CITY OF TORONTO

2023 SECTOR-BASED EMISSIONS INVENTORY

TORONTO

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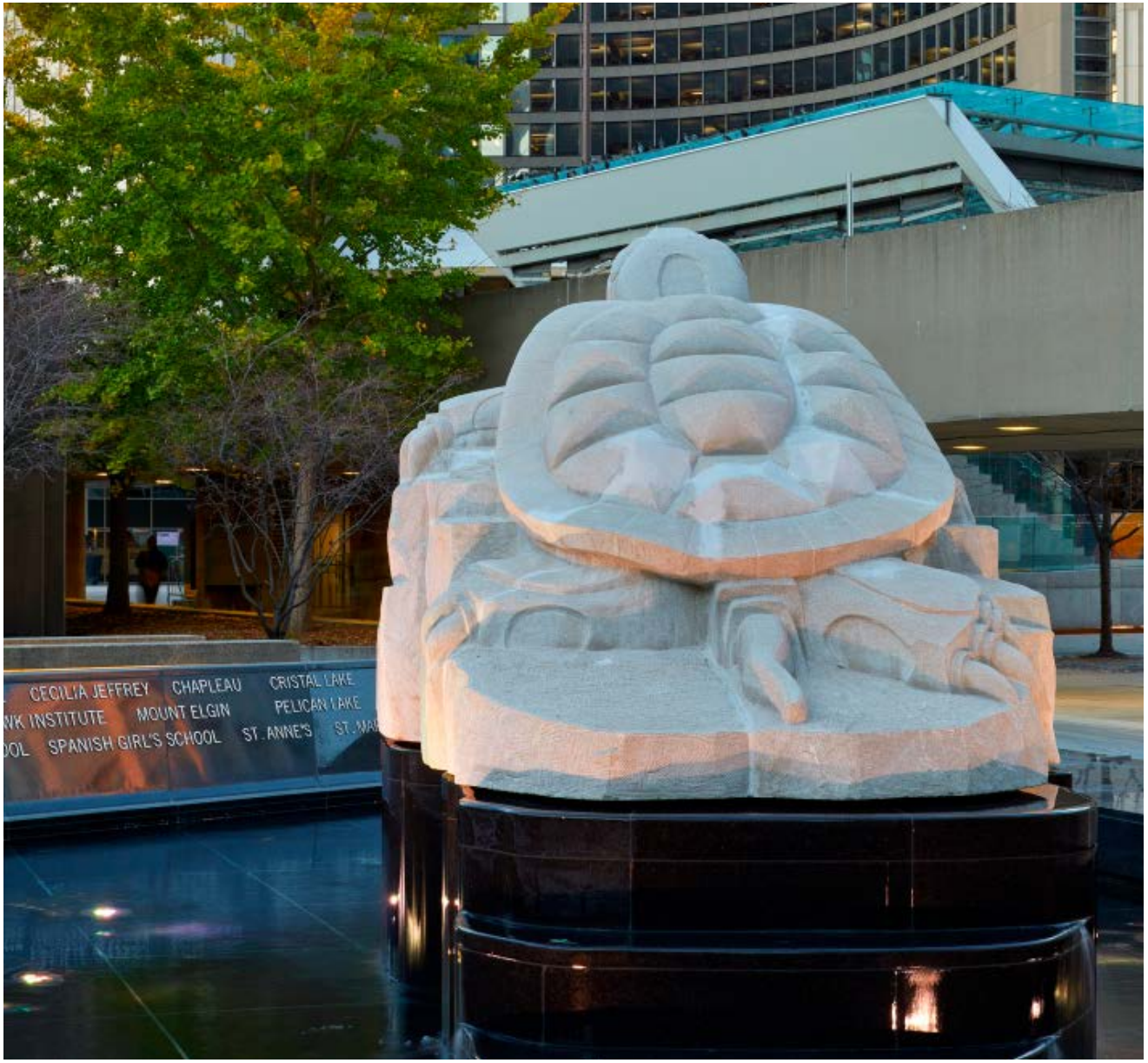
LAND ACKNOWLEDGEMENT



The City acknowledges that all facets of its work are carried out on the traditional territories of many nations, including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee, and the Wendat peoples and is now home to many diverse First Nations, Inuit, and Métis peoples. These territories are currently covered by Treaty 13 with the Mississaugas of the Credit and the Williams Treaties signed with multiple Mississaugas and Chippewa bands. We are eternally grateful for Indigenous stewardship of these lands and waters.

Gchi Miigwetch, Niawen, Marsi, Nakummesuak, Quannamiik

GLOSSARY

Term	Definition
Activity data	Activity data refers to a quantitative measure of the amount of an activity that leads to greenhouse gas (GHG) emissions.
Baseline	The reference year against which annual emissions reductions/increases are measured over time. In the case of Toronto's emission reduction targets, the baseline year is 1990.
Carbon dioxide equivalent (CO_2e)	A metric used to aggregate and/or compare the emissions from different greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) based on their global warming potential (GWP)[1].
Community-wide GHG emissions	Community-wide emissions are an estimate of all GHG emissions[2] that occur within the geographic boundary of Toronto for the sectors of stationary energy, transportation, waste, industrial processes and product use. The estimate also includes emissions from certain activities that occur outside Toronto, including emissions from the use of electricity, steam, and/or heating/cooling supplied by grids which cross city boundaries, and emissions from fuel use in waste collection vehicles travelling to waste disposal sites outside of city boundaries. Community-wide emissions are currently estimated using the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), version 1.1[3].
Consumption-based emissions inventory	A consumption-based emissions inventory (CBEI) is a calculation of all GHG emissions associated with producing, transporting, using, and disposing of waste, products, and services consumed by a particular community or entity in a given time (typically one year), including emissions outside the community's geographic boundaries. Please refer to Appendix A for more details.
Cooling Degree Days (CDD)	Cooling Degree Days (CDD) is a quantitative index used to estimate the energy demand needed to cool a home or business in a given time (typically one year).
Corporate-wide GHG emissions	Corporate-wide emissions account for emissions generated only by local government activities. Corporate emissions are included in the community-wide emissions inventory. Please refer to Appendix C.6 Corporate emissions for more details on the scope and boundaries of the corporate inventory.

1 Eurostat (2025). Glossary: Carbon dioxide equivalent. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Carbon_dioxide_equivalent

2 The GPC requires cities to report, as possible, on the seven sources of GHG emissions currently required for most national GHG inventory reporting under the Kyoto Protocol: carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6), and nitrogen trifluoride (NF3). Toronto currently reports on CO2, CH4 and N2O emissions.

3 World Resources Institute (2021). Global Protocol for Community-Scale Greenhouse Gas Inventories: An Accounting and Reporting Standard for Cities. Version 1.1. Available at: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

Term	Definition
Emission factor	An emission factor is a measure of the mass of GHG emissions (usually expressed in $kgCO_2e$) relative to a unit of activity.
Fossil (natural) gas	Fossil (natural) gas is a naturally occurring gas comprised primarily of methane and other hydrocarbons. It is used as a source of energy for heating, cooking, and used in the production of electricity[4]. In Toronto's sector-based emissions inventory reports up to 2021, emissions related to fossil (natural) gas were reported as emissions from "natural gas".
Gigawatt hour (GWh)	A GWh is a unit of energy representing one billion (10^9) watt hours and is equivalent to one million (10^6) kilowatt hours (kWh). Gigawatt hours are often used as a measure of the output of large electric power stations.
Global Warming Potential (GWP)	GWP measures how much a particular GHG contributes to global warming relative to carbon dioxide (CO_2), which has a GWP of 1. GWP is used to express the mass of other GHGs, like methane (CH_4), as mass of carbon dioxide equivalent (CO_2e) to quantify overall emissions using a common unit. For more details, see Appendix C.1 Global Warming Potential (GWP).
Greenhouse gases (GHGs)	Compound gases that trap heat and emit longwave radiation in the atmosphere causing global warming, also called the greenhouse effect. The three GHGs considered for this inventory are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
Heating Degree Days (HDD)	Heating Degree Days (HDD) is a quantitative index used to estimate the energy demand needed to heat a home or business in a given time (typically one year).
Megatonnes (Mt)	A megatonne, abbreviated as Mt, is a metric unit equivalent to one million (10^6) tonnes or one billion (10^9) kilograms.
Net zero	Occurs when the amount of greenhouse gases released is equivalent to the amount taken out of the atmosphere.
Sector-based emissions inventory	Sector-based emissions inventories measure GHGs attributable to emissions-generating activities taking place within the geographic boundary of the city, as well as some indirect emissions from waste produced in the city, and transmission of electricity into the city boundary in a given time (typically one year). This report presents the community-wide (Toronto-wide) and corporate (City of Toronto government operations) sector-based emissions inventories for 2023.

The values reported annually in Toronto's sector-based emissions inventory report may not match those in previously published inventories. Updates to both current and past datasets occur throughout each year, sometimes after the publication of past inventories. The values reported here are the most up to date as of the publication of this 2023 sector-based emissions inventory. Values may not add up to totals due to rounding.

4 Canada Energy Regulator (2024). Energy Information Program – Glossary: Natural Gas. Available at: https://www.cer-rec.gc.ca/en/data-analysis/glossary/index.html

KEY FINDINGS

In 2023, Toronto's community-wide greenhouse gas (GHG) emissions were 16.1 megatonnes (Mt) of carbon dioxide equivalent (CO_2e), a one per cent increase over the 15.8 $MtCO_2e$ emitted in 2022. Emissions in 2023 were 35 per cent lower than 1990 levels. The sources that contributed the largest percentage of emissions in Toronto were fossil (natural) gas heating in residential buildings and gasoline combustion in passenger vehicles, which represented 26 per cent and 22 per cent of Toronto's community-wide emissions, respectively.

NET ZERO BY 2040

The sector-based emissions inventory is Toronto's main tool for measuring community-wide and corporate-wide progress towards net zero. The 2023 emissions inventory shows that, while overall emissions increased slightly, Toronto reached the lowest level of GHG emissions per capita since records began in 1990 (excluding 2020, an irregular year due to the COVID-19 pandemic). Though there is an overall downward trend in emissions over time by sector (buildings, transportation and waste) since 1990, the pace of emissions reduction will not meet the 2025 or 2030 community-wide targets. A 2.4 $MtCO_2e$ reduction in annual emissions would be required to meet the 2025 target and Toronto is not moving at this pace. This 2.4 $MtCO_2e$ reduction in yearly emissions would be equivalent to removing two thirds (around 730,000) of all gasoline-powered cars from the road[5]. To reach Toronto's future emissions targets (65 per cent reduction from 1990 levels by 2030, and net zero by 2040), bold action is needed across all levels of government, the private sector, and individuals to further reduce GHG emissions. Whether this action is taken in the near term will determine if Toronto can achieve its net zero by 2040 target.

Buildings remained the primary source of GHG emissions in Toronto in 2023 at 8.8 $MtCO_2e$, accounting for 55 per cent of community-wide emissions—decreasing slightly from 9 $MtCO_2e$ (57 per cent) in 2022. The largest source of these emissions was fossil (natural) gas heating in residential buildings, which accounted for 26 per cent of community-wide emissions in 2023. Although there was a seven per cent reduction in fossil (natural) gas emissions from residential buildings in 2023 compared to 2022, these emissions have remained relatively stable since 1990.

5 See Appendix C.4 Community-wide transportation sector for detailed calculations.

Transportation sector emissions continued to be the second largest source of GHG emissions in Toronto at 5.7 $MtCO_2e$, accounting for 36 per cent of community-wide emissions in 2023. This was a slightly higher emissions share than in 2022. These emissions were mostly attributable to gasoline used in passenger cars and trucks, which accounted for 22 per cent of community-wide emissions in 2023. The total emissions from passenger vehicles decreased slightly by 0.3 per cent, even though the total kilometres travelled for these vehicles increased by 1 per cent. For commercial vehicles, while the total kilometres travelled in 2023 rose only one per cent, GHG emissions from these vehicle classes increased 16 per cent.

Waste sector emissions, primarily from landfills, were the third largest source of GHG emissions in Toronto at 1.5 $MtCO_2e$, accounting for roughly 10 per cent of community-wide emissions in 2023. This represented an increase of 13 per cent compared to 2022 and was due to an increase in GHG emissions from Toronto's landfills.

In 2023, the City of Toronto's corporate emissions from City-owned buildings, vehicle fleets and waste were 0.89 $MtCO_2e$, accounting for about six per cent of Toronto's community-wide emissions. Corporate emissions increased four per cent (from 0.85 $MtCO_2e$) since 2022 and were seven per cent below 2008 levels. A concerted effort will be necessary to reach the 2030 target of a 65 per cent reduction in GHG emissions from the 2008 baseline while providing services for a growing population. Corporate emissions were roughly equally distributed across sectors in 2023, including: buildings (38 per cent), transportation (31 per cent), wastewater (27 per cent) and waste (four per cent). Unlike community-wide emissions, the City has more control of its own operations and has put into place policies and processes to catalyze its decarbonization efforts. Supported by these tools, the City aims to reduce its use of fossil (natural) gas to heat buildings operated by the City and the Toronto Community Housing Corporation (TCHC), as well as reduce emissions from its vehicle fleet.

1 BACKGROUND

1.1 Toronto's SBEI

The City's TransformTO Net Zero Strategy (NZS)[6] aims to create a future Toronto that is zero-carbon, equitable, healthy, prosperous, and resilient. To achieve this, the City of Toronto (the City) set an ambitious target to reduce community-wide greenhouse gas (GHG) emissions to net zero by 2040, with interim targets shown in Table 1. These targets are set to meet the global, science-based pathways to achieve the Paris Agreement 1.5°C goal, as determined by the Intergovernmental Panel on Climate Change (IPCC).

The City of Toronto's 2023 sector-based emissions inventory (SBEI) presents the quantity and sources of Toronto's GHG emissions during the year 2023. It tracks the City's progress towards meeting its emission reduction targets. It also informs City-led climate policies, programs and initiatives, such as the Toronto's Carbon Budget[7] and TransformTO NZS. The SBEI provides the main benchmark against which the success of these initiatives and other emission reduction activities can be measured.

