City of Toronto

Greenhouse Gas Emissions Inventory 2019

TORONTO

Live green Toronto

Toronto must nearly halve its 2019 emissions within 10 years to meet the 2030 target of a 65 per cent emissions reduction from 1990 levels.

Toronto must rapidly reduce its annual emissions to meet future targets.

Artist: birdO | Photo by: Ryan Snelling

This report contains photos of local art created through the StreetARToronto ('StART') program. For 10 years, StART has helped instigate and provide space for individual and community expressions to come alive through street art, using the art itself as the catalyst to bring communities together, stimulate discussion and advance diversity, equity and inclusion. StreetARToronto is an initiative of the City of Toronto, Transportation Services Division.

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Introduction

On October 2, 2019, Toronto City Council declared a climate emergency, joining a global call to recognize the urgency of the climate crisis, and adopted a stronger emissions reduction target for Toronto: net zero by 2050 or sooner.

The 2019 Greenhouse Gas (GHG) Emissions Inventory presented in this document tracks Toronto's progress towards net zero and identifies keys emissions sources. It is one of the tools that the City will use to inform its actions to achieve net zero emissions.

As shown in Table 1 and Figure 1, though community-wide emissions[1] have decreased since 1990 and the city is on track to achieve the 2020 emissions target, emissions have not decreased appreciably in recent years. Our data suggest that emissions have plateaued, and we must rapidly decrease emissions in order to meet the City's 2030 target of a 65 per cent emissions reduction from 1990 levels and net zero by 2050 or sooner.

Toronto's GHG emissions and Council-approved GHG emissions targets are shown in Figure 1.

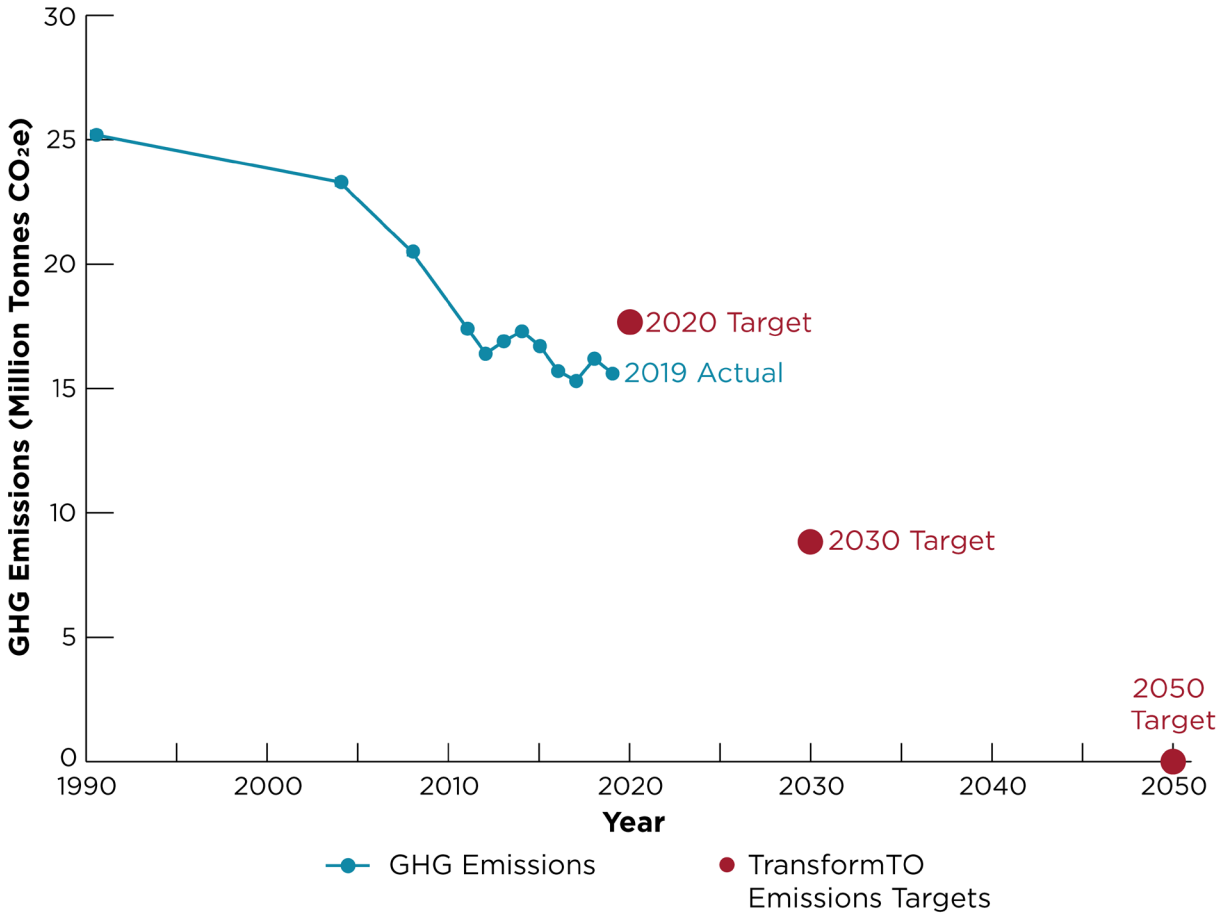
Artist: Emmanuel Jarus | Photo by: StreetARToronto

[1] Community-wide emissions account for all GHG emissions within the City of Toronto that can currently be estimated or measured by the City. By contrast, corporate emissions account for emissions generated only by local government activity. Corporate emissions are included in community-wide emissions. See Corporate Emissions on page 13 for further detail on corporate emissions estimates.

Table 1: Toronto's greenhouse gas emissions targets, status and progress

GHG Reduction Targets	2019 Status	Progress
30% by 2020, from 1990 levels	38% lower than 1990 levels	On track
65% by 2030, from 1990 levels	38% lower than 1990 levels	Toronto must nearly halve its 2019 emissions within 10 years to meet the 2030 target. Toronto must rapidly decrease its annual emissions to meet the 2030 target.
Net zero by 2050	15.6 million tonnes emitted	15.6 million tonnes must be eliminated to meet the 2050 target.

Figure 1: Toronto Community-Wide GHG Emissions



Note: The historical values reported in this 2019 GHG Inventory do not exactly match those in the 2018 GHG Inventory. The values reported here are the most up to date as of publication of this 2019 GHG Inventory.

Highlights

Toronto is on track to exceed its 2020 target of a 30 per cent reduction in greenhouse gas emissions from 1990 levels.

In 2019, Toronto's community-wide GHG emissions were 15.6 million tonnes (MT) equivalent carbon dioxide (CO_2e)*, which is 38 per cent lower than in 1990.

Community-wide emissions decreased nearly four per cent compared to 2018, when Toronto emitted 16.2 MT CO_2e.

Emissions have not decreased appreciably in recent years. Our data suggest that emissions have plateaued, and we must rapidly decrease emissions in order to meet the City's 2030 target (65 per cent emissions reduction from 1990 levels) and net zero by 2050 or sooner.

Buildings sector emissions accounted for 57 per cent of community-wide emissions in 2019, followed by transportation sector emissions at 36 per cent, and waste emissions at seven per cent (Figures 2 and 3).

Buildings sector emissions, primarily from natural gas used to heat buildings, continue to be the largest source of community-wide emissions.

Transportation sector emissions continue to be the second-largest source of community-wide emissions, with most of those emissions coming from gasoline used in passenger cars and trucks.

