding in external loans and grants was committed to support climate change mitigation efforts, including funding for zero emission buses and for the Better Homes Ottawa – Loan Program. Four additional funding applications and nine letters of support were submitted (decisions pending) to encourage private action

Additionally, a number of policies, plans, and programs are currently in development that will be brought forward to Committee and Council before the end of 2022. These include:

- High-Performance Development Standard
- Corporate Green Building Policy Update
- Personal Electric Vehicle Strategy
- Corporate Electric Vehicle Policy Update
- Update to Municipal Green Fleet Plan
- Draft Solid Waste Master Plan
- Part 1 of Transportation Master Plan Update (Policy)
- Carbon Accounting Tool Framework

ANNEX A – GHG EMISSIONS PROGRAMS

Federation of Canadian Municipalities' Partners for Climate Protection Program

Since 1997, the City has been a member of the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program. It is a network of Canadian municipalities committed to reducing GHG emissions and acting on climate change with over 350 municipalities taking part.

The PCP program comprises five "milestones" used to guide municipalities to reduce their GHG emissions. The milestone included creating an emissions baseline, setting reduction targets, and developing an action plan. In 2012, the City completed all five milestones.

Global Covenant of Mayors for Climate and Energy

In April 2016, Mayor Jim Watson formally committed the City to join the Compact of Mayors, now called the Global Covenant of Mayors for Climate and Energy (GCoM). GCoM is described as "the world's largest coalition of mayors promoting and supporting voluntary action to combat climate change and move to a low-carbon economy". Cities participating in the initiative are to meet a series of requirements to fully comply, including setting a greenhouse gas reduction target, tracking progress in meeting said target, and preparing for the impacts of climate change. In 2020, the City had achieved all of its required mitigation requirements.

EnviroCentre's Carbon 613 Program

In June 2016, the City joined EnviroCentre's Carbon 613 program. Carbon 613 is described as a "made-in-Ottawa, target-based sustainability program for businesses". The City joined as both a program catalyser and a program member. As part of its membership, the City commits to setting a GHG reduction target, and to tracking and reporting out on the corporation's annual emissions. The City is also a part of the Carbon 613 Advisory Council.

Race to Zero

In 2020, the City committed to Cities Race to Zero, a UN-backed global campaign to take action to halve global emissions by 2030.

ANNEX B – DATA SOURCES

Global Warming Potential (GWP) values

GHG emissions are not created equally and each has its own lifespan and heat-trapping potential. GWPs measure how much a GHG contributes to global warming relative to CO_2 and are used to convert tonnes of GHG to tonnes of carbon dioxide equivalent (CO_2e) to calculate total emissions using a common unit. The higher the GWP, the higher the warming capacity. Both the community and corporate GHG inventories were calculated using the GWPs from the IPCC's Fourth Assessment Report based off Environment and Climate Change Canada's *National Inventory Report 1990-2019: Greenhouse Gas Sources and Sinks in Canada:.*

Table 19: IPCC's Fourth Assessment Report GWPs

GHG	Global Warming Potential
CO_2	1
CH_4	25
N_2O	298

Emission Factors

Emission factors are applied to convert activity data into GHG emissions. Of note, the emissions factors for the 2020 calendar year were unavailable at the time of completing the 2020 inventory. Typically, Environment Canada releases the National Inventory Report two years after a given calendar year (for example, the 2016 emission factors were released in 2018). The 2020 inventory will be revised when the 2020 emissions factors become available, where required.