This report also fulfils one of the requirements the City has as a Global Covenant of Mayors signatory: the City of Toronto discloses its GHG emissions inventory and its climate mitigation and adaptation actions annually to the Carbon Disclosure Project (CDP) to share Toronto's progress and benchmark against other cities facing similar challenges. Disclosing GHG emissions annually enables the City to be transparent about its progress to reduce GHG emissions. For the sixth year in a row, the City of Toronto was recognized on the 2024 CDP Cities "A" List for its leadership and transparency on climate action[8]. Toronto was one of 112 cities globally to receive an "A" rating out of approximately 750 participating cities.

The City relies on Environment and Climate Change Canada (ECCC)'s National Inventory Report (NIR)[9] as a primary source for emission factors used to calculate GHG emissions (please refer to Appendix C: Methodology for more information). Typically, Environment Canada releases the NIR two years after a given calendar year (for example, the 2023 emission factors were released in 2025). When completing its annual emissions inventory, the City updates its previously reported annual emissions estimates using the latest (revised) emission factors for previous inventory years, as published in the NIR.

[6] City of Toronto (2023). TransformTO 2022 Annual Report: Laying the Foundation for Net Zero. Available at: https://www.toronto.ca/legdocs/mmis/2023/ie/bgrd/backgroundfile-235849.pdf

[7] City of Toronto (2023). Carbon Accountability: Institutionalizing governance, a Carbon Budget and an Offset Credits Policy. Available at: https://www.toronto.ca/legdocs/mmis/2023/ie/bgrd/backgroundfile-235864.pdf

[8] The 2025 CDP Cities "A" List was not released by the publication date of this inventory.

[9] Government of Canada (2025). Canada's official greenhouse gas inventory. Available at: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html

1.2 City-led GHG emissions reduction actions in Toronto

This SBEI provides opportunities to understand the city-wide impacts of individual and collective actions from citizens, businesses, visitors, and all levels of government as we work together in addressing the climate crisis and meeting Toronto's future emission reduction targets, as outlined in the TransformTO NZS. Some of the key drivers of community-wide emissions, with examples of activities undertaken by the City to support, enable, or achieve emissions reductions include:

Fossil (natural) gas use in buildings

Fossil (natural) gas usage for heating buildings is the largest source of Toronto's GHG emissions. The City is working to reduce building emissions through the comprehensive Net Zero Existing Buildings Strategy[10]. This strategy outlines nine key policy actions that the City is taking to accelerate the uptake of retrofits by home and building owners, while maximizing potential benefits and minimizing potential harms to building owners and tenants[11].

GHG emission intensity of electricity

Although electricity consumption in Toronto decreased by two per cent in 2023 compared to 2022, GHG emissions related to electricity use increased by 18 per cent in 2023 as a direct result of increased fossil (natural) gas power generation. When fossil (natural) gas is burned to generate electricity, GHG emissions from electricity use increase. Specifically, the GHG emission intensity of electricity in Ontario—that is, the amount of GHG emissions per unit of electricity generated—increased by 20 per cent from 2022 to 2023. The City cannot directly control how electricity is generated, as this is under provincial jurisdiction. However, the City actively supports, advocates, and partners with the provincial and federal governments to decarbonize the provincial electricity grid, promote energy conservation, and enable local distributed renewable energy generation.

[10] City of Toronto (2021). Net Zero Existing Buildings Strategy. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2021.IE23.1

[11] City of Toronto (2025). Key City Strategies for Net Zero Buildings. Available at: https://www.toronto.ca/services-payments/water-environment/net-zero-homes-buildings/key-city-strategies-for-net-zero-buildings/

Gasoline use in passenger vehicles

Gasoline use for transportation is the second largest source of community-wide GHG emissions. Among other activities, the City is working to expand and improve cycling and pedestrian infrastructure[12,13], including rolling out new and upgrading existing cycling routes[14], installing bicycle parking, and improving Bike Share Toronto[15], the City's bicycle-sharing system. Toronto's Vision Zero Road Safety Plan[16], a comprehensive action plan focused on eliminating traffic-related fatalities and serious injuries on Toronto's streets adopted in 2017 and continually updated[17], is related and complementary to these initiatives. To further address GHG emissions from transportation, the City passed a bylaw in 2023 mandating all vehicles-for-hire (VFH) operating in the city to be zero-emission by 2031[18,19].

Methane emissions from solid waste management

Methane emissions from both operating and closed landfill sites and organics processing facilities (anaerobic digestion facilities) are a key driver of GHG emissions, and some of the largest producers of biogas and landfill gas in Ontario. Toronto's Solid Waste Management Services Division (SWMS) is exploring how to beneficially utilize landfill gas and harnessing the green energy potential of biogas by upgrading it to renewable natural gas (RNG)[20]. RNG produced through biogas upgrading is blended with the fossil (natural) gas that the City buys to create a lower-carbon fuel blend used across the organization to power City vehicles and heat City-owned facilities. Two biogas upgrading facilities are now online at the Dufferin and Disco Road Organic Processing Facilities, with a combined annual RNG output of 6.2 million cubic metres of RNG[21].

[12] City of Toronto (2025). Toronto's Cycling Infrastructure. Available at: https://www.toronto.ca/services-payments/streets-parking-transportation/cycling-in-toronto/torontos-cycling-infrastructure/

[13] City of Toronto (2024). Cycling Network Plan Update 2025-2027. Available at: https://www.toronto.ca/legdocs/mmis/2024/ie/bgrd/backgroundfile-245671.pdf

[14] City of Toronto (2025). 2024 Toronto Cycling Year In Review. Available at: https://www.toronto.ca/wp-content/uploads/2025/04/97a9-2024-Toronto-Cycling-Year-in-Review-FINAL.pdf

[15] Bike Share Toronto (2025). Bike Share Toronto. Available at: https://bikesharetoronto.com/

[16] City of Toronto (2025). Vision Zero Road Safety Plan. Available at: https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/

[17] City of Toronto (2025). Updates on Vision Zero Road Safety Initiatives: Improving Crossings for Pedestrians, Updated Road Classification Criteria and Other Matters. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2025.IE22.4

[18] City of Toronto (2023). Transitioning the Vehicle-for-Hire Industry to Net Zero Emissions by 2030. Available at: https://www.toronto.ca/legdocs/mmis/2023/ec/bgrd/backgroundfile-239119.pdf

[19] There are ongoing policy and emissions modelling efforts at the City of Toronto examining the efficacy of zero-emission vehicle (ZEV) policies on reducing community-wide GHG emissions, including the federal Light-Duty Zero Emission Vehicle Mandate. Modelling efforts will help inform future policy decisions at the municipal level related to ZEVs. Further information on the City's climate-related modelling is available at: https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/local-emissions-for-net-zero-modelling-suite/

[20] City of Toronto (2025). Turning Waste into Renewable Natural Gas. Available at: https://www.toronto.ca/services-payments/recycling-organics-garbage/solid-waste-facilities/renewable-natural-gas/

[21] The City of Toronto used 157 million cubic metres of fossil (natural) gas in 2023.

The City of Toronto, like other municipal governments across Ontario, has limited tools to reduce GHG emissions generated within Toronto's territorial boundary (see **Figure 1**). Approximately six per cent of GHG emissions are the direct result of the City of Toronto government operations (see Section 3.1 for further details). Corporate emissions include those from City-owned buildings, vehicle fleets, and—to a certain extent—municipal waste and wastewater management[22]. The City is working to reduce its corporate emissions through established programs and major policy achievements[23] such as:

- The Corporate Real Estate Management (CREM) Net Zero Carbon Plan[24] for City-owned buildings
- Enhancing sustainable[25] and circular[26] procurement policies
- Greening City[27] and Toronto Transit Commission (TTC) fleets[28] through the Sustainable City of Toronto Fleets Plan[29]
- Application of the Toronto Green Standard Version 4 for City buildings
  - Since 2022, the Toronto Green Standard has mandated that all new City-owned buildings be net zero[31].
  - The City's first net zero community recreation facility, the Rouge Valley Community Recreation & Child Care Centre, opened in October 2025[30]. The building's leading-edge design uses innovative strategies to eliminate the use of fossil fuels, reduce overall energy consumption, and incorporate on-site renewable energy systems. This building is fully electricity powered through a mix of solar photovoltaic panels on its roof and facade, as well as a parking lot canopy.
- Implementing the Single-use and Takeaway Items Reduction Strategy, including amendments to the Single-Use and Takeaway Items Bylaw[32].

[22] While the City has control over waste and wastewater operations and infrastructure in public facilities, emissions from these sources are also connected to the volume and composition of waste and wastewater produced by the community, which cannot be directly controlled by the City.
[23] City of Toronto (2024). Toronto's Climate Change Readiness: Updates on commitments and a refreshed mandate for coordinating resilience activities. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2024.IE12.3
[24] City of Toronto (2021). City of Toronto Real Estate Portfolio Net Zero Carbon Plan. Available at: https://www.toronto.ca/wp-content/uploads/2022/09/9624-City-of-Toronto-Corporate-Real-Estate-Management-Net-Zero-Carbon-Plan-September-2022.pdf
[25] City of Toronto (2024). Procurement Policy Updates resulting from amendments to Toronto Municipal Code, Chapter 195, Procurement. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2024.GG12.18
[26] City of Toronto (2018). Circular Economy Procurement Implementation Plan and Framework. Available at: https://www.toronto.ca/legdocs/mmis/2018/gm/bgrd/backgroundfile-115664.pdf
[27] City of Toronto (2023). The Sustainable City of Toronto Fleets Plan (2023 Update and Status Report). Available at: https://secure.toronto.ca/council/agenda-item.do?item=2023.IE3.5
[28] Toronto Transit Commission (2025). TTC Green Initiatives. Available at: https://www.ttc.ca/riding-the-ttc/TTC-Green-Initiatives/
[29] City of Toronto (2023). Sustainable City of Toronto Fleets Plan. Available at: https://www.toronto.ca/legdocs/mmis/2023/ie/bgrd/backgroundfile-235807.pdf
[30] City of Toronto (2025). Rouge Valley Community Recreation & Child Care Centre. Available at: https://www.toronto.ca/city-government/planning-development/construction-new-facilities/new-parks-facilities/rouge-valley-crc-child-care/
[31] City of Toronto (2025). Toronto Green Standard Version 4 - City Agency, Corporation & Division-Owned Facilities. Available at: https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/city-agency-corporation-division-owned-facilities-version-4/
[32] City of Toronto (2024). Update on Stage 2 of the Single-Use and Takeaway Items Reduction Strategy. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2024.IE13.6

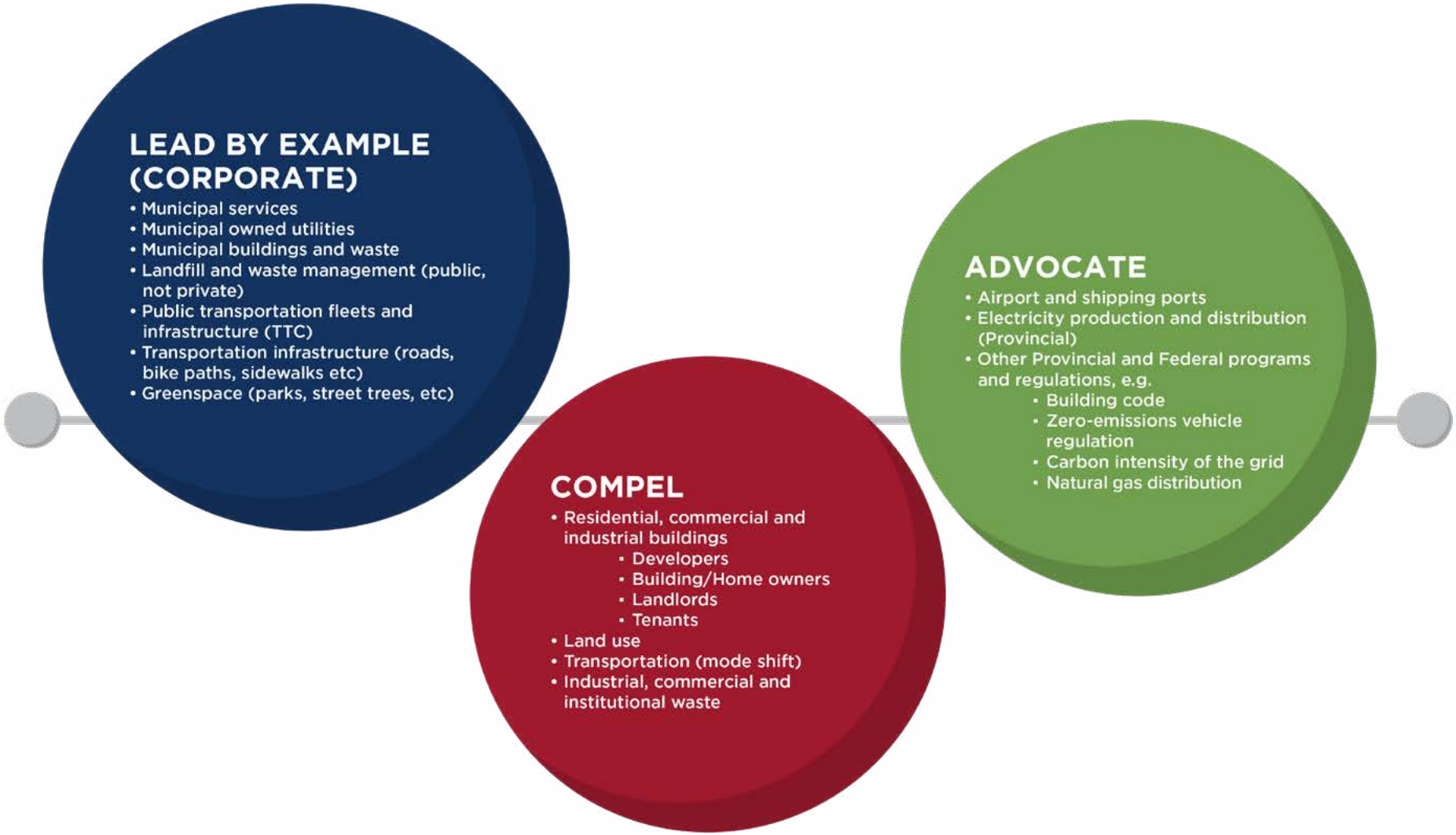


Figure 1: Understanding the City's authority, influence and advocacy related to GHG emissions sources

1.3 Overarching issue: Increasing electricity generation emissions in Ontario

Electricity generation is outside of municipal control and is under provincial jurisdiction (see **Figure 1**). Electricity generation directly impacts emissions associated with activities that rely on electricity use in the city. Ontario's electricity is supplied by nuclear, fossil (natural) gas, hydroelectricity (hydro) and renewable (such as solar and wind) sources. Most of the electricity produced in Ontario is generated at nuclear and hydro plants, which produce low levels of GHG emissions. However, since 2021, the amount of fossil (natural) gas used to generate electricity has increased considerably due to declining nuclear output during refurbishment periods and growing electricity demand that cannot yet be fully met by low-carbon sources. As a direct result, GHG emissions from electricity usage have increased in Toronto. In 2023, fossil (natural) gas accounted for 12.8 per cent of all electricity generated in Ontario; in contrast, fossil (natural) gas accounted for 10.4 and 8.6 per cent in 2022 and 2021, respectively[33]. As a result, while annual electricity usage in Toronto decreased by two per cent in 2023 compared to 2022, GHG emissions from Toronto's electricity usage increased by 18 per cent—an increase explained by the higher reliance in fossil (natural) gas for electricity generation[34].