Waste sector emissions are mainly driven by landfill emissions, which decreased in 2019.

The City of Toronto's corporate emissions, or local government emissions, decreased nearly four per cent over 2018 and continued to account for about five per cent of community-wide emissions.

**Emissions are tracked in CO_2e, a unit that allows emissions of different GHGs (such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)) to be expressed as a single unit of measurement.*

Figure 2: GHG Emissions by Sector from 1990 to 2019

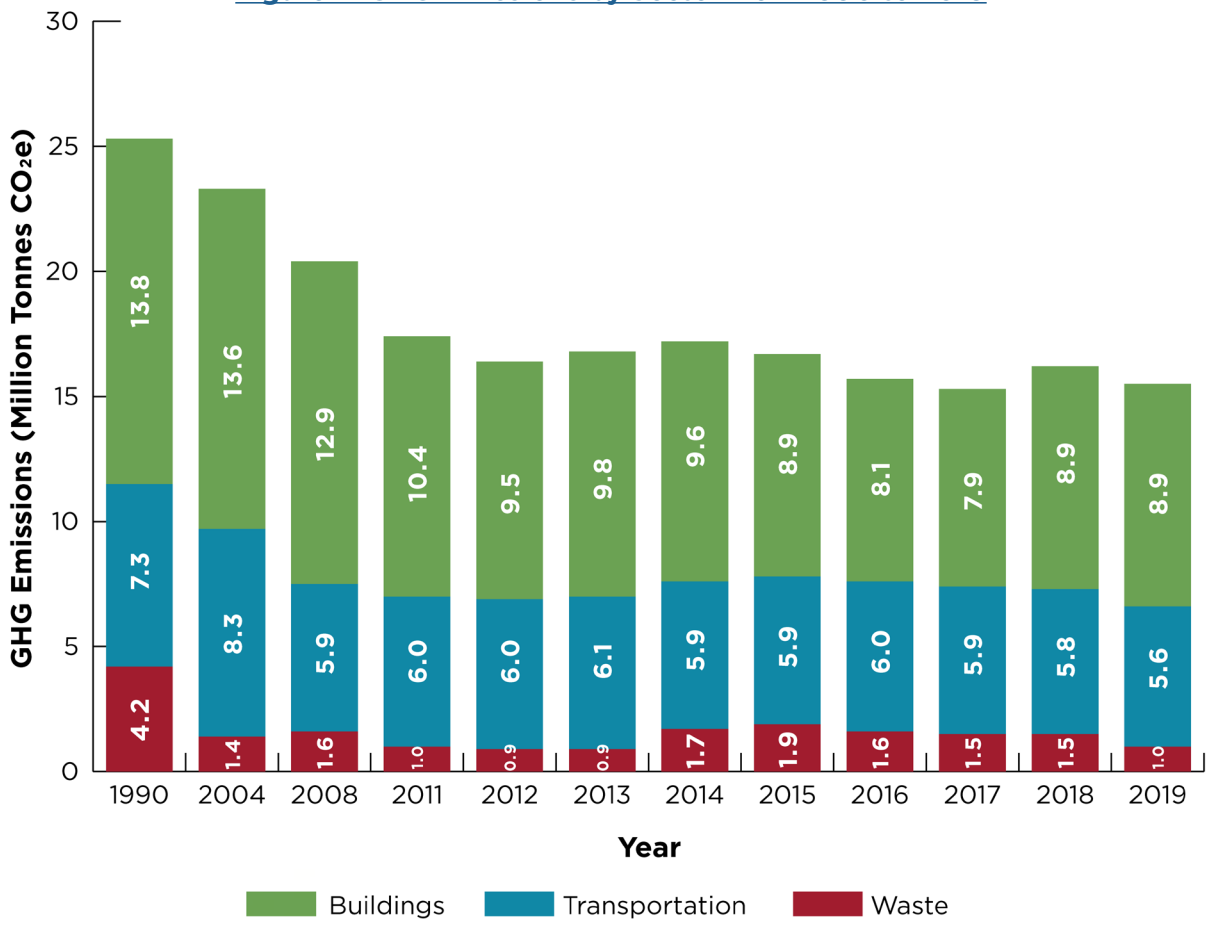
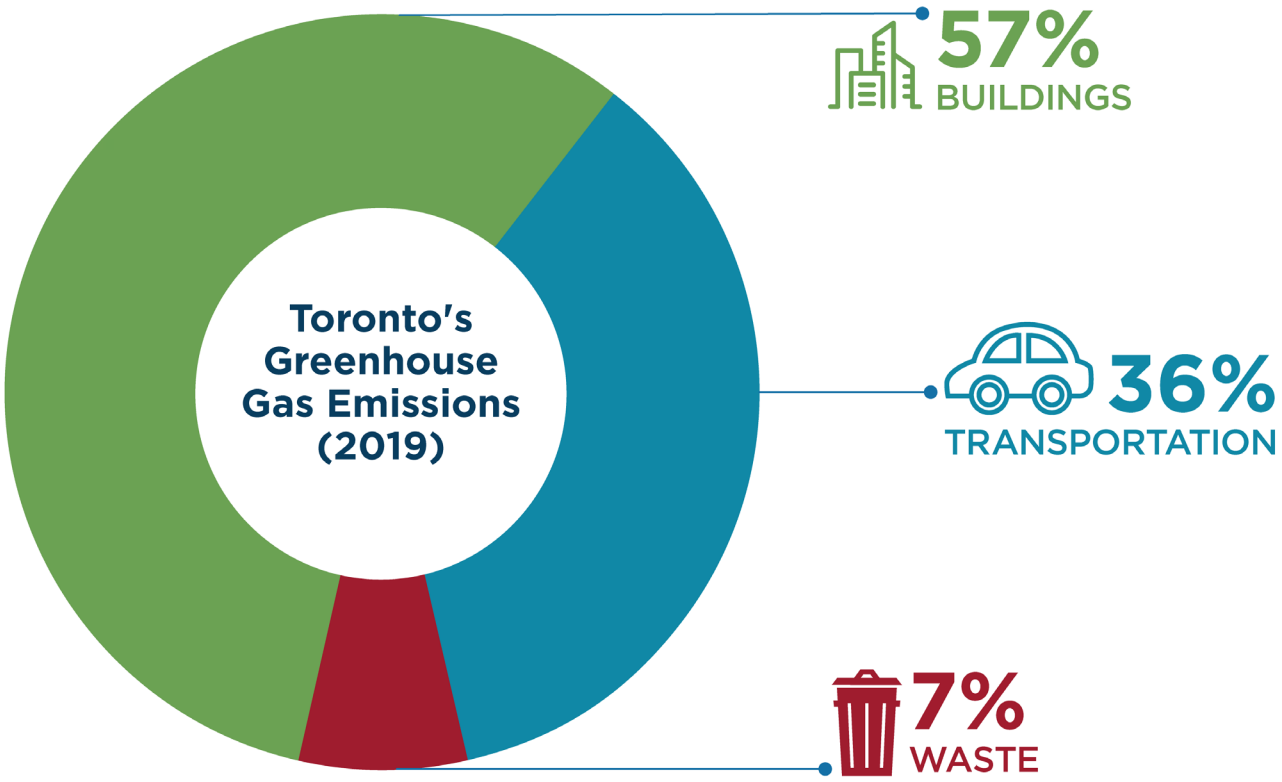


Figure 3: Toronto's Greenhouse Gas Emissions (2019)



What's Included in the 2019 Inventory

Toronto's GHG inventory consists of direct and indirect GHG emissions from three dominant sectors – buildings, transportation, and waste:

- **Energy use of buildings** is used to calculate the emissions produced from the consumption of natural gas and electricity.
- **Transportation emissions** represent emissions from on-road passenger vehicles, heavy trucks, and buses as well as from commuter rail and some marine and aviation navigation. Freight rail emissions are not accounted for in this inventory, as reliable data for these emissions sources is currently not available. Identifying emissions sources from all transportation modes continues to be a methodological challenge. Due to the number of different authorities and private businesses that may contribute to transportation emissions, as well as the varying levels of voluntary, sometimes proprietary versus regulated reporting, this section of the inventory presents the best data available at time of collection.
- **Waste emissions**, primarily methane, originating in landfills constitute the majority of Toronto's waste emissions. In addition, there is a small portion of emissions from organics, yard waste and wastewater treatment processes. Emissions from privately managed waste are estimated.