Table 20: Ontario Emission Factors

Emission Source	CO_2	CH_4	N_2O	CO_2e	Data Source
Electricity	-	-	-	30 gCO2e/kWh	National Inventory Report 1990-2019, Part 3, Table A13-7 + Hydro Ottawa and Hydro One local renewable energy generation data
Natural Gas	1,888 g/m^3	0.037 g/m^3	0.035 g/m^3	-	National Inventory Report 1990-2019, Part 2, Table A6.1-1 and Table A6.1-3
Propane	1,515 g/L	0.027 g/L	0.108 g/L	-	National Inventory Report 1990-2019, Part 2, Table A6.1-4
Heating Oil	2,753 g/L	0.026 g/L	0.031 g/L	-	National Inventory Report 1990-2019, Part 2, Table A6.1-5
Gasoline	2,307 g/L	0.14 g/L	0.022 g/L	-	National Inventory Report 1990-2019, Part 2, Table A6.1-14

Emission Source	CO_2	CH_4	N_2O	CO_2e	Data Source
Diesel	2,681 g/L	0.11 g/L	0.151 g/L	-	National Inventory Report 1990-2019, Part 2, Table A6.1-14

Energy Conversion Factors

Energy conversion factors are specific coefficients used to convert different energy sources into a common unit, in this case gigajoules.

Table 21: Energy Conversion Factors[10]

Fuel Type	Conversion Factor
Electricity	0.0036 GJ/kWh
Natural Gas	0.039 GJ/m^3
Propane	0.025 GJ/L
Heating Oil	0.039 GJ/L
Gasoline	0.035 GJ/L
Diesel	0.039 GJ/L

Population and Employment Data Sources

Population and employment data are sourced from the City of Ottawa's Annual Development Reports.

Community Data Sources

The community inventory was calculated based on the best available data at the time of reporting. Data used to calculate community emissions included City departments, utilities, Statistics Canada, Natural Resources Canada, and Environment Canada.

Table 22: Community Inventory Data Sources

Emissions Source	Data	Data Quality
Electricity	Hydro Ottawa annual electricity consumption	High
	Hydro One annual electricity consumption	High
Natural Gas	Enbridge Gas annual natural consumption	High
Propane / Heating Oil / Wood	Natural Resources Canada Comprehensive Energy Use Database, Residential and Commercial; Table 1: Secondary Energy Use and GHG Emissions By Energy Source (Modelled Data)	Low
Gasoline	Kent Group Inc. annual fuel sales	High

[10] Statistics Canada. Report on Energy Supply and Demand in Canada, 2017 Preliminary. May 29, 2019. Page 131. https://www150.statcan.gc.ca/n1/en/pub/57-003-x/57-003-x2019002-eng.pdf?st=unFh7uHv

Emissions Source	Data	Data Quality
Diesel	Kent Group Inc. annual fuel sales	Medium
	Statistics Canada's Supply and Demand of Primary and Secondary Energy Sources, Annual (Modelled Data)	Low
	Natural Resources Canada Comprehensive Energy Use Database; Transportation Sector (Modelled Data)	Low
	City of Ottawa O-Train annual consumption data	High
Aviation Fuel	Natural Resources Canada Comprehensive Energy Use Database, Transportation Sector (Modelled Data)	Low
Solid Waste	Resource Productivity & Recovery Authority (RPRA) residential waste data (Modelled Data)	Medium
	City of Ottawa ICI sector data (Modelled Data)	Low
Wastewater	City of Ottawa Robert O. Pickard Environmental Centre annual data	High
Agriculture	Statistics Canada 2016 Census of Agriculture (Modelled Data)	Low

Corporate Data Sources

Six departments within the City of Ottawa are responsible for the data collected for inclusion in the corporate inventory. As the City has mostly direct control over its municipal operations, the quality of the data is considered high.

ANNEX C – METHODOLOGY

Emissions Scope

Under the GPC, emissions are separated into three categories to identify which emissions are generated from within the city boundary and outside the city boundary.

Table 23: Scopes definitions for city inventories[11]

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam, and/or cooling within the city boundary.
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary.

The community and corporate GHG inventories calculate Scope 1 and Scope 2 emissions with some scope 3 emissions from transmission and distribution losses from the electrical grid.