An example of increasing fossil (natural) gas electricity generation is the Portlands Energy Centre (PEC), the only fossil (natural) gas electrical generating station in Toronto. PEC's electricity generation increased from 1,623 GWh in 2022 to 2,156 GWh in 2023, a 33 per cent year-over-year increase and more than double the average yearly output of 1,000 GWh for the 2010-2019 period[35]. As a result, the GHG emissions from this facility increased 32 per cent year over year, from 613 $ktCO_2e$ in 2022 to 808 $ktCO_2e$ in 2023[36].

Photo Credit: Ryan Walker & Vid Ingelevics

[33] Independent Electricity System Operator (2025). IESO Year-End Data. Available at: https://ieso.ca/corporate-ieso/media/year-end-data

[34] Environment and Climate Change Canada (2025). Canada's Official Greenhouse Gas Inventory – Annex 13 - Electricity in Canada: Summary And Intensity Tables. Available at: https://data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/C-Tables-Electricity-Canada-Provinces-Territories/?lang=en, Table A13-7: Electricity Generation and GHG Emission Details for Ontario

[35] Generation output based on data from the Independent Electricity System Operator of Ontario (IESO). Available at: https://ieso.ca/en/Power-Data/Data-Directory

[36] GHG emission data for the Portlands Energy Centre (PEC) is available through Canada's National Pollutant Release Inventory (NPRI) at: https://climate-change.canada.ca/facility-emissions/GHGRP-G10413-2023.html

Looking to the future, the GHG emission intensity of electricity generated in Ontario is projected to increase further this decade because of greater fossil (natural) gas use at fossil (natural) gas electricity generating stations throughout the province[37]. It is important that Toronto be aware that since electricity emissions will likely increase alongside usage (through strategies such as fuel switching to electricity for space heating and vehicle power) given the increasing GHG emission intensity of electricity in Ontario, emission mitigation efforts from reduced fossil fuel use may be partially undermined. The Net Zero Strategy asserts that the backbone of a net zero Toronto must be an efficient, emissions-free electricity grid. This will help address the demands of an increasing population and increasing electricity consumption while remaining a stable, reliable power source during extreme weather events[38]. With this objective in mind, Toronto has established direction on municipal renewable energy programs[39] that will increase local renewable energy generation to contribute to a resilient, carbon-free grid, including:

- Working with Toronto's local utility, Toronto Hydro, to increase the number of and ease of installing solar and battery storage projects on City-owned lands[40], reducing demand for grid-supplied electricity;
- Encouraging and facilitating larger scale heat exchange projects that harness alternative heating and cooling sources[41].
- Developing corporate standards for solar and battery storage installation on City assets, frameworks to facilitate renewable thermal energy infrastructure under City land assets, and heat exchange infrastructure on the Lake Ontario lakebed.

[37] Toronto Atmospheric Fund (2024). Ontario Electricity Emissions Factors and Guidelines. Available at: https://taf.ca/publications/ontario-electricity-emissions-factors-2024/
[38] City of Toronto (2025). TransformTO Net Zero Strategy: 2024 Annual Report on Implementation Progress. Available at: https://www.toronto.ca/legdocs/mmis/2025/ie/bgrd/backgroundfile-255754.pdf
[39] City of Toronto (2023). Update: City Renewable Energy Programs. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2023.IE9.7
[40] See Toronto Hydro Climate Action: 2023 Year-End Status Report, page 11: https://www.torontohydro.com/documents/20143/193303016/climate-action-2023-year-end-status-report.pdf
[41] Including the City's first renewable energy district, the Etobicoke Civic Center Project, in collaboration with Enwave (https://www.toronto.ca/legdocs/mmis/2023/ie/bgrd/backgroundfile-240803.pdf) and first wastewater energy project, in collaboration with Noventa Energy Partners (https://secure.toronto.ca/council/agenda-item.do?item=2022.MM47.61)

2 CITY OF TORONTO CORPORATE EMISSIONS

2.1 Status of Toronto's GHG emissions and progress to targets

Figure 2 shows that community-wide emissions have decreased since 1990 and that the City achieved its 2020 emissions reduction target. However, community-wide emissions in Toronto have increased every year since 2021 as economic activity bounced back following the COVID-19 pandemic. The City's 2025 target of a 45 per cent emissions reduction from 1990 levels is not feasible given the current emissions level and the required mitigation trajectory over time. A 2.4 $MtCO_2e$ reduction in annual emissions would be required to achieve the 2025 target, which equates to removing 66 per cent (around 730,000) of gasoline-powered cars from the road. In the context of buildings, switching all fossil (natural) gas-heated single-family homes in Toronto in 2023 (just over 500,000) from fossil (natural) gas furnaces to electric heat pumps would only partially achieve the level of mitigation required to achieve Toronto's 2025 target[42]. The scale of these changes has not materialized as of the publication of this report in late 2025, putting Toronto's 2025 emissions reduction target out of reach.

[42] See Appendix C.3 Community-wide buildings sector for detailed calculations.

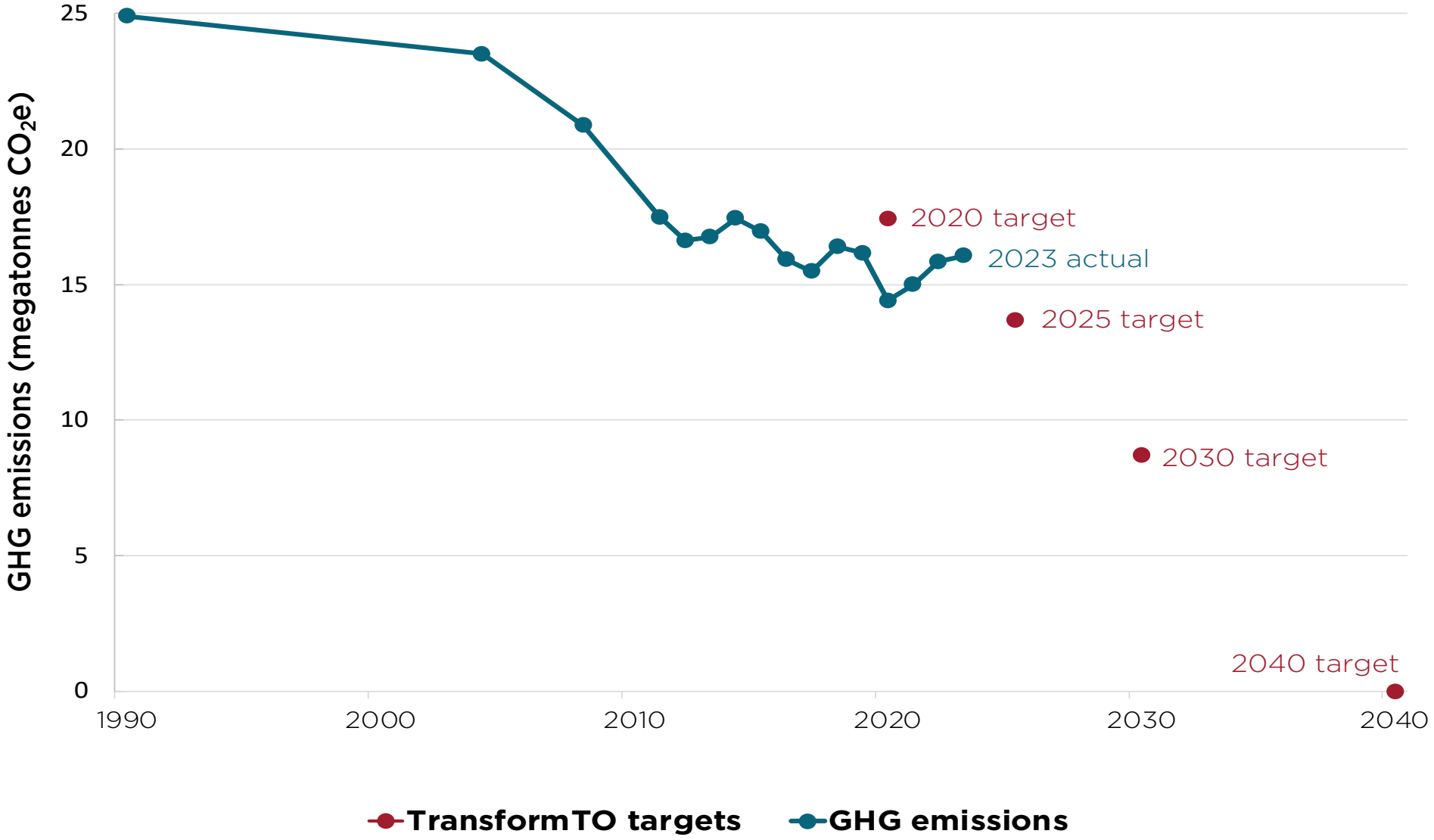


Figure 2: Toronto's GHG emissions and Council-approved GHG emissions targets

Table 1 displays the Council-adopted community-wide GHG emission targets and the City's emission reduction progress as of 2023. Toronto needs to cut its annual community-wide emissions by roughly 7.3 $MtCO_2e$ to meet the City's 2030 target of a 65 per cent emissions reduction below 1990 levels.

Table 1: Council-adopted community-wide GHG emissions targets and 2023 status

Year	Percentage GHG reduction target from 1990 baseline	Absolute GHG emissions target ($MtCO_2e$)[a]	Progress as of 2023
2020	30 per cent	17.4 $MtCO_2e$	The City achieved its 2020 GHG reduction target. In 2020[b], Toronto's community-wide emissions were 14.4 $MtCO_2e$, which is 42 per cent lower than in 1990.
2023	N/A	N/A	In 2023, Toronto's community-wide emissions were 16.1 $MtCO_2e$, which is a one per cent increase from 2022. This remains below the 2020 reduction target and is 35 per cent lower than 1990.
2025	45 per cent	13.7 $MtCO_2e$	To reach this target, annual emissions need to be reduced by 2.4 $MtCO_2e$ from 2023 levels. This target will not be achieved given the current pace of emissions reductions as compared to the required trajectory.
2030	65 per cent	8.7 $MtCO_2e$	Toronto must reduce annual emissions by about 7.3 $MtCO_2e$ from 2023 levels to meet its 2030 target. Toronto's annual emissions must be rapidly reduced to make significant progress towards this target. Based on 2023 emissions, an average annual reduction of 1 $MtCO_2e$ would be needed between 2024-2030.
2040	Net zero	Net zero	16.1 $MtCO_2e$ in annual emissions must be eliminated to meet the 2040 target. Whether action is taken in the near-term will determine if Toronto can achieve this target.

Notes:

a Emissions target calculated relative to 1990 baseline emissions of 24.9 $MtCO_2e$.

b Although 2020 was an irregular year due to the COVID-19 pandemic, note that the City's 2019 community-wide GHG emissions were 35 per cent lower than 1990 levels, achieving the 30 per cent reduction target set for 2020 one year early.

2.2 Population, economic growth, and GHG emissions

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

Decoupling is defined by the IPCC as economic growth which is no longer linked to the consumption of fossil fuels[43]. Starting in 2016, Toronto's Gross Domestic Product (GDP, an indicator of overall economic activity) and population began to grow at a faster rate than GHG emissions. This is called relative decoupling, where both economic growth and emissions increase but at different rates, with GDP rising at a faster rate than GHG emissions[44]. Absolute decoupling is reached when economic growth increases while overall GHG emissions decrease, with the two becoming independent of each other[45]. For Toronto to become an economically prosperous, net zero city, economic growth must decouple from GHG emissions in absolute terms, as reflected in the City's net zero targets which require overall reductions in emissions regardless of Toronto's economic and population growth.

Figure 3 shows the trends in Toronto's GHG emissions (total and per capita), energy use, population, and GDP over time since 2008. In 2023, most of these indicators increased, with GDP and population growth having the most significant increases, and energy use and GHG emissions per capita decreasing compared to 2022. The increase in population and GDP in 2023 (five and six per cent over 2022 levels, respectively) was higher than the yearly increase in GHG emissions (one per cent), indicating that Toronto is following a relative decoupling trend. Notably, GHG emissions per capita decreased three per cent from 5.3 tCO_2e/person in 2022 to 5.1 tCO_2e/person in 2023. This indicates that, despite providing more services and infrastructure for a growing population, GHG emission reduction efforts in Toronto are helping to mitigate the growth rate of GHG emissions. Notably, 2023 was the year with lowest levels of GHG emissions per capita in Toronto for all years where GHG emission estimates are available—excluding 2020, an irregular year due to the COVID-19 pandemic—with GHG emissions per capita being 51 per cent lower than 1990 levels (10.5 tCO_2e/person).

[43] IPCC (2018). Annex I: Glossary. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Available at: https://doi.org/10.1017/9781009157940.008.

[44] Ibid.

[45] Ibid.