Currently, lifecycle emissions from the products and services consumed by residents, businesses and institutions in Toronto are not included in this inventory. Work to define and calculate these emissions is planned for 2022.

Key Drivers - Emissions by Source

Figure 4 shows emissions by source. Natural gas consumption to heat buildings continues to be the largest source of emissions community-wide, accounting for approximately 53 per cent of all emissions. Second to natural gas is gasoline, which continues to account for almost 30 per cent of emissions. The next largest source of emissions comes from the release of methane, nitrous oxide and carbon dioxide from landfills, which makes up about seven per cent. Electricity consumption results in about five per cent of community-wide emissions.

Natural Gas

Natural gas used to heat buildings continues to be the largest overall emissions source at approximately 8.2 MT[2]. Compared to 2018, emissions from natural gas remain essentially unchanged.

Gasoline

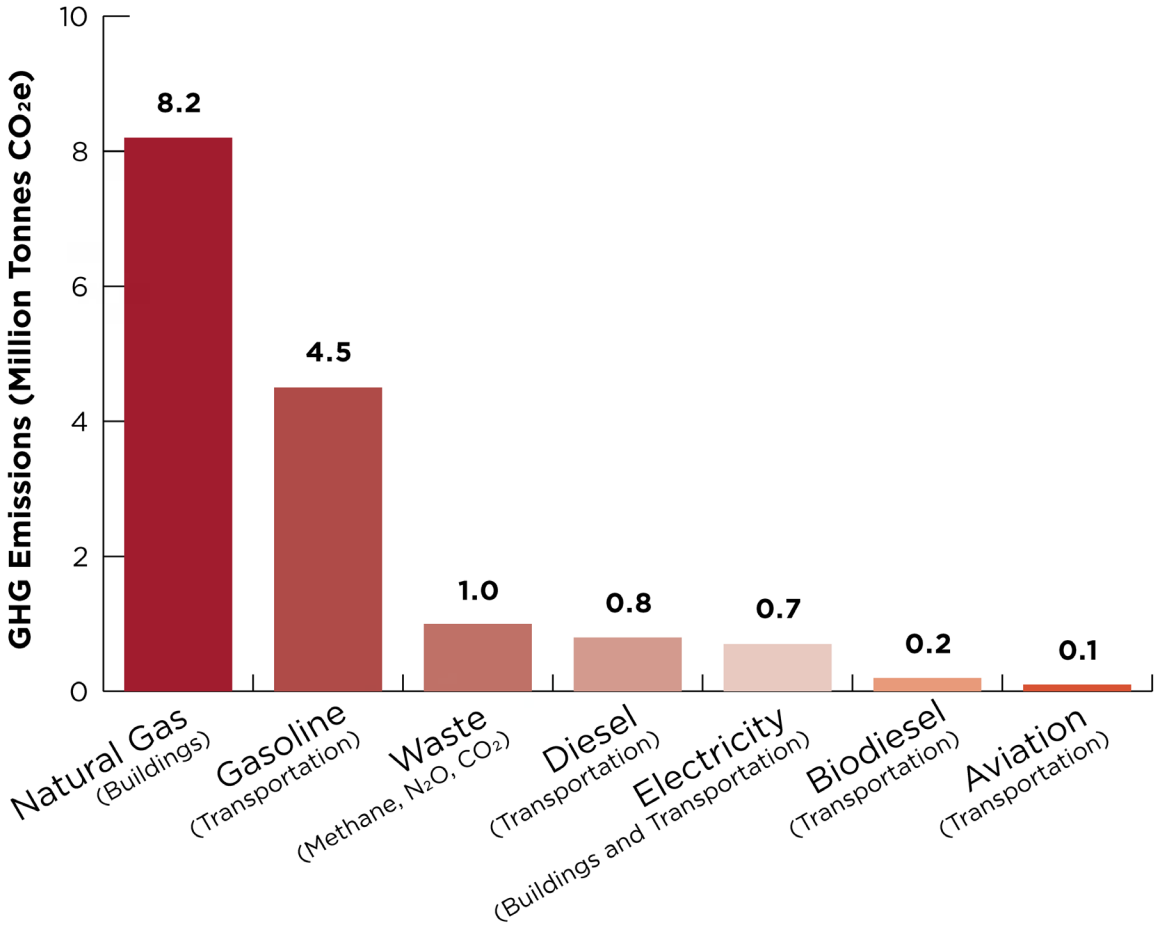
Gasoline use in on-road vehicles is the second largest emissions source at approximately 4.5 MT. Emissions from gasoline use have decreased slightly while the total vehicle kilometers travelled (VKT) have increased. The reason that emissions have not gone up is primarily due to increases in the overall fuel efficiency of passenger vehicles. Passenger vehicles alone make up about 50 per cent of on-road vehicles in Toronto, and account for about 26 per cent of community-wide emissions.

Electricity

Emissions from electricity were measured at approximately 0.72 MT, an increase of less than one per cent over 2018.

[2] Total residential, commercial, institutional and industrial plus fugitive emissions.

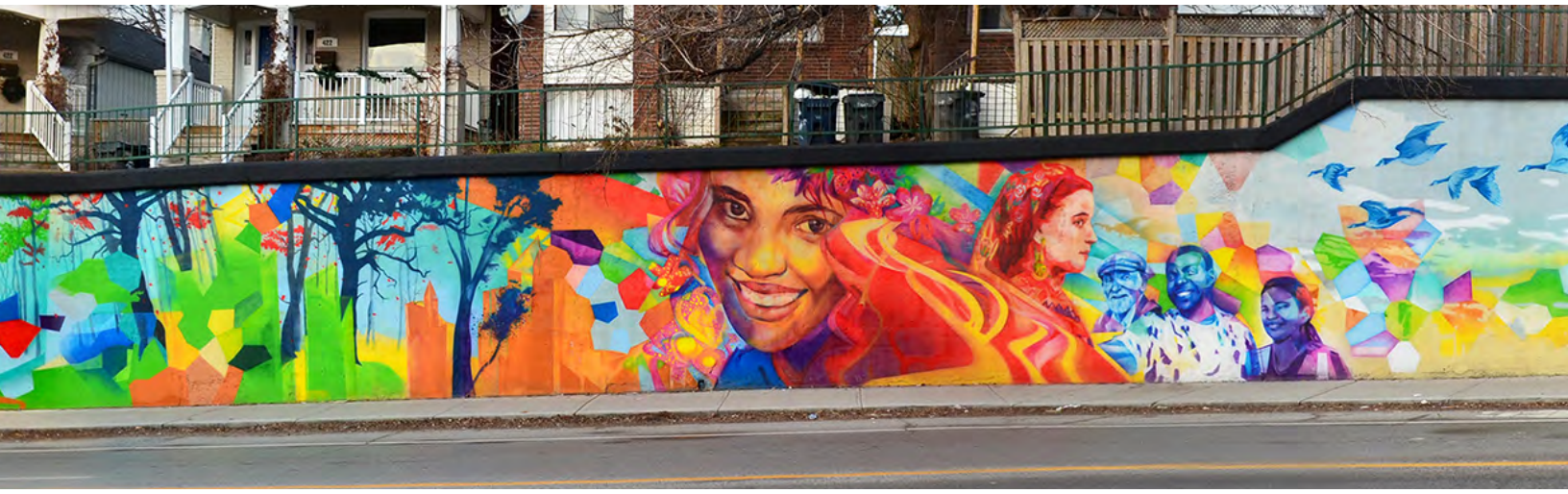
Figure 4: GHG Emissions by Source (2019)