Community GHG Inventory Methodology

a) Buildings Sector

Emissions for the buildings sector are calculated by multiplying fuel and electricity consumption activity data by their corresponding emission factors and are broken down into the following sub-sectors:

- Residential buildings
- Commercial and institutional buildings and facilities (includes apartment buildings)
- Manufacturing industries and construction.

For all sub-sectors, emissions from natural gas are calculated using local Enbridge Gas consumption data and emissions from electricity usage are calculated using Hydro Ottawa and Hydro One usage data. Emissions from propane, heating oil and wood are calculated using Ontario data from Natural Resource Canada's Comprehensive Energy Database prorated by population to estimate use within Ottawa.

Assumptions and Notes:

- The emission factor for electricity was calculated by accounting for the local renewable energy generation within the provincial generation intensity factor.

[11] Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories.

- Until 2018, apartment account classes for natural gas were included under the ICI building sub-sector. Starting in 2019, apartment account classes were captured under residential building sub-sector.
- Wood source heating applies to the rural residential sector only.
- The latest year available for data from the Comprehensive Energy Database is 2018. Data to be updated when 2020 data becomes available.

b) Transportation Sector

The transportation sector calculated emissions from the mobile combustion of gasoline and diesel and is broken down into the following sub-sectors:

- On-road transportation
- Railways
- Aviation
- Off-road transportation

For on-road transportation, emissions from gasoline consumption are calculated using annual retail fuel sales data provided by Kent Group Inc. Emissions from diesel consumptions are calculated using a combination of:

- Fuel sales data provided by Kent Group Inc; and
- Modelled data based on Statistics Canada data prorated to local levels using population data.

Assumptions and Notes:

- Gasoline and diesel fuel sales data was converted to simulate induced activity data to represent cross-boundary trips. An induced activity reduction percentage of 15.6 per cent was applied for gasoline and 0.7 per cent for diesel, both of which were sourced from the City's Energy Evolution's Business As Planned model.
- It is assumed that the data provided by Kent Group Inc underrepresents diesel fuel sales as it does not include fuel sales of private fleets.
- *Ontario Regulation 663/20: Cleaner Transportation Fuels: Renewable Content Requirements for Gasoline and Diesel Fuels* mandates that the average amount of renewable content in gasoline is 10 per cent and 4 per cent for diesel.
- CO_2 emissions from combustion of biofuels are not reported as they are considered of biogenic origin and therefore excluded from the inventory results.
- Electricity used to power electric vehicles is captured under the building sector.

Emissions from gasoline and diesel consumption for aviation, railways, and off-road transportation were calculated using Natural Resources Canada's Comprehensive Energy Database energy use data for Ontario prorated to the local level using population data. Emissions from railway transportation also included diesel consumption from O-Train Line 2.

Assumptions and Notes:

- The latest year available for data from the Comprehensive Energy Use Database is 2018. Data to be updated when 2020 data becomes available.
- O-Train Line 2 was shut down for expansion work starting May 2020 and the route was replaced by conventional buses.

c) Waste Sector

Emissions from the waste sector can be broken down into two sub-sectors:

- Solid Waste
- Wastewater

Solid waste includes emissions from waste generated inside the city boundaries and are calculated using a first order of decay method. Both residential waste and ICI waste data were accounted for in the emission calculations.

In Ottawa, municipal wastewater is treated anaerobically, meaning that both CH_4 and N_2O are accounted for, and all wastewater (except for septic tanks) is treated at the Robert O. Pickard Environmental Centre centralized wastewater treatment plant. The methodology for accounting for emissions from the wastewater treatment plant can be found under the Corporate GHG Inventory Methodology. Community inventories also include emissions from septic tanks.

Assumptions and Notes:

- CO_2 emissions from the decomposition of biomass are not reported as they are considered of biogenic origin and are therefore excluded from the inventory results.
- It is assumed that the ICI sector waste is landfilled within the city boundary.
- It is assumed that septic tanks are in rural areas only.
- 2020 data was not available at the time of the inventory and waste sector to be updated when data is available, if required.

d) Agriculture Sector

Agriculture is included in the community inventory only and includes emissions from agricultural land use and livestock operations. Emissions are calculated using provincial Statistics Canada data for crop production and livestock operations prorated to Ottawa based on population.