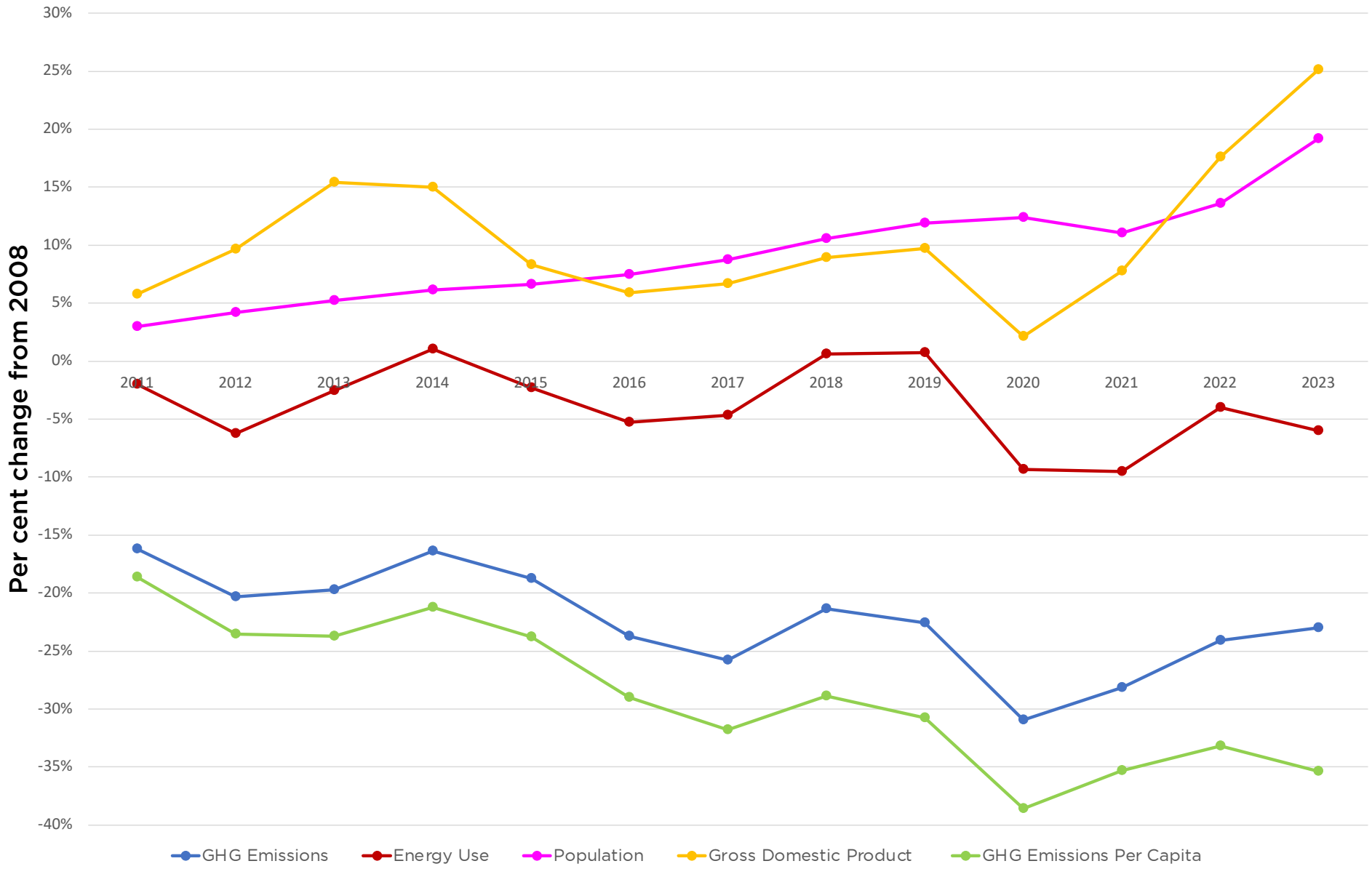


Figure 3: Energy, GHG emissions, and economic indicators (per cent change from 2008 baseline)

2.3 Sector-level findings summary

Figure 4 presents the proportion each sector contributed to total annual emissions in 2023, while **Figure 5** shows the year-over-year changes in sectoral emissions from 1990 to 2023.

- **Buildings:** In 2023, buildings sector emissions were 8.8 $MtCO_2e$, representing 55 per cent of overall community-wide emissions. Most of those emissions were attributable to fossil (natural) gas used for space and water heating. This represents a decrease from the 9 $MtCO_2e$ emissions from buildings in 2022. This reduction in emissions was likely due to lower cooling and heating demands in 2023 compared to 2022 (please refer to Appendix D: Heating and cooling degree days).
- **Transportation:** Transportation emissions accounted for 36 per cent of overall community-wide emissions, with most of those emissions coming from gasoline used in passenger cars and light trucks.
- **Waste:** Waste sector emissions, which include emissions from landfills, organics and yard waste processing, and wastewater treatment processes, were just under 10 per cent of overall community-wide emissions.

More details on GHG emissions by sector are provided in Section 2.5.

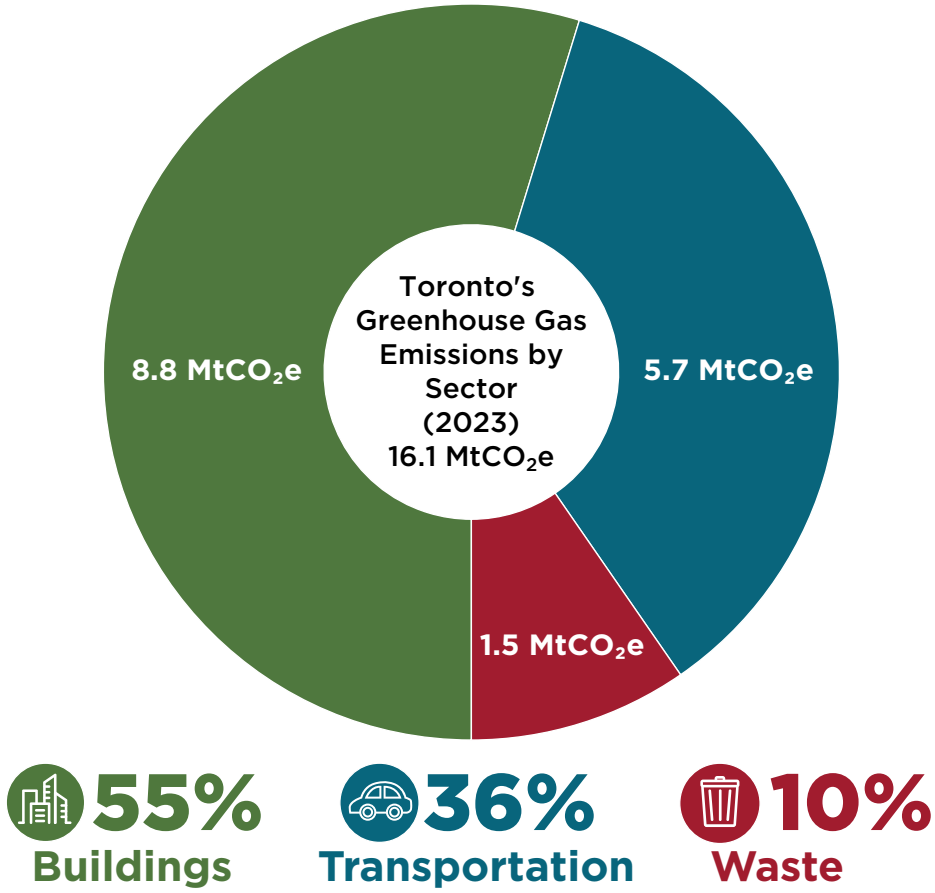


Figure 4: Toronto's percentage breakdown of community-wide GHG emissions by sector (2023)

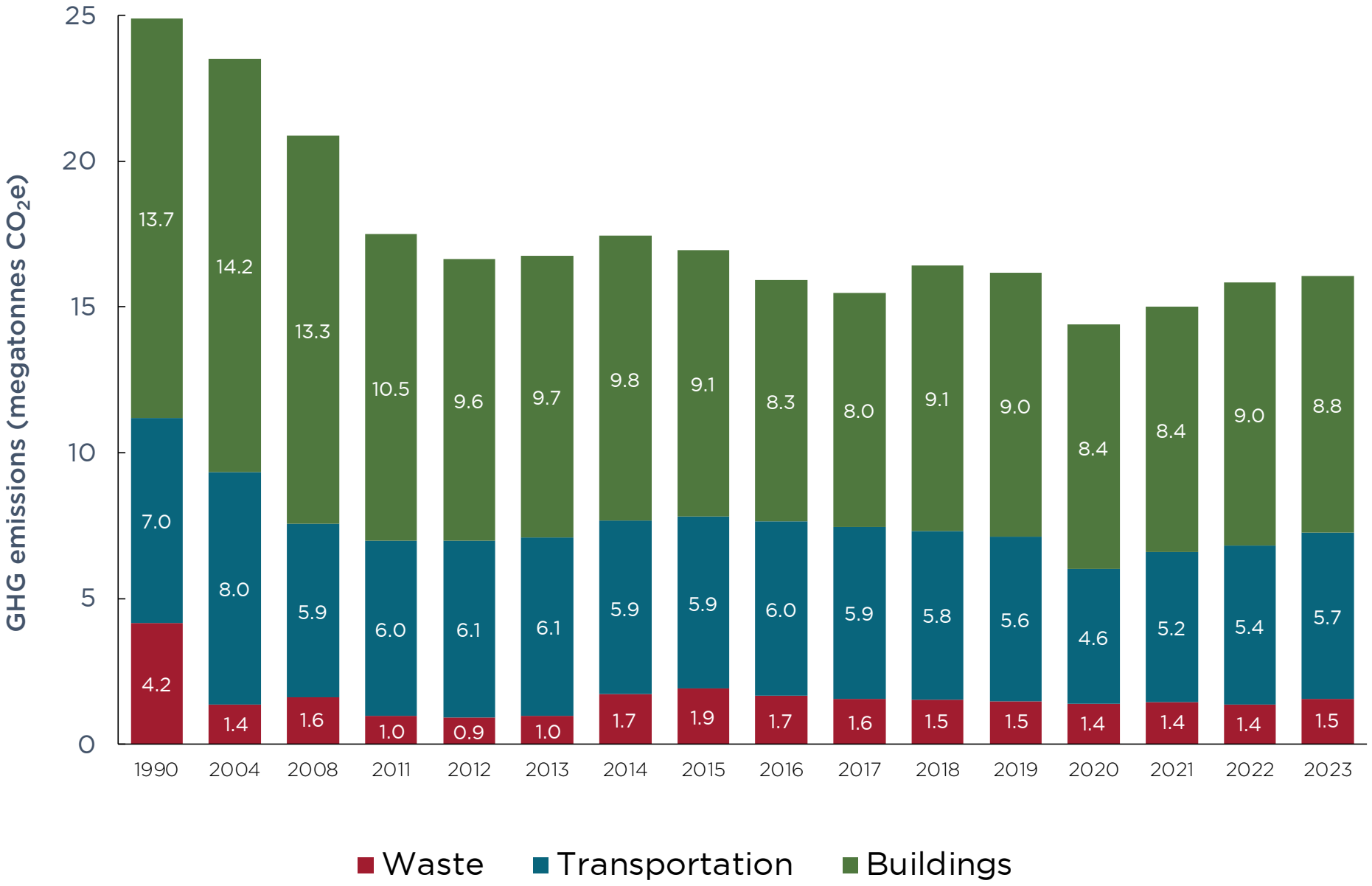


Figure 5: Toronto's year-over-year community-wide GHG emissions by sector

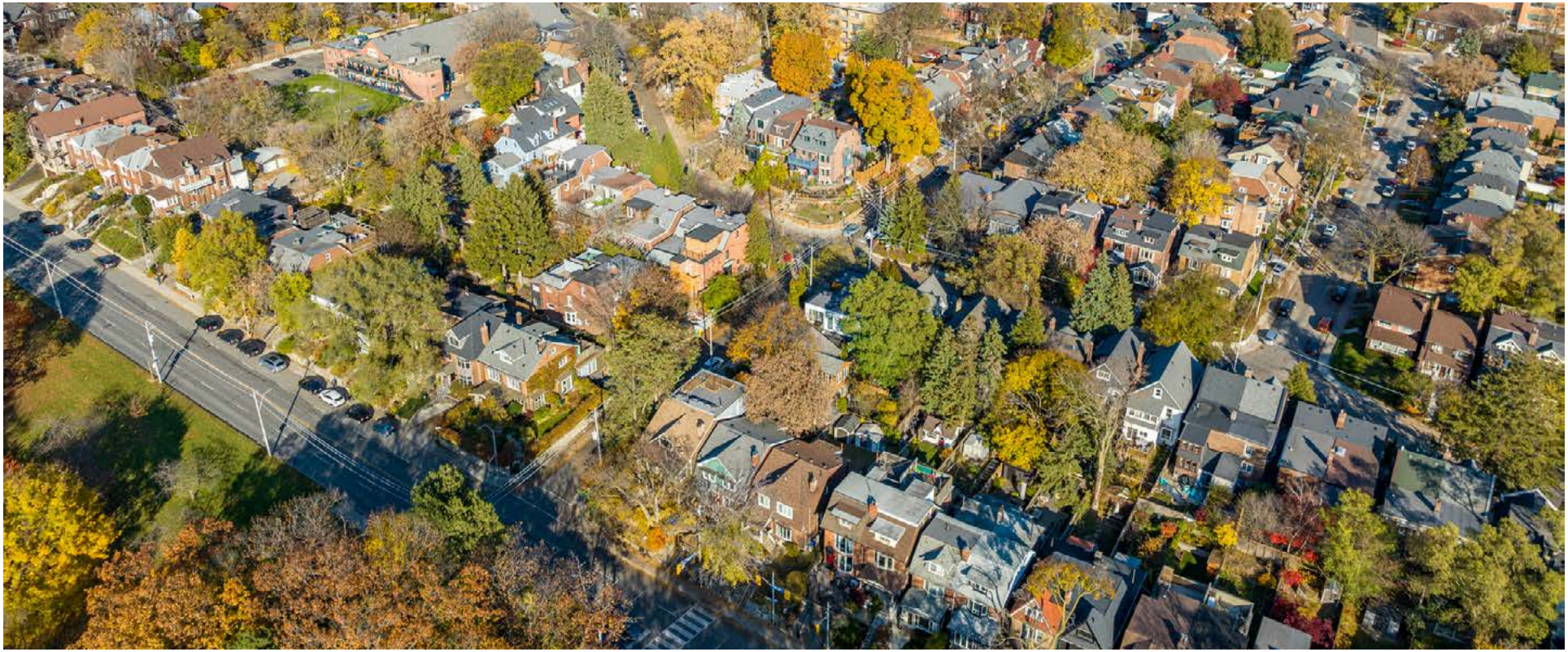


Figure 6 presents a Sankey diagram, a data visualisation tool that illustrates the proportion of GHG emissions by sector (left column of the diagram) and source (middle and right columns). The thickness of each coloured link shown flowing from left to right is proportional to the quantity of GHG emissions represented. Thicker links indicate more emissions, while thinner links indicate less emissions. Reading the diagram from the left side, Toronto's total community-wide GHG emissions (16.06 $MtCO_2e$) are divided into the sectors of buildings, transportation and waste (left column). Moving to the center column, each sector's emissions are then shown by their component categories; for example, buildings is divided into commercial, industrial, and residential, the three categories of buildings included in the inventory. In the right column, these categories are further divided into specific emissions sources; to continue our example for buildings, the emissions sources are electricity and fossil (natural) gas. Individually, fossil (natural) gas heating in residential buildings (4.18 $MtCO_2e$) and gasoline combustion in passenger vehicles (3.60 $MtCO_2e$) contributed the largest percentage of emissions to the community-wide emissions total. Residential fossil (natural) gas use represents 26 per cent of Toronto's sector-based emissions, while gasoline use in passenger vehicles accounts for 22 per cent. The Sankey diagram (**Figure 6**) helps visualize the large scale of emissions associated with two basic daily activities many people carry out, heating homes with fossil (natural) gas and getting around the city in a gasoline-fueled car.