Note: Biodiesel is reported separately from Diesel in 2019.

Methane

Emissions from methane were 0.80 MT in 2019. The majority of methane emissions originate from our landfills, both closed and operating. Wastewater treatment, organics and yard waste processing are other sources of methane emissions accounted for in the 0.80 MT total. Methane emissions decreased about 32 per cent from 2018. This decline is attributable to an improvement in methane emissions estimates at two landfills (discussed further in the Waste section on page 12). The majority of methane emissions in 2019 emanated from closed landfills; these will continue to be a steady source of emissions for the lifetime of the landfills.



Artist & photo by: Christiano De Arujo

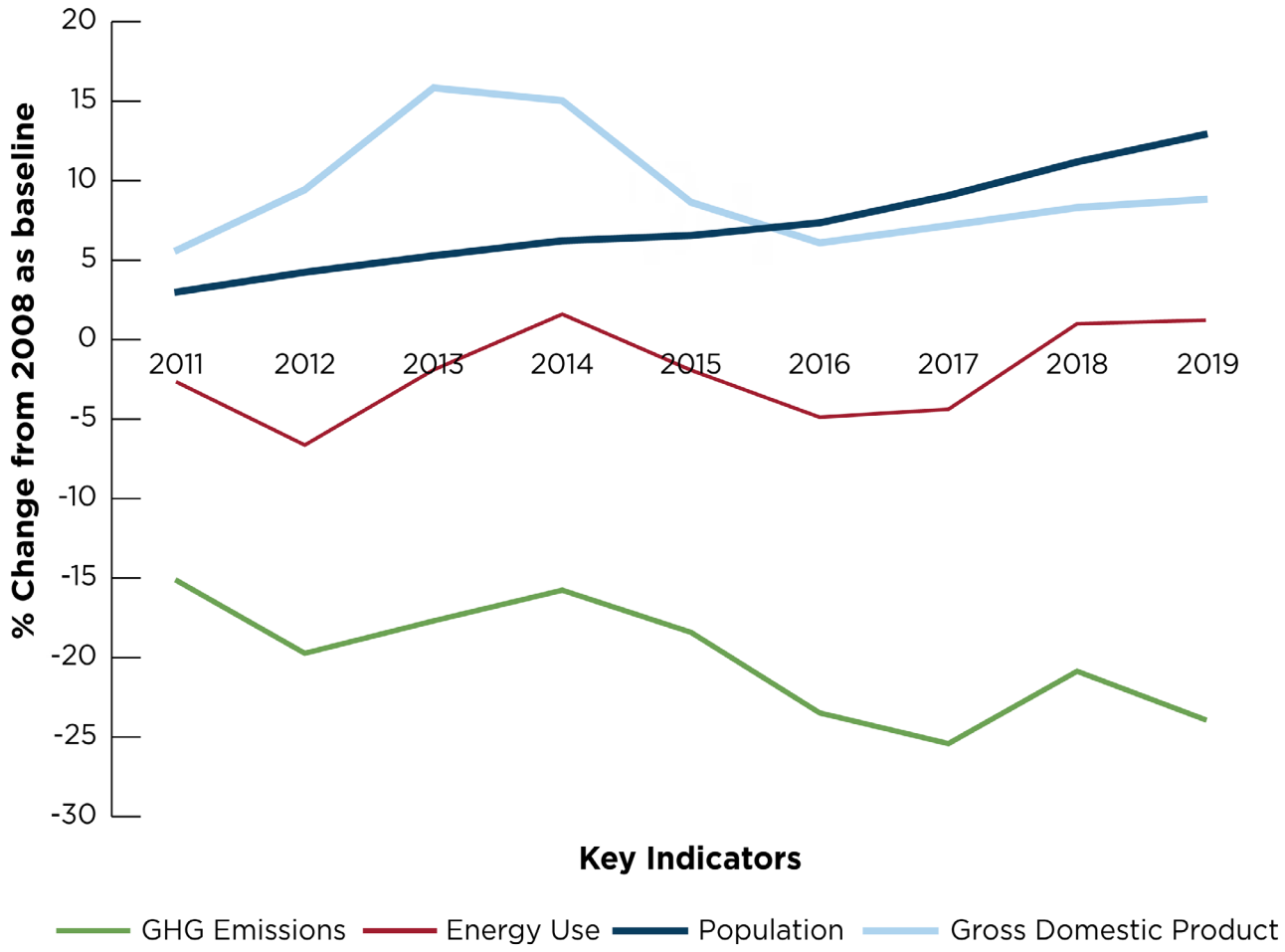
Population, Economic Growth and GHG Emissions

Understanding the relationship between factors such as population, economic growth and GHG emissions is important as they are indicative of a city's well-being and resilience.

Figure 5 shows that GHG emissions in Toronto have de-coupled from economic prosperity (as measured by gross domestic product (GDP)), population and energy use. Generally over time, community-wide emissions are decreasing even as population and GDP rise, which indicates that Toronto is on the path to a low-carbon future. Moreover, energy use has been fairly stable since 2011 despite an increase in population and GDP. Emissions declined while maintaining stable energy use through:

- A "greener" electricity grid, due to the Province phasing out coal-fired power plants entirely in 2014 and increasing the share of lower-emission energy sources over time (hydroelectric, nuclear, natural gas and non-hydro renewables)[3].
- Lower transportation emissions from gasoline and diesel fuels over time, due to two main factors – the City shifting our public transit buses from diesel to biodiesel fuel, and the Province increasing the percentage of ethanol in gasoline, and biodiesel in diesel fuel.

Figure 5: Energy, GHG Emissions and Economic Indicators (% Change from 2008 as baseline)



[3] Government of Ontario. 2017. The End of Coal. https://www.ontario.ca/page/end-coal

Details on Sectors and Sources

The three dominant sources of GHG emissions in Toronto are: energy use in buildings (natural gas and electricity); transportation fuels; and waste in landfills. Toronto shows an overall decline in emissions from 1990 though emissions in all sectors are not declining consistently year over year. In particular, we observed higher emissions in the buildings sector in 2018 and 2019 than during 2017. Figure 2 on page 4 of this report shows the total emissions of these three sectors combined.