Assumptions and Notes:

- The most recent data available from Statistics Canada for agriculture processes was for 2016. Data will be updated when more current data is available.

Corporate GHG Inventory Methodology

a) Facilities Sector

This section of the corporate inventory seeks to quantify the emissions related to electricity, natural gas, propane and heating oil consumption of corporate facilities. Corporate facilities include all corporate buildings, streetlights, and traffic lights.

Electricity is used in corporate buildings for lighting, building controls, electronics, heating, charging electric vehicles and other uses. Streetlights, traffic lights and road flashers also consume electricity. Natural gas, propane and heating oil is primarily used for space heating purposes in corporate buildings.

Assumptions and Notes:

- The emission factor for electricity was calculated by accounting for the local renewable energy generation within the provincial generation intensity factor.
- Electricity consumption for the operation of the light rail transit network, including trains and stations, is captured under the Transit Fleet

b) Fleet Sector

The fleet sector calculated emissions by multiplying the City's gasoline, diesel and propane purchases by their corresponding emission factor. Emissions are tracked within the following sub-sectors:

- Municipal fleet, which includes service areas such as by-law, solid waste, paramedics, fire, roads, etc.
- Transit fleet, which includes OC Transpo, O-Train, and Para Transpo.
- Police fleet

Assumptions and Notes:

- *Ontario Regulation 663/20: Cleaner Transportation Fuels: Renewable Content Requirements for Gasoline and Diesel Fuels* mandates that the average amount of renewable content in gasoline is 10 per cent and 4 per cent in diesel.
- Electricity used to power electric vehicles is captured under the Facilities sector.
- O-Train Line 2 was shut down for expansion work starting May 2020 and the route was replaced by conventional buses.

c) Solid Waste Sector

Emissions from the Trail Road Waste Facility and Nepean landfill are calculated by using the reported annual values that are submitted to the Province in accordance with O. Reg. 390/18. The City retains Dillon Consulting and Comcor to meet the reporting requirements. The reported annual values are calculated using a methodology which uses a reported methane generation rate and estimates the emissions from fugitive

uncollected landfill gas, and landfill gas combustion from the landfill flare and reciprocating engines on site.

Assumption and Notes

- CO_2 emissions from the decomposition of biomass are not reported as they are considered of biogenic origin and are therefore excluded from the inventory results.
- Emissions associated with the waste collection vehicles are captured under Fleet.

d) Wastewater Sector

The City controls the Robert O. Picard Environmental Centre centralized wastewater treatment plant. Any City related sewage not connected into the municipal wastewater service is assumed to be treated in localized septic systems. Since the City does not have operational control over localized septic systems, septic systems are excluded from the corporate control. Wastewater emissions accounted for under this section can be allocated in three major categories:

- *Stationary CH_4 emissions*: include emissions from incomplete combustion of digester gas at a centralized wastewater treatment plant.
- *Process CH_4 emissions*: include emissions from anaerobic and facultative treatment lagoons and poorly operated aerobic wastewater plants. As the city does not use lagoons as part of their treatment methods, these emissions are not accounted for. The City facilities also meets regulatory systems and is not considered to be a poorly operated aerobic wastewater plant, therefore emissions resulting from poor operations are not accounted for.
- *Process N_2O emissions:* include emissions resulting from nitrification/denitrification in centralized wastewater treatment plant and effluent discharged into receiving aquatic environment.

Wastewater emissions were calculated using the methodology outlined in Chapter 10 of The Climate Registry's *Local Government Operations Protocol*.

Assumption and Notes

- CO_2 emissions from the decomposition of biomass are not reported as they are considered of biogenic origin and are therefore excluded from the inventory results.