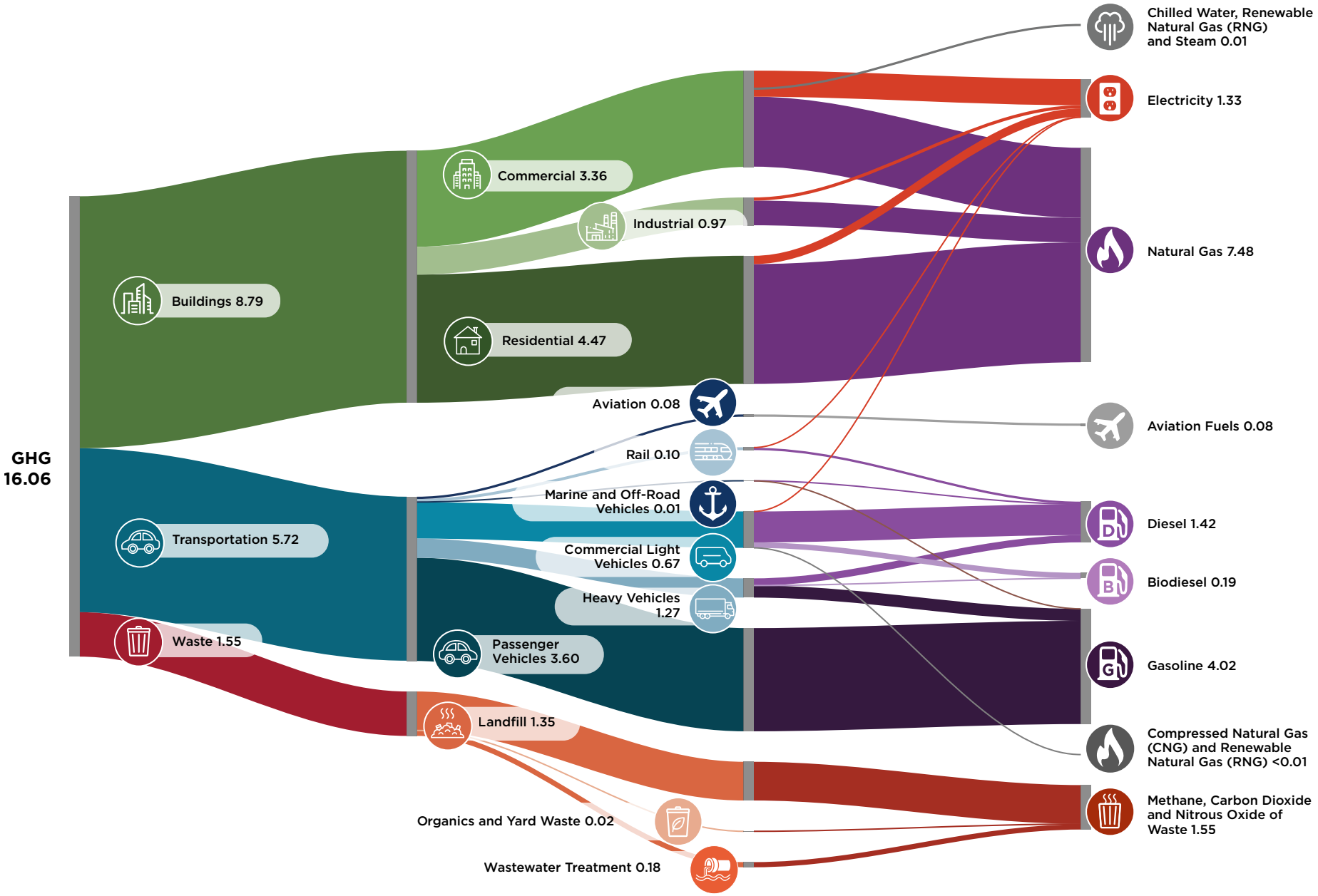
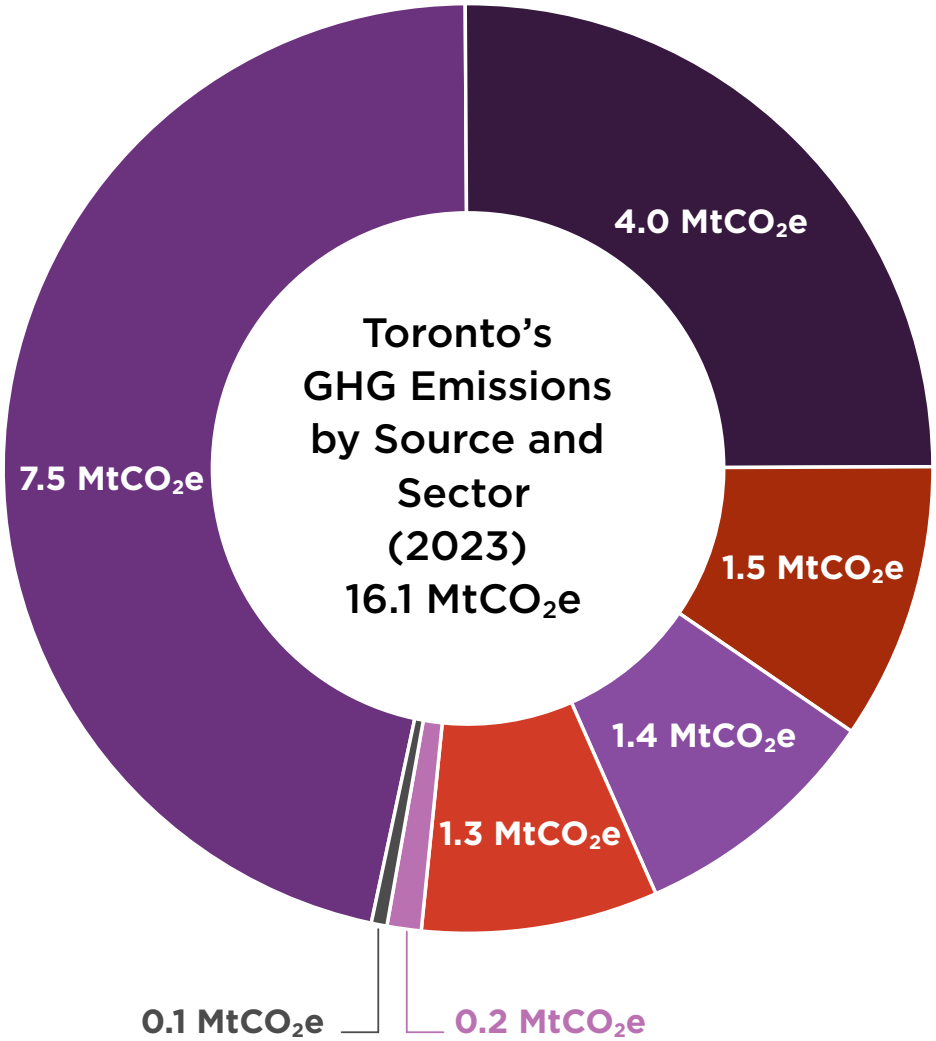


Figure 6: Sankey diagram of Toronto's community-wide emissions ($MtCO_2e$) by sector and emissions source (2023)

2.4 Key drivers of community-wide GHG emissions

Toronto's community-wide emissions are driven by several main sources, as shown in **Figure 7**.



47%
Fossil (Natural) Gas (Buildings)

25%
Gasoline (Transportation)

10%
Methane, Carbon Dioxide and Nitrous Oxide (Waste)

9%
Diesel (Transportation)

8%
Electricity (Buildings and Transportation)

1%
Biodiesel (Transportation)

0.5%
Other (Aviation, Chilled Water, RNG, Steam, CNG & Propane)

Figure 7: Key drivers of community-wide GHG emissions (2023) expressed in $MtCO_2e$ and per cent of total emissions

The key drivers of community-wide emissions include:

1. **Fossil (natural) gas**. Fossil (natural) gas consumption to heat buildings continued to be the largest source of community-wide GHG emissions in 2023 at 7.5 $MtCO_2e$, accounting for 47 per cent of all emissions. This was five per cent lower than 2022. Fluctuations in fossil (natural) gas and electricity consumption are sensitive to weather conditions, with more fossil (natural) gas used to heat homes and buildings during colder winters and more electricity used to cool these spaces during hotter summers. The decrease in fossil (natural) gas use in 2023 was likely due to a warmer winter than the previous year, translating into less fossil (natural) gas use for heating and less emissions from this source.
2. **Gasoline.** Gasoline used for transportation across all vehicle types was the second largest source of GHG emissions in Toronto, accounting for 4 $MtCO_2e$ (25 per cent) of GHG emissions community-wide, a slight increase of 0.3 per cent in GHG emissions from gasoline compared to 2022. The majority (around 90 per cent) of gasoline-related GHG emissions in Toronto come from passenger vehicles and light trucks.
3. **Methane, carbon dioxide, and nitrous oxide (CH_4, CO_2 & N_2O) from waste.** Waste emissions from methane, carbon dioxide and nitrous oxide were 1.5 $MtCO_2e$ in 2023, making up just under 10 per cent of total community-wide emissions. Waste emissions increased 13 per cent from 2022 to 2023 due to higher emissions from landfills across the city. Most methane emissions not associated with fossil (natural) gas consumption originate from City-managed landfills, both closed and operating, where any uncaptured methane gas is released to the atmosphere through the soil landfill cap. The City's open and largest closed landfills operate continuous landfill gas collection and flaring systems that destroy methane, significantly reducing emissions. Wastewater treatment accounted for 176 $ktCO_2e$ (11 per cent of all waste-related emissions), while organics and yard waste processing accounted for an additional 20 $ktCO_2e$ (one per cent of all waste emissions). Further discussion of the nature of these waste emissions, which are not related to burning fossil fuels for energy production, is provided in Section 2.5.3.
4. **Diesel.** Diesel use for transportation accounted for 1.4 $MtCO_2e$ of emissions in 2023, or nine per cent of community-wide emissions. The majority (1.3 $MtCO_2e$) of these emissions were from commercial light and heavy diesel-fuelled trucks travelling on Toronto's roads.
5. **Electricity.** Emissions from electricity consumption accounted for 1.3 $MtCO_2e$ in 2023, increasing by 18 per cent even though there was a two per cent decrease in electricity usage for buildings in 2023 compared to 2022 (see Section 2.5.1, **Table 3**). This was due to the provincial power grid using more fossil (natural) gas to generate electricity than in 2022, considerably increasing the emissions per unit of electricity delivered to Toronto customers.
6. **Biodiesel from corporate transportation.** The City tracks biodiesel use in corporate vehicles including TTC buses, on- and off-road vehicles, and marine vessels. Biodiesel use by privately owned vehicles is not included in the emissions inventory. Corporate biodiesel use accounted for 0.2 $MtCO_2e$ (one per cent of community-wide emissions) in 2023. Over 99 per cent of these emissions came from TTC buses, which have replaced diesel fuel use with biodiesel as part of TTC's sustainability initiatives.

7. **Other.** Other sources of emissions in Toronto, including aviation fuels, chilled water, RNG, steam, compressed natural gas (CNG) and propane, accounted for 0.1 $MtCO_2e$ or 0.5 per cent of community-wide emissions. Aviation fuel emissions reported in the inventory are limited to fuel in airplanes filled at Billy Bishop Toronto City Airport on Toronto Island. Note that this amount is an overestimate, as a portion of the fuel used in airplanes leaving the airport is consumed outside the City of Toronto's municipal boundaries[46]. Apart from aviation fuels, emissions sources in this category reflect only corporate (City of Toronto government) use, as data on community-wide use of RNG, steam, CNG and propane is not available. Finally, note that this inventory does not currently account for emissions from fossil-fuel powered off-road or small engine equipment. The City is currently developing a strategy to transition towards zero-emission outdoor power equipment[47].

Further details on key drivers of Toronto's GHG emissions, described in the context of their respective emissions sectors, are provided in Section 2.5.