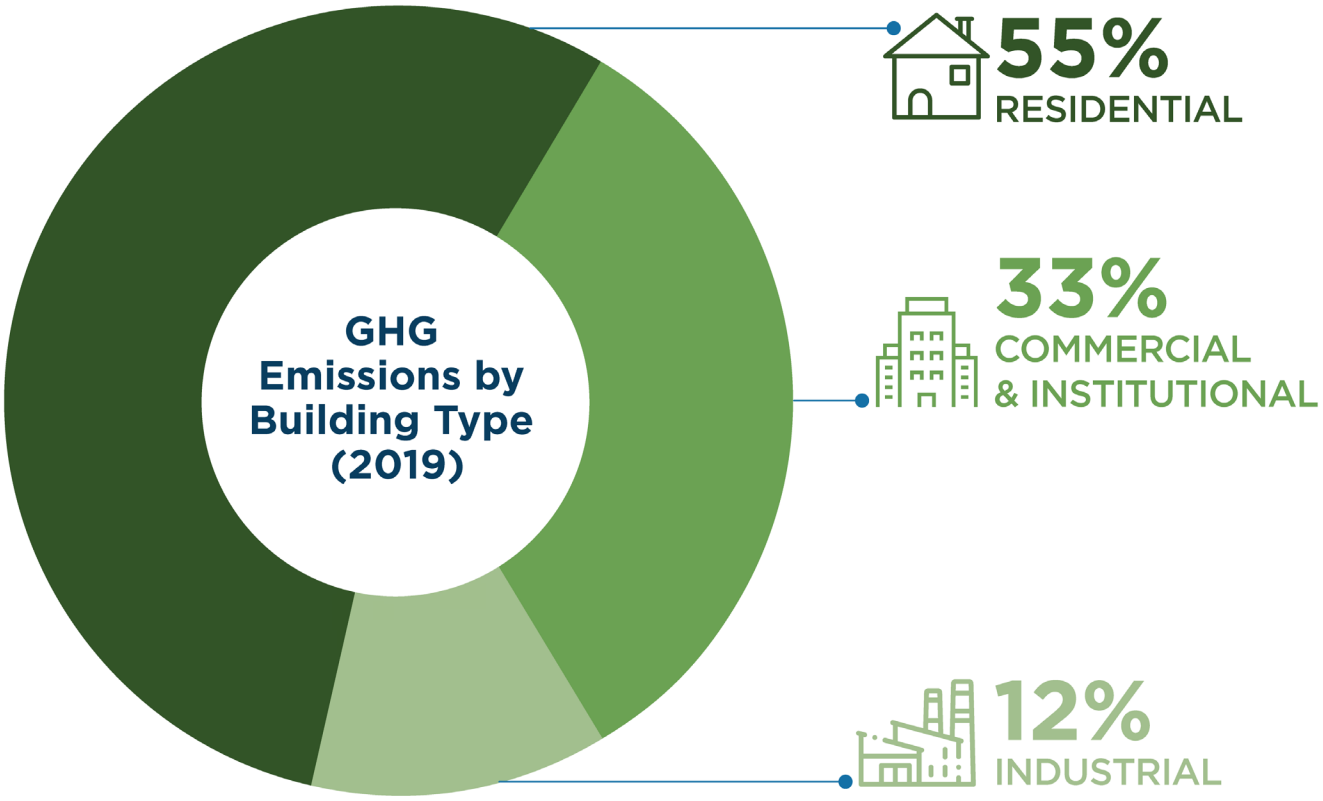
Emissions from Different Building Types and Fuel Sources

In 2019, emissions from residential, commercial and industrial buildings emitted approximately 8.9 MT of the city's total inventory, making buildings the largest source of emissions at 57 per cent. Compared to 2018, overall building emissions decreased by less than one per cent.

Residential homes and buildings account for 55 per cent of all building emissions and, at 4.9 MT, they account for 32 per cent of all community-wide emissions.

Figure 6 breaks down the emissions contribution of each type of building – residential, commercial/ institutional and industrial[4].

Figure 6: GHG Emissions by Building Type (2019)

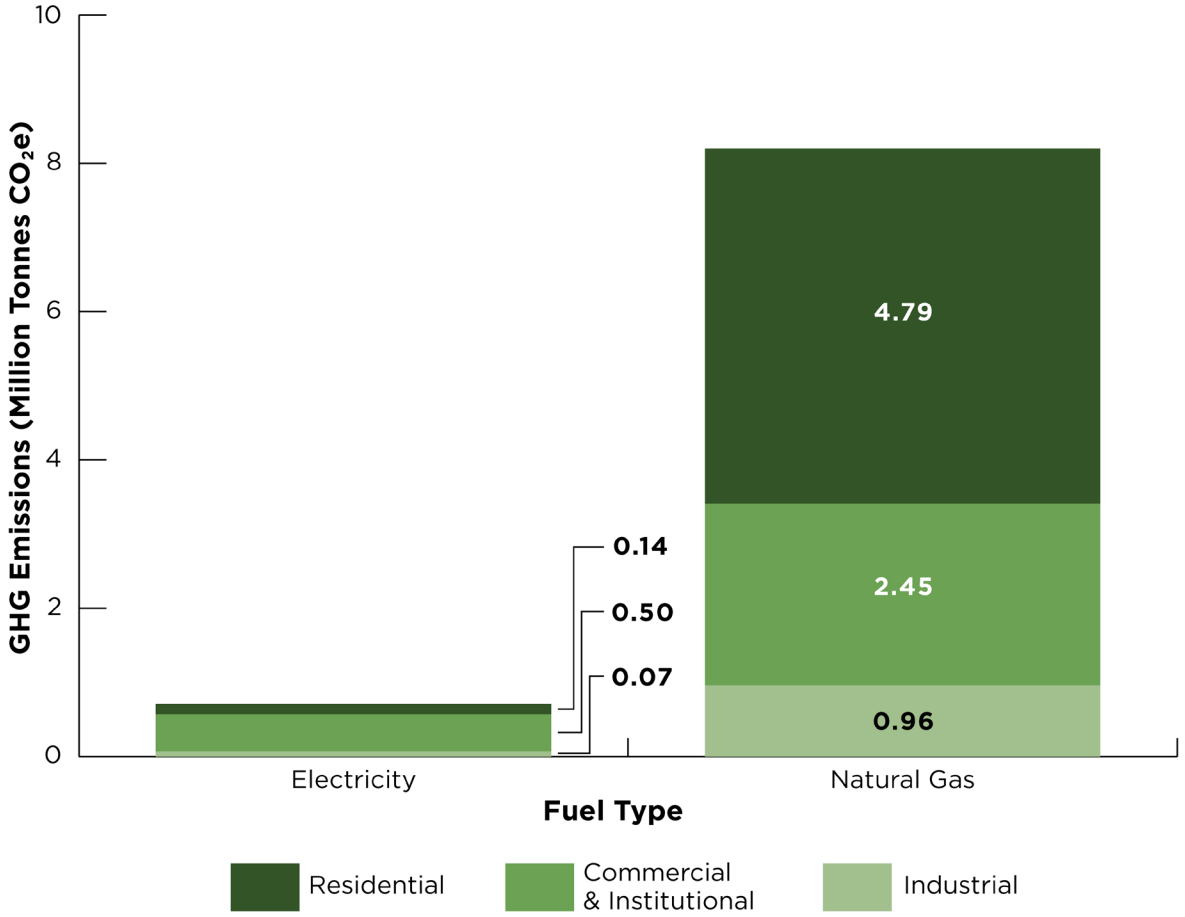


Buildings Emissions by Fuel Type

Figure 7 shows the proportion of emissions coming from the two main fuel sources – electricity and natural gas – by building type. Natural gas is primarily used for heating during the winter months. The contribution of emissions from natural gas in buildings is approximately 11 times greater than emissions contributed by electricity.

[4] Industrial emissions include emissions from heating and industrial cooling in buildings, as well as process emissions.

Figure 7: GHG Emissions from Buildings by Fuel and Building Type (2019)



Natural Gas Emissions in Buildings

Natural gas emissions in buildings have remained essentially stable overall since 2018, though a decrease of nearly four per cent was observed in industrial buildings in 2019. Residential and commercial building emissions from natural gas each decreased by less than one per cent, respectively, since 2018.

Fluctuations in the consumption of natural gas are highly weather dependent, as natural gas is the main fuel used to heat buildings seasonally. The winter of 2019 was cooler than the previous year, however, total natural gas consumption remained stable. This may have partly been driven by improved building efficiency, though more data would be needed to confirm whether measures to enhance building performance indeed affected total natural gas use in 2019.

Natural gas accounts for 92 per cent of emissions from buildings. Residential natural gas use alone accounts for 54 per cent of building emissions. These statistics highlight the need to reduce natural gas use in buildings to meet future emissions targets.

Further, we see that the proportion of natural gas emissions is higher from single-family homes than from multi-unit residential buildings (MURB): 57 per cent (single-family) and 43 per cent (multi-unit residential).

Emissions from natural gas use in multi-unit residential buildings decreased by 0.05 MT from 2018 to 2019.

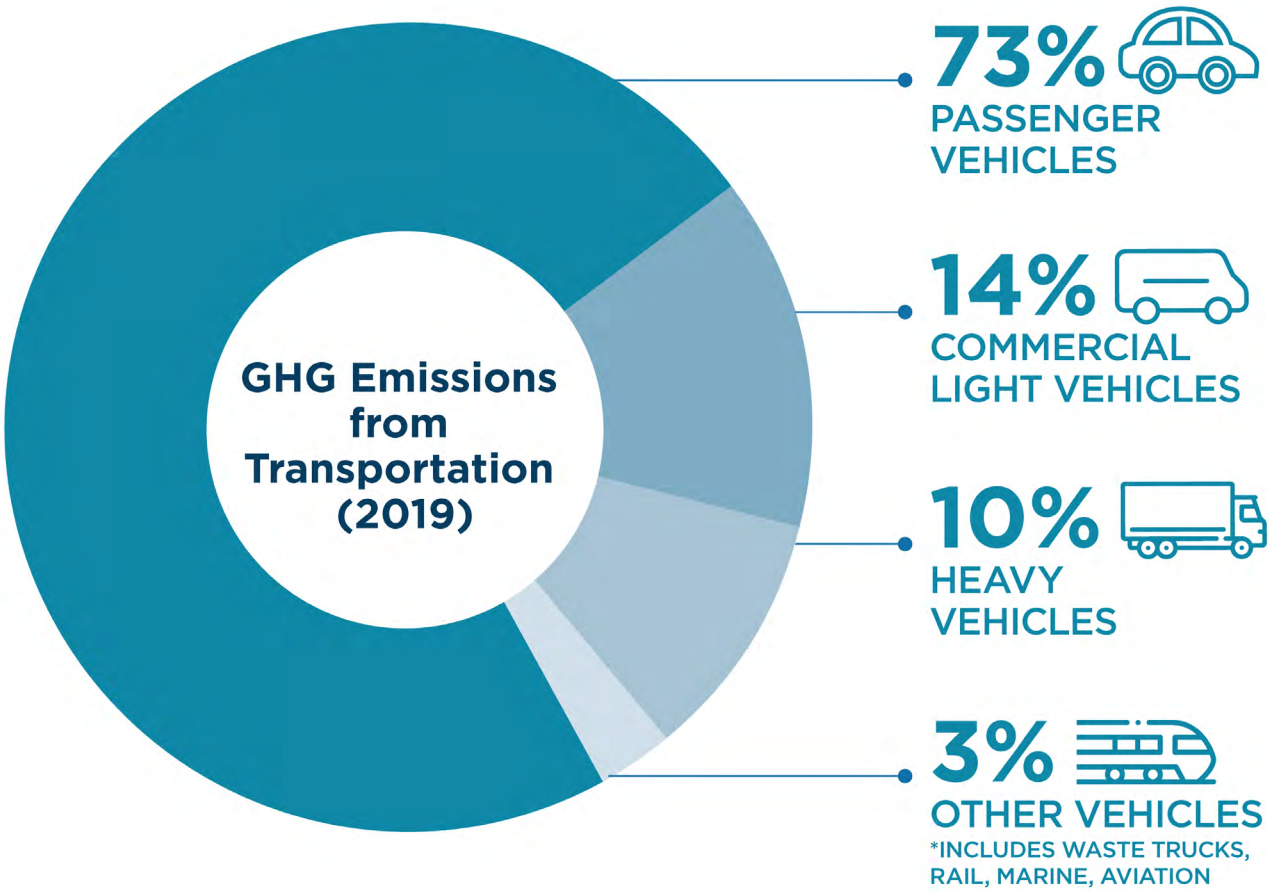
According to Municipal Property Assessment Corporation (MPAC) data obtained for the years 2016 and 2020, single-family home floor space increased by about two per cent while MURB floor space increased by roughly eight per cent over the four-year period.

As well, within the MURB category, floor space for rental apartments increased by about three per cent from 2016 to 2020 whereas residential condominium space increased by almost 13 per cent. Further examination of these trends is planned for 2022.

Emissions from Different Modes of Transportation

Transportation emissions in 2019 were approximately 5.6 MT, accounting for 36 per cent of the community-wide inventory. On-road vehicle emissions from cars, trucks, vans, and buses dominate the emissions profile accounting for approximately 97 per cent of all transportation emissions. The largest portion of on-road emissions, approximately 73 per cent of all transportation emissions, are attributed to passenger cars and trucks (Figure 8). Since 2018, there was an overall decline in transportation emissions of about 0.2 MT, though the proportion of total transportation emissions from on-road vehicles and specifically passenger cars and trucks remained the same in 2019.

Figure 8: GHG Emissions from Transportation (2019)



In Figure 8, the "Other Vehicles" category includes Toronto Transit Commission (TTC) rail emissions from electricity used to power streetcars and subways. In total, these emissions account for only 0.18 per cent of all transportation emissions, making the TTC's subways and streetcars an almost "emissions-free" public transit mode. Also in this category are GO and UP commuter rail, which mainly capture diesel emissions within the city boundary, and together they make up 1.4 per cent of total transportation emissions. Marine emissions reporting is limited and captures only the fuel used by the City's marine fleet (e.g. Toronto Island Ferry, Toronto Police and Fire vessels), totalling 0.02 per cent of all transportation emissions. Similarly, emissions from aviation include only aviation fuel used at Billy Bishop airport on Toronto Island, which accounts for 1.35 per cent of total transportation emissions.

The GHG emissions associated with Toronto residents' extensive air travel to and from Toronto Pearson International Airport are not captured in this inventory due to current constraints in acquiring data. Another gap resulting from data availability limitations is emissions from marine vessels associated with cargo transport and personal use. These emissions are currently not accounted for in the inventory.