[46] Aviation fuel use at Toronto Pearson International Airport is discussed in Section 2.5.2.
[47] City of Toronto (2025). Transitioning Towards Zero-Emission Outdoor Power Equipment. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2025.IE21.4

2.5 Details on GHG emissions by sector

As shown in **Figure 8**, overall emissions in Toronto have declined since 1990. In 2023, GHG emissions in the city were 35 per cent lower than the 1990 baseline. Yearly GHG emissions increased one per cent from 2022, when total emissions were 36 per cent lower than 1990 levels. Though there is an overall downward trend in emissions over time by sector (buildings, transportation and waste[48]) since 1990 (see **Figure 8**), the pace of emissions reduction will not meet the 2025 or 2030 community-wide targets. Annual emissions need to be reduced by 2.4 $MtCO_2e$ (compared to 2023 levels) to reach the 2025 target of 13.7 $MtCO_2e$. A 2.4 $MtCO_2e$ reduction in yearly emissions equates to removing 66 per cent (around 730,000) of all gas-powered cars in Toronto from the road. Given the required rapid pace and scale of change required to meet the 2025 emissions target of a 45 per cent reduction, and the knowledge that policy and programmatic interventions occurring during the 2024 and 2025 years are still in in the process of being implemented, Toronto's emissions reductions will not meet the 2025 goal. Keeping in mind that the 2030 emissions target (65 per cent reduction) is only five years beyond the 2025 target, Toronto would need to decrease its annual emissions by around 1 $MtCO_2e$ per year on average between 2024 and 2030 to achieve its 2030 objective.

[48] Annual waste emissions decreased substantially from 1990 to 2004. This was largely because methane emissions from landfill waste naturally decrease over time once landfills close, and three of the City's four landfills closed during this time period (Brock West, Beare Road and Thackeray Landfills). At the landfill that was open in 1990 and remained open through 2004 (Keele Valley Landfill), methane collection systems were enhanced to increase the methane collection rate from 23 to 73 per cent, reducing its annual emissions by 2004. The City's current landfill, Green Lane Landfill, was acquired in 2008.

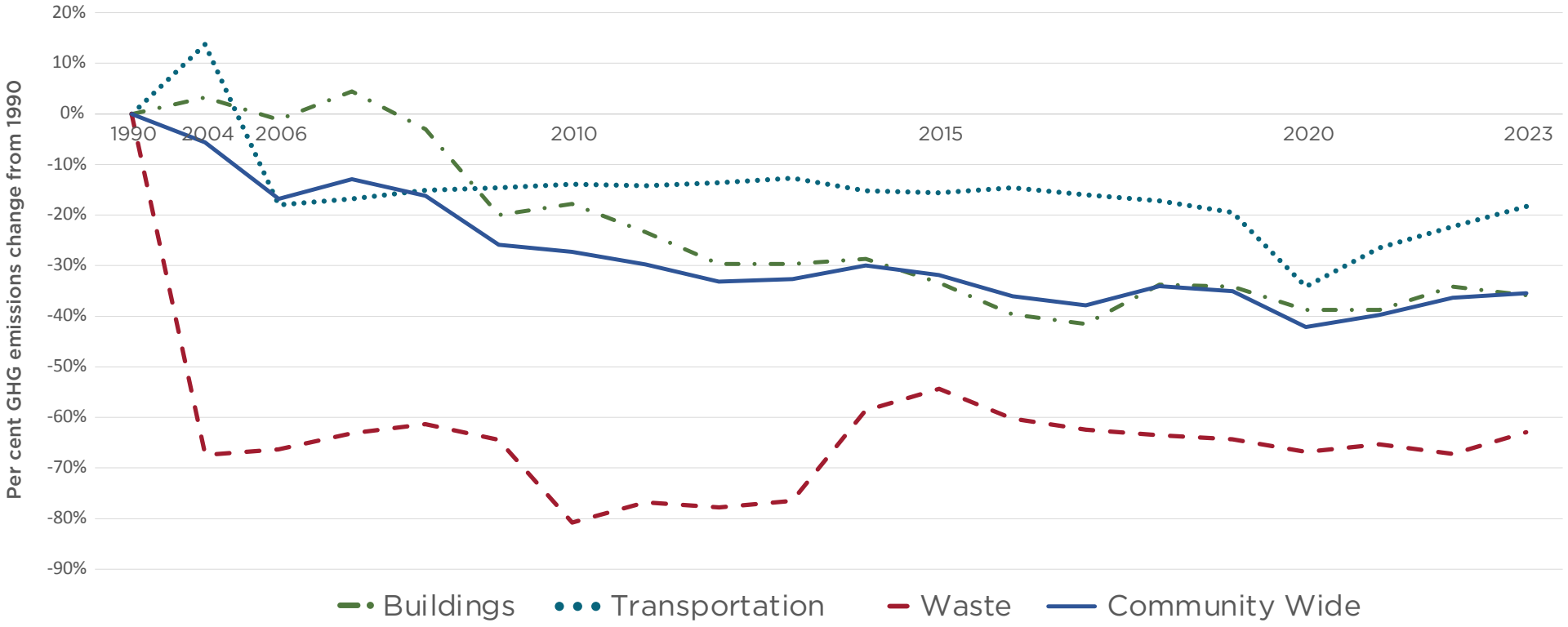


Figure 8: Annual per cent change in emissions by sector relative to 1990 baseline

City of Toronto emissions monitoring and action planning through modelling

To monitor and project near-term emissions reduction progress in support of its TransformTO Net Zero Strategy, the City of Toronto has developed LENZ (Local Emissions for Net Zero), an open-source suite of energy system and GHG emissions modelling tools[49]. The suite is designed to model action plans to support deep decarbonization across all sectors and achieving net-zero emissions by 2040. LENZ enables the City to test and evaluate various climate policies and actions, as well as assess their associated financial feasibility. LENZ can model net-zero pathways and optimizes the cost of energy technologies and fuels for activities like building heating and lighting, transportation, and waste processing. By using LENZ to simulate different actions (such as building retrofit implementation, bikeshare program, or electric bus adoption) and scenarios (such as business-as-usual, or net-zero by 2040), the City can make informed decisions about its climate and energy-related policies, and adjust its strategies as needed to achieve its emissions goals.

[49] City of Toronto (2023). Local Emissions for Net Zero Modelling Suite. Available at: https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/local-emissions-for-net-zero-modelling-suite/

2.5.1 Buildings

In 2023, GHG emissions from residential, commercial and industrial buildings accounted for approximately 8.8 $MtCO_2e$ of Toronto's total inventory, making buildings the largest source of emissions at roughly 55 per cent of community-wide emissions. In 2022, building emissions were 9 $MtCO_2e$ and accounted for 57 per cent of community-wide emissions.

Figure 9 breaks down the emissions contribution of each building type for 2023: residential (51 per cent), commercial and institutional (38 per cent), and industrial[50] (11 per cent). **Figure 10** shows the proportion of building emissions from the two main energy forms—electricity and fossil (natural) gas—and how this proportion has changed over time, by building type, from 1990 to 2023. While the trend in overall emissions is decreasing over time, this is largely due to a decrease in commercial and industrial electricity emissions and fossil (natural) gas usage.

Figure 10 shows that the largest source of emissions, residential fossil (natural) gas usage, has remained relatively stable since 1990.

Figure 11 highlights the large proportion of building GHG emissions that come from fossil (natural) gas. Residential fossil (natural) gas usage accounted for 26 per cent of community-wide emissions. In 2023, emissions from fossil (natural) gas in buildings (7.5 $MtCO_2e$) were approximately six times greater than emissions from electricity (1.3 $MtCO_2e$). Further, the proportion of fossil (natural) gas emissions from single-family homes was higher than from multi-unit residential buildings (MURB), at 56 per cent (single-family) compared to 44 per cent (multi-unit residential).

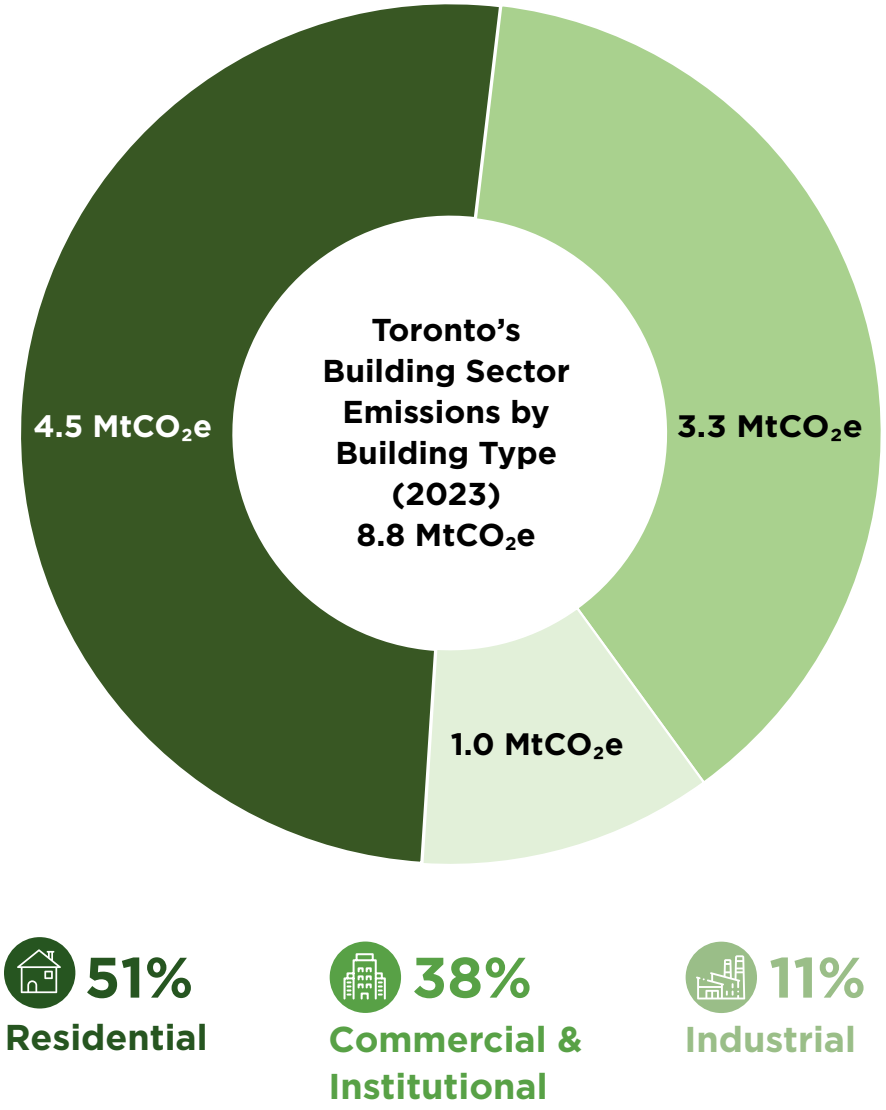


Figure 9: Percentage breakdown of GHG emissions by building type (2023)

[50] Industrial emissions include emissions from heating and cooling industrial buildings.

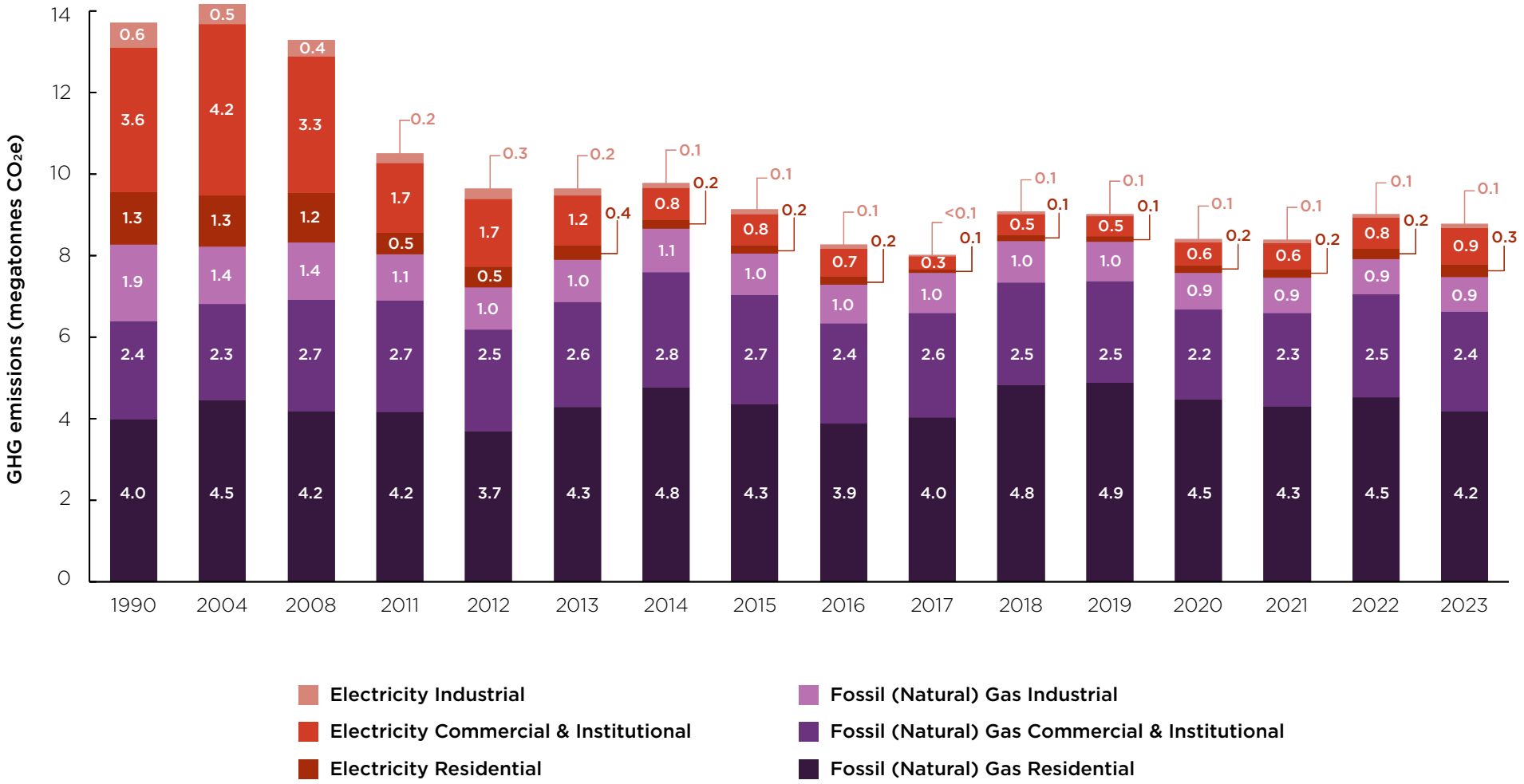


Figure 10: Buildings GHG emissions by energy form from 1990 to 2023

Relative to 2022, residential buildings' fossil (natural) gas consumption in 2023 decreased by seven per cent, while industrial buildings' fossil (natural) gas usage decreased by one per cent, and commercial and institutional fossil (natural) gas usage decreased by three per cent (**Table 2**). This decrease in fossil (natural) gas consumption was likely due to warmer winter weather, which decreased the demand for space heating. For more information on how weather affects fluctuations in fossil (natural) gas consumption, please refer to Appendix D: Heating and cooling degree days. Aside from weather conditions, changes in fossil (natural) gas consumption may have also been partly driven by improved building efficiency, though more data would be needed to confirm whether measures to enhance building performance affected total fossil (natural) gas use in 2023.