On-Road Vehicle Fuel Use

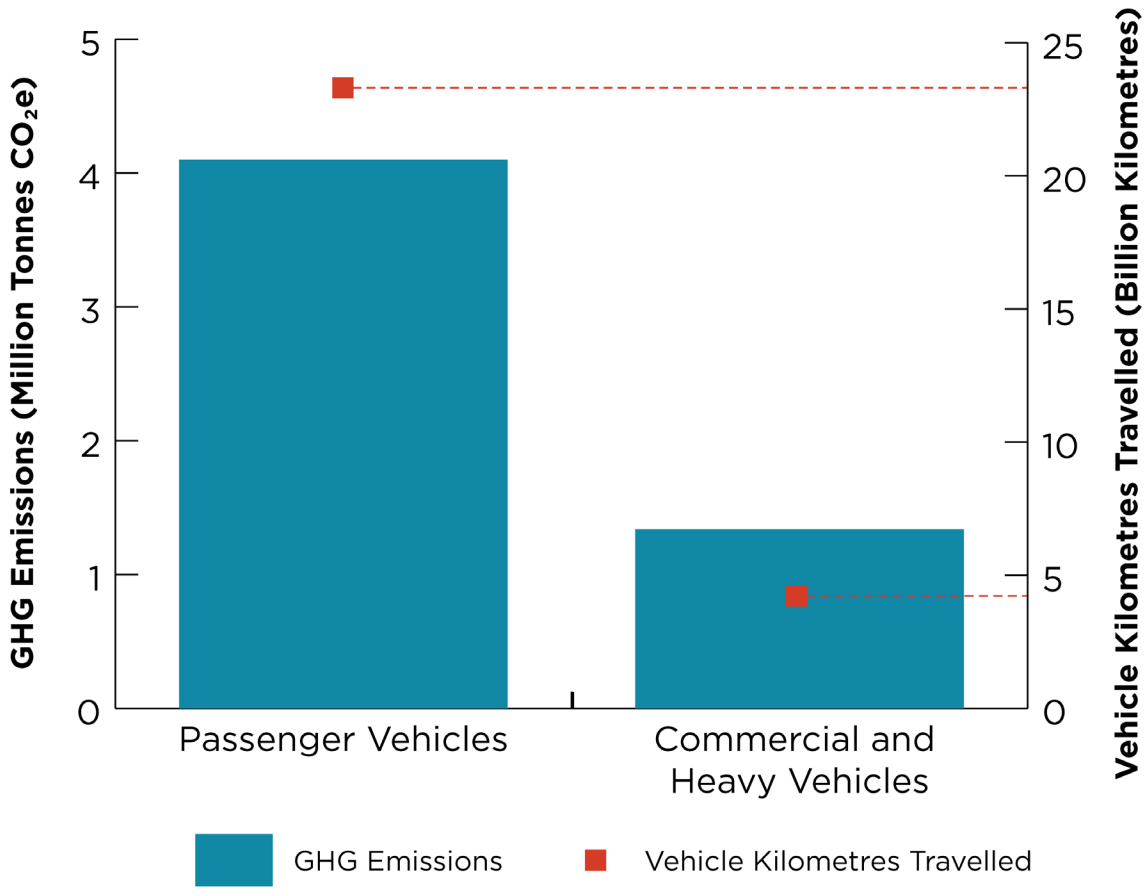
The City employs a model, created by the University of Toronto, that uses vehicle count data from Transportation Services[5] to simulate traffic in the city.

The model results show that on-road Vehicle Kilometres Travelled (VKT) increased between 2018 and 2019 but that emissions from on-road vehicles decreased by approximately 0.15 MT during the same period (Figure 9). The reduction primarily reflects improvements in vehicle fuel efficiency, increased percentage of ethanol in gasoline and biodiesel in diesel fuel, and a gradual uptake of electric vehicles in Toronto[6].

Generally, the proportion of emissions from passenger vehicles in 2019 is consistent with 2018. Approximately 80 per cent of all emissions from transportation continue to originate from gasoline-powered vehicles which include passenger cars, SUVs, vans and commercial light trucks. Passenger vehicles make up about 50 per cent of on-road vehicles. Commercial diesel vehicles, which include commercial delivery vehicles, account for approximately four per cent of all transportation emissions in the city.

As a fuel, gasoline accounts for about 30 per cent of total community-wide emissions.

Figure 9: Transportation GHG Emissions and Related Vehicle Kilometres Travelled (2019)



Note: "Passenger Vehicles" includes cars and trucks fueled by gasoline. "Commercial and Heavy Vehicles" includes a mix of gasoline- and diesel-fueled vehicles.

[5] Traffic Emission Prediction Scheme. University of Toronto, City of Toronto Transportation Services, City of Toronto Environment and Energy Division, and Toronto Atmospheric Fund.

[6] Starting in 2004, the Canadian government and US federal EPA began harmonizing vehicle technical standards in order to ensure that vehicles and engines entering the Canadian market met more stringent exhaust emission standards (see federal On-Road Vehicle and Engine Emission Regulations, SOR2003/2). Successive reviews of the technical harmonization have led to improvements in emissions of cars and light duty trucks, with the most recent revisions applied to the 2017 to 2025 model years.

Emissions from Waste Processing

Waste emissions in 2019 were approximately 1.0 MT, accounting for about seven per cent of the community-wide inventory – far less than the contributions of the buildings and transportation sectors. This is a reduction of about 0.5 MT since 2018. Community-wide waste emissions are now 75 per cent below 1990 levels, which exceeds the emissions goal for 2030. Just under 1.0 MT of emissions from the waste sector are landfill emissions, which include emissions estimated from publicly- and privately-managed waste disposal, with the remaining small portion originating from organics, yard waste and wastewater treatment processes.

Landfill Emissions

Waste emissions from landfills account for methane, nitrous oxide and carbon dioxide emissions, and capture GHGs originating from all landfills, open and closed, within and outside the city's boundary. For most landfills, Toronto uses a first order decay model to determine the emissions from methane in any given year – from both historical waste and current waste going to landfill. Prior to 2019, landfill emissions were calculated using this model, which applies conservative default values to roughly estimate emissions based on landfill-specific characteristics. In 2019, the same model was used to estimate emissions at all except for two City-owned landfills, where an alternative method was used[7]. In part due to the enhanced accuracy of the alternative emissions calculation approach at these two landfills, the waste sector showed an approximately 31 per cent emissions reduction (about 0.47 MT) since 2018. By comparison, emissions in the transportation sector decreased by almost three per cent, and in the buildings sector by less than one per cent between 2018 and 2019; though, the absolute change in waste emissions is relatively small, as the waste sector is by far the smallest source of emissions compared with the transportation and buildings sectors.

The keys to reducing methane emissions from landfill are the landfill gas capture and processing systems in place, and waste reduction.

[7] The City engaged a consultant to estimate the emissions from stationary combustion, on-site transportation, fugitive landfill gas (LFG), and LFG combustion (flare) sources. Between 2018 and 2019, the difference in emissions was primarily due to the methods used for estimating fugitive LFG emissions. Through application of the new approach, the estimated methane composition of LFG decreased and the reported uncontrolled LFG generation decreased, resulting in fewer fugitive emissions in 2019.

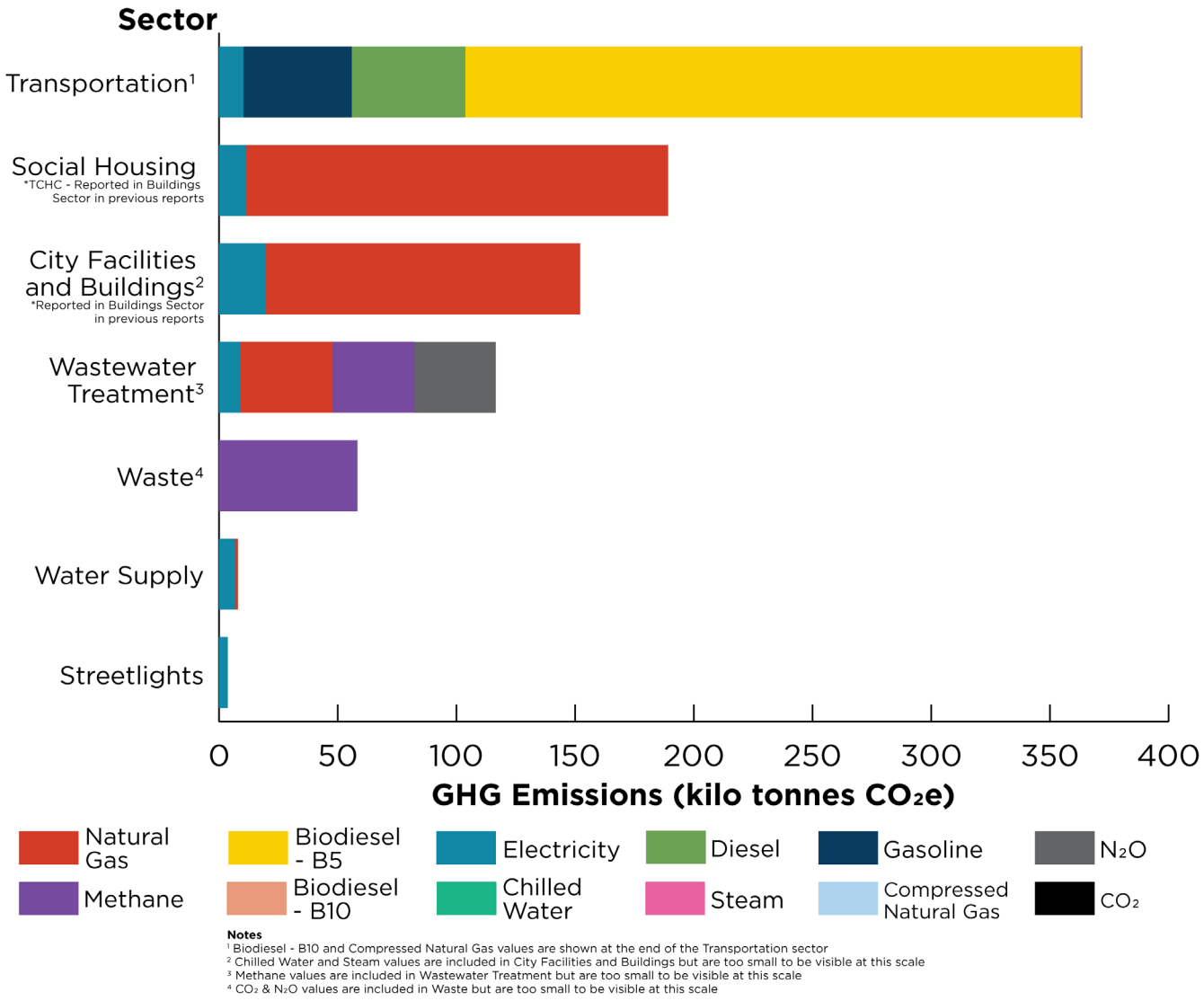
City of Toronto Corporate (Local Government) Emissions

The City of Toronto's corporate, or local government, emissions are calculated based on the energy used in all municipal buildings (offices, community recreation centres, Toronto Community Housing Corporation (TCHC) housing), vehicle fleets including TTC transit vehicles, water supply and treatment, as well as streetlights.

In 2019, corporate emissions were 0.74 MT, which is about five per cent of Toronto's community-wide emissions. The City's corporate emissions decreased by nearly four per cent from 2018 but remained a stable share of community-wide emissions between 2018 and 2019.

Figure 10, below, shows the City's corporate emissions sources broken down by main operational sectors.

Figure 10: City of Toronto Corporate GHG Emissions by Sector and Source (2019)



Notes

[1] Biodiesel - B10 and Compressed Natural Gas values are shown at the end of the Transportation sector
[2] Chilled Water and Steam values are included in City Facilities and Buildings but are too small to be visible at this scale
[3] Methane values are included in Wastewater Treatment but are too small to be visible at this scale
[4] CO_2 & N_2O values are included in Waste but are too small to be visible at this scale

Corporate Emissions by Sector

The largest source of emissions at the corporate level is now the transportation sector at 0.36 MT, surpassing emissions from the City facilities and buildings, and social housing sectors. Within the transportation sector, diesel and biodiesel emissions account for about 84 per cent of corporate transportation emissions, while gasoline emissions represent approximately 12 per cent. In 2019, the TTC changed its fuel source for all buses from diesel to biodiesel. Fuel use remained fairly stable year over year (roughly 89 million litres in 2018, and about 83 million litres in 2019). However, emissions per litre of biodiesel fuel are lower than for diesel. Therefore, TTC bus emissions in 2019 were lower by about 0.01 MT, or 11 kilo tonnes, than if TTC buses still used diesel fuel.

Corporate buildings emissions in the City Facilities and Buildings sector and the Social Housing sector amount to 0.34 MT. Within these sectors, natural gas for heating is the dominant emissions source.

Corporate Emissions by Source

Natural gas consumption makes up approximately 47 per cent of all corporate emissions. Diesel fuels (including diesel and biodiesel) from the combined fleets of TTC, EMS, Fire, Police Services and the City's corporate fleet make up about 34 per cent of corporate emissions. Electricity accounts for about eight per cent of corporate emissions, followed by gasoline at roughly five per cent and nitrous oxide (N_2O) at about five per cent.

Global Emissions Inventory Protocol

Toronto's community-wide emissions are calculated and reported as per guidance in the Global Protocol for Community-Scale GHG Emissions Inventory (GPC). The GPC provides a robust framework for accounting and reporting community-wide GHG emissions to support climate action planning. Use of the GPC is also required to uphold Toronto's commitment as a signatory of the Global Covenant of Mayors for Climate and Energy. Toronto's level of compliance is BASIC.

Toronto's "A List" Score on GHG Accounting and Action Reporting

As a Global Covenant of Mayors signatory, Toronto has been disclosing its GHG emissions inventory and its climate mitigation and adaptation actions annually to the Carbon Disclosure Project (CDP) in order to share Toronto's progress and benchmark against other cities facing similar challenges.

As we reported in the 2018 GHG Inventory Report, for the third year in a row, the City of Toronto is recognized on the 2020 Carbon Disclosure Project (CDP) Cities "A" List for its leadership and transparency on climate action. Toronto is one of 88 cities globally to receive an "A" rating. The CDP Cities "A" List for 2021 will be updated later this year.

Stay Involved

Stay informed about what the City of Toronto and its partners are doing to reduce greenhouse gas emissions in the city. Subscribe for e-updates at Toronto.ca/transformto

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