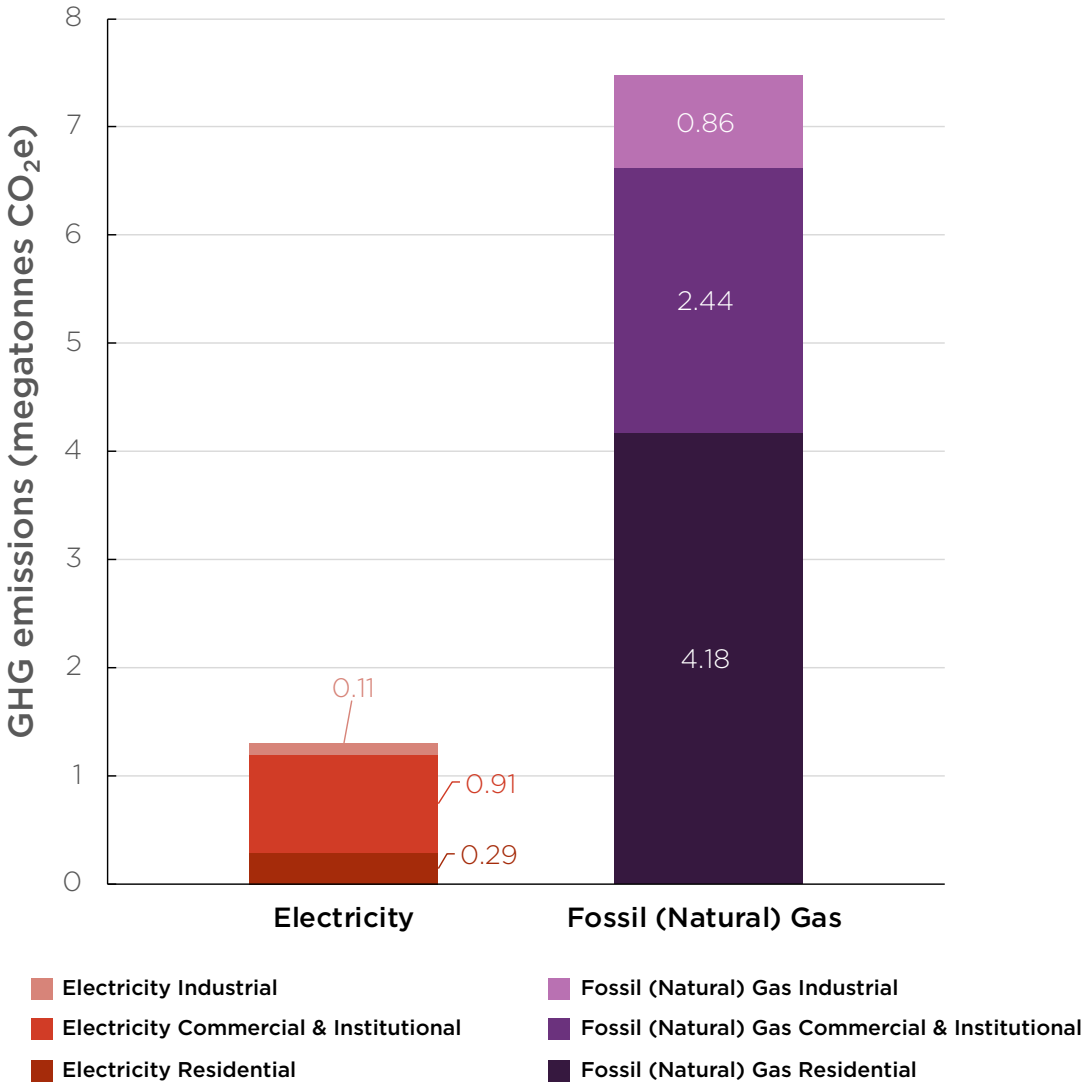


Figure 11: Buildings GHG emissions by energy form (2023)

Table 2: Fossil (natural) gas consumption by building type (2022 to 2023)

Building type	Fossil (natural) gas (millions m^3)		Per cent change
	2022	2023	
Residential	2,336	2,162	-7.5%
Commercial & institutional	1,307	1,263	-3.4%
Industrial	450	446	-0.9%
Total (all building types)	4,093	3,871	-5.4%

Electricity consumption in buildings in Toronto has not changed much in recent years. As shown in **Table 3**, residential electricity usage in 2023 decreased by three per cent from 2022 to 2023. Commercial & institutional and industrial electricity usage decreased by one per cent and two per cent, respectively.

Table 3: Electricity consumption by building type (2022 to 2023)

Building Category	Electricity (GWh)		Per cent change
	2022	2023	
Residential	5,536	5,373	-2.9%
Commercial & institutional	17,100	16,899	-1.2%
Industrial	2,011	1,971	-2.0%
Total (all building types)	24,647	24,242	-1.6%

2.5.2 Transportation

Transportation emissions in 2023 were approximately 5.7 $MtCO_2e$, accounting for 36 per cent of community-wide GHG emissions. As shown in **Figure 12**, on-road vehicle emissions from passenger vehicles, commercial light vehicles and heavy vehicles dominated the emissions profile, accounting for 97 per cent of all transportation emissions. Although the GHG emissions from passenger vehicles decreased slightly by around 12 $ktCO_2e$ in 2023 (0.3 per cent less compared to 2022), gasoline-powered passenger vehicles remain the largest contributor of transportation emissions (63 per cent), and account for 22 per cent of total community-wide emissions. Included in passenger vehicles are vehicles-for-hire (VFH) which encompasses taxicabs, limousines, and private transportation companies such as Lyft and Uber. VFH are estimated to contribute four to six per cent of total transportation emissions in Toronto[51].

From an energy source perspective, gasoline consumption for transportation across all vehicle types included in the inventory accounted for 4 $MtCO_2e$ (25 per cent) of community-wide emissions. This was followed by diesel consumption for transportation, which resulted in 1.4 $MtCO_2e$ (nine per cent) of community-wide GHG emissions.

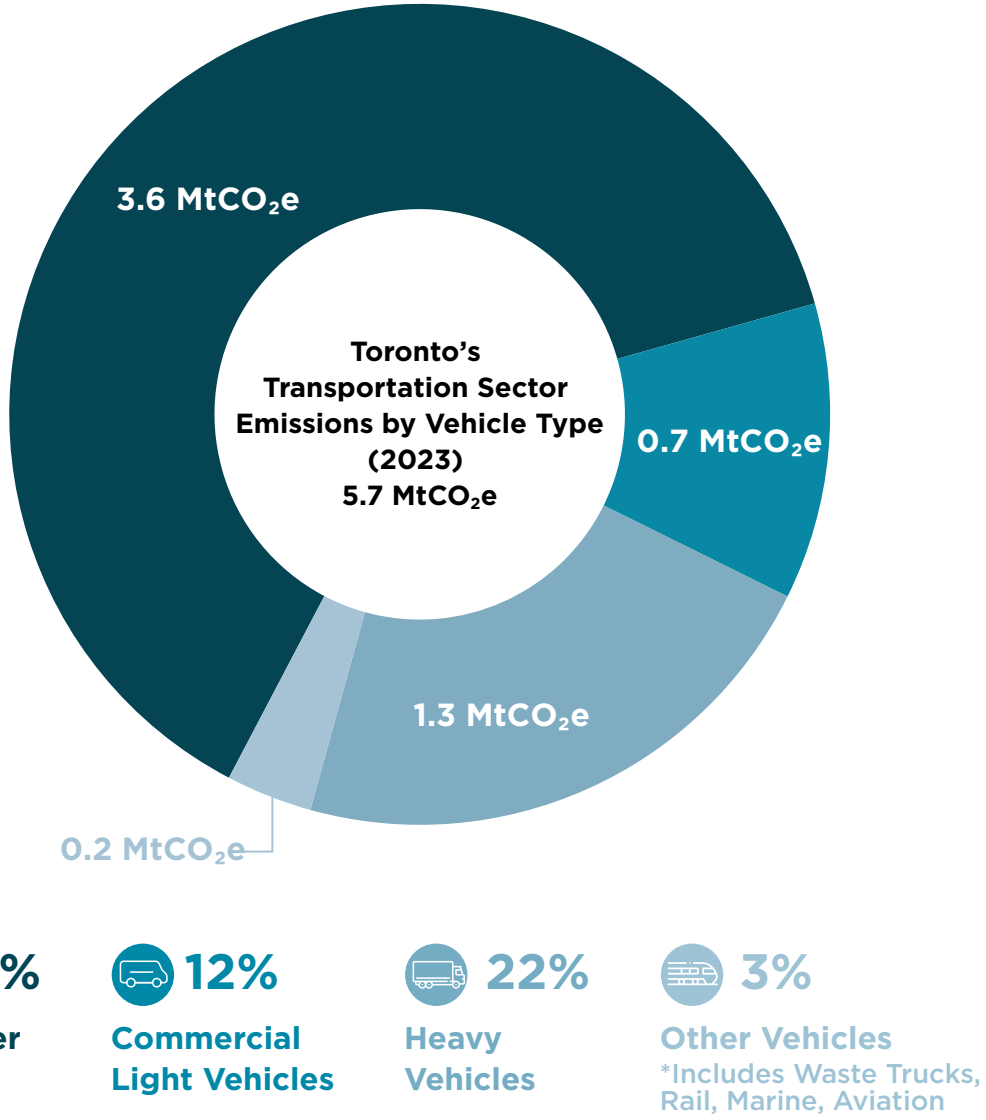


Figure 12: Percentage of GHG emissions by vehicle type (2023)

[51] City of Toronto (2023). Transitioning the Vehicle-for-Hire Industry to Net Zero Emissions by 2030. Available at: https://www.toronto.ca/legdocs/mmis/2023/ec/bgrd/backgroundfile-239119.pdf

Other vehicles

In **Figure 12**, the "Other Vehicles" category includes TTC rail emissions from electricity used to power streetcars and subways. TTC rail emissions accounted for only 18 $ktCO_2e$, or 0.3 per cent of all transportation emissions, making TTC subways and streetcars an almost "emissions-free" public transit mode. Also in this category are the GO and UP commuter rail diesel emissions within the city boundary, which resulted in 77 $ktCO_2e$, or 1.4 per cent of total transportation emissions. Marine emissions reporting in the inventory was limited and captured only the fuel used by the City's marine fleet (such as the Toronto Island Ferry, Toronto Police, Emergency Medical Services (EMS), and Fire vessels), totalling around 1 $ktCO_2e$, or 0.02 per cent of all transportation emissions. Similarly, emissions from aviation included only aviation fuel used to fill aircraft at Billy Bishop Toronto City Airport on Toronto Island, which accounted for 77 $ktCO_2e$, or 1.4 per cent of total transportation emissions. Note that the aviation fuel emissions value is an overestimate, as a portion of the fuel in airplanes leaving the airport is burned outside municipal boundaries.

Transportation emissions excluded from inventory

Emissions associated with Toronto residents' extensive air travel to and from Toronto Pearson International Airport were not captured in this inventory due to constraints in acquiring data. Note that while this airport is located outside of Toronto's city boundaries, some of the fuel consumed by airplanes leaving and arriving to Pearson airport is burned within municipal boundaries. The emissions from marine vessels associated with cargo transport and personal use were also not captured due to data availability limitations.

Estimating transportation emissions

The City employs a transportation emissions model, created by the University of Toronto, to simulate traffic in the city and estimate its associated emissions[52]. As presented in **Figure 13**, the model shows that the amount of Vehicle Kilometres Travelled (VKT) for passenger vehicles[53] increased from 2006 until 2019, decreased in 2020 due to COVID-19 travel restrictions, and have increased every year since. Before the COVID-19 pandemic in 2020, passenger vehicle emissions were decreasing, especially from 2013 to 2019, despite increasing VKT. The emission savings during that period primarily reflect improvements in vehicle fuel efficiency and a gradual uptake of electric vehicles (EVs) in Toronto[54]. Both VKT and passenger vehicle transportation emissions decreased substantially in 2020 due to pandemic-related travel restrictions and public health measures. Upon the COVID-19 restrictions being lifted, VKT and emissions began to rise in 2021 but remained below 2019 levels. In 2023, VKT from passenger vehicles increased by 1.4 per cent, while GHG emissions from these vehicles decreased slightly by 12 $ktCO_2e$ (0.3 per cent).

Similarly, the VKT and associated emissions from commercial and heavy vehicles[55] were stable from 2006 to 2019, followed by COVID-19 pandemic-related declines in 2020, and subsequent increases beginning in 2021. In 2023, commercial and heavy vehicle VKT rose slightly at 1.4 per cent, but emissions from these vehicle classes increased considerably by 270 $ktCO_2e$ (16 per cent). Note that this increase is partially due to recent methodological improvements for GHG emission accounting of commercial and heavy vehicle use in the University of Toronto's model.

[52] Note that the model does not estimate vehicle kilometres traveled for electric vehicles (EVs) separately at this time.
[53] In Figure 13, "passenger vehicles" includes cars and light trucks fueled by gasoline.
[54] The number of registered passenger electric vehicles in Toronto increased from 19,374 vehicles in 2022 to 27,336 vehicles in 2023 (41 per cent increase). However, the total number of registered passenger EVs in Toronto remained quite low (2.5 per cent of registered passenger vehicles) in 2023. Data available through the Ministry of Transportation of Ontario: https://data.ontario.ca/dataset/electric-vehicles-in-ontario-by-forward-sortation-area
[55] In Figure 13, "commercial and heavy vehicles" includes a mix of gasoline- and diesel-fueled vehicles.

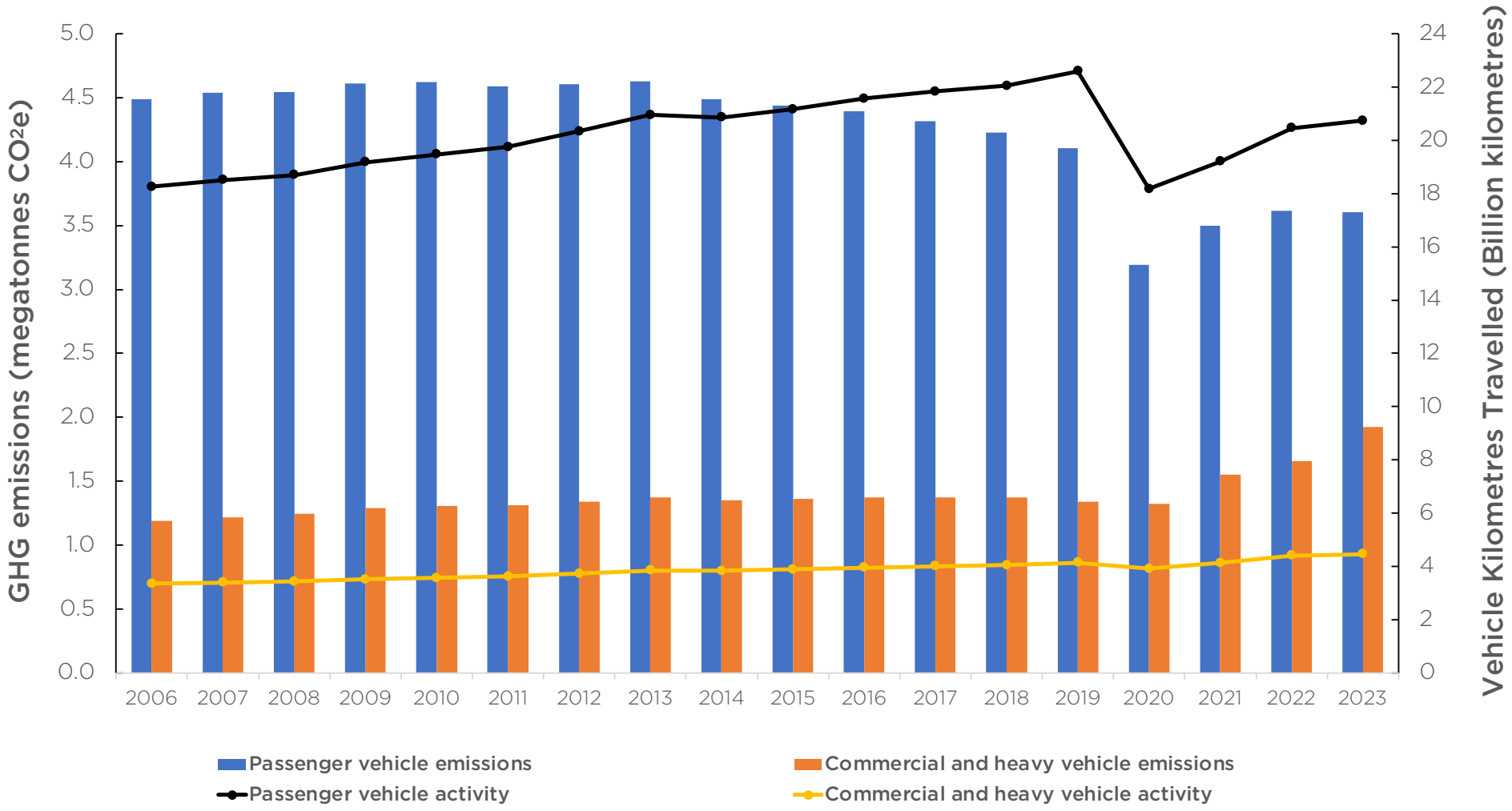


Figure 13: Annual GHG emissions from on-road transportation and associated Vehicle Kilometres Travelled (VKT)

2.5.3 Waste

Community-wide waste emissions account for emissions from landfills, organics processing, and yard waste processing facilities, as well as wastewater treatment. Waste emissions in 2023 were approximately 1.5 $MtCO_2e$, or just under 10 per cent of community-wide GHG emissions—a considerably smaller share than the emissions from the buildings and transportation sectors. GHG emissions from waste in 2023 were about 180 $ktCO_2e$ (13 per cent) higher than 2022 due to higher emissions from landfills. Community-wide waste emissions in 2023 were 63 per cent lower than in 1990. Roughly 1.35 $MtCO_2e$ (87 per cent of emissions from the waste sector) were landfill emissions, which include emissions estimated from waste disposal in both public and private landfills. The remaining waste emissions are composed of 0.18 $MtCO_2e$ from wastewater treatment processes (11 per cent of waste emissions), and 0.02 $MtCO_2e$ from organics and yard waste (one per cent of waste emissions)[56].

Estimated emissions from landfills are composed of methane, nitrous oxide, and carbon dioxide emissions, and capture GHGs originating from reported landfills, open and closed, within and outside the city's boundary. Please refer to Appendix C.5 Community-wide waste sector for more information on how the City calculates waste emissions.

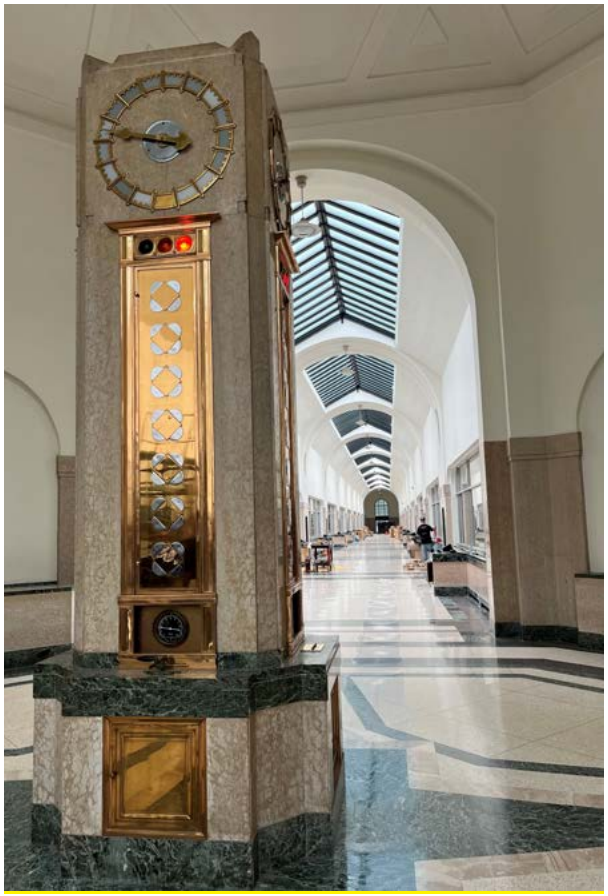
[56] Percentages may not add up to 100 per cent due to rounding.

3 CITY OF TORONTO CORPORATE EMISSIONS

3.1 Status of corporate emissions and progress to targets

The City of Toronto's corporate (or local government) emissions are calculated based on the following sources:

- Energy used in all municipal buildings including offices, community recreation centres, Toronto Community Housing Corporation (TCHC) housing, and city infrastructure such as streetlights,
- Fuel used in vehicle fleets (including TTC public transit vehicles),
- Waste, water supply and wastewater treatment processes.



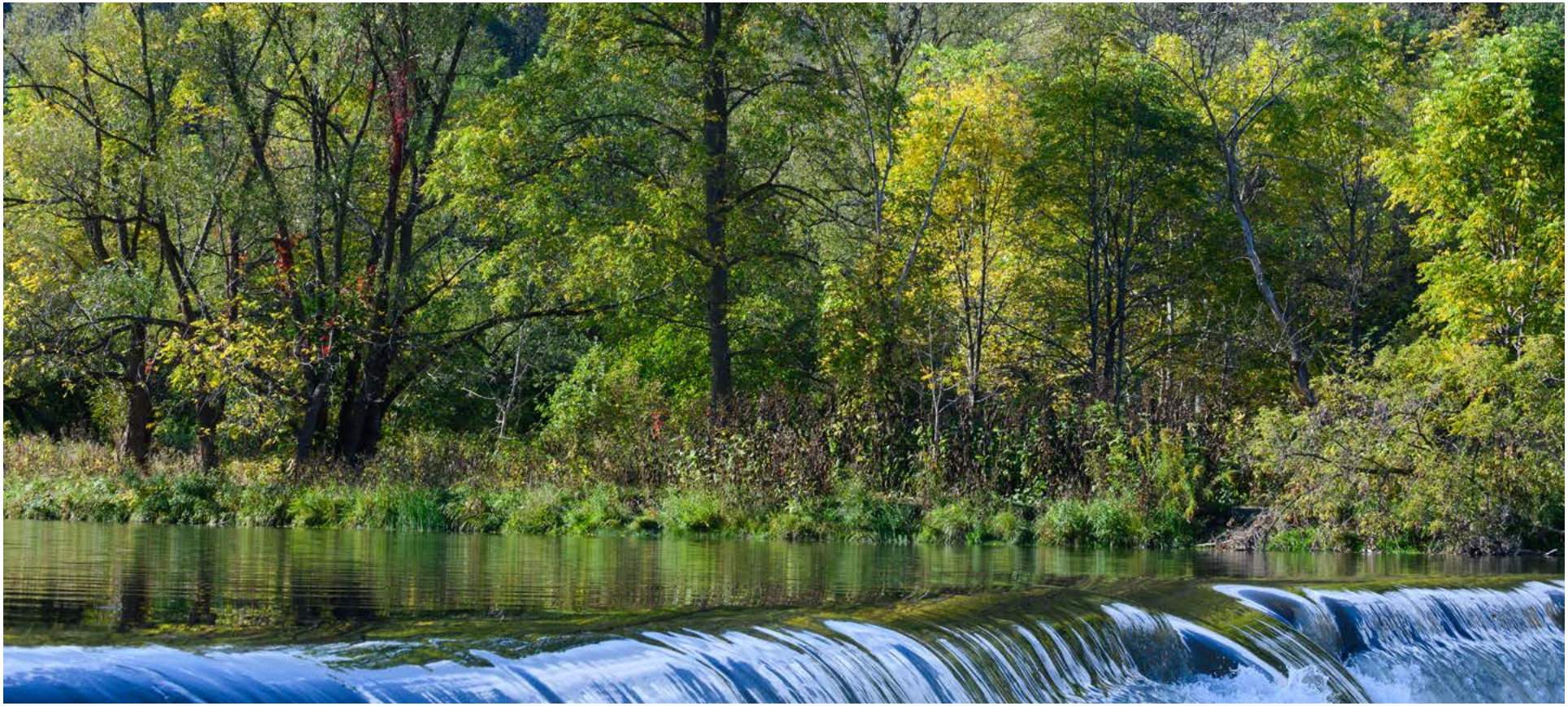
In 2023, corporate emissions were 0.89 $MtCO_2e$ (six per cent of Toronto's community-wide emissions). The City's corporate emissions increased four per cent from 2022 and remained a stable share of community-wide emissions between 2022 and 2023.

The City's corporate GHG emissions reduction target is a 65 per cent reduction from a 2008 baseline by 2030, followed by net zero by 2040[57]. In 2023, corporate emissions were only seven per cent below 2008 levels and are not trending downward over time. To reach its 2030 corporate emissions target, the City is using tools such as a corporate carbon budget[58,59] to more actively manage its own emissions. Although GHG emissions are roughly equal across the buildings, transportation and water & wastewater sectors, the City has existing policies and processes enabling immediate action to reduce buildings and transportation emissions. Supported by policies such as the Net Zero Carbon Plan[60,61] and the Sustainable City of Toronto Fleets Plan[62], the City is developing more specific plans in alignment with the corporate carbon budget process to reduce its use of fossil fuels for

[57] City of Toronto (2021). TransformTO - Critical Steps for Net Zero by 2040. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2021.IE26.16
[58] City of Toronto (2023). Carbon Accountability: Institutionalizing Governance, a Carbon Budget and an Offset Credits Policy. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2023.IE3.4
[59] City of Toronto (2025). 2025 Capital/Operating Budget Briefing Note – Carbon Budget. Available at: https://www.toronto.ca/legdocs/mmis/2025/bu/bgrd/backgroundfile-252125.pdf
[60] City of Toronto (2021). Building Net Zero Emissions City Buildings - Corporate Real Estate Management's Net Zero Carbon Plan. Available at: https://secure.toronto.ca/council/agenda-item.do?item=2021.IE23.2
[61] City of Toronto (2022). City of Toronto Real Estate Portfolio Net Zero Carbon Plan. Available at: https://www.toronto.ca/wp-content/uploads/2022/09/9624-City-of-Toronto-Corporate-Real-Estate-Management-Net-Zero-Carbon-Plan-September-2022.pdf
[62] City of Toronto (2023). Sustainable City of Toronto Fleets Plan. Available at: https://www.toronto.ca/wp-content/uploads/2023/05/8f83-Sustainable-City-of-Toronto-Fleets-Plan.pdf

heating City- or TCHC-owned buildings with fossil (natural) gas and powering fleet vehicles with diesel and gasoline.

Though waste and wastewater treatment are significant emissions sources[63], these sectors differ from the buildings and transportation sectors in that their emissions do not result from burning fossil fuels, but as a by-product of waste and wastewater treatment processes at landfills, organic waste processing facilities, and wastewater treatment facilities. These emissions are known as "process emissions" (direct greenhouse gas emissions resulting from the biological treatment of waste and wastewater), they make up the majority of waste and wastewater emissions, and do not have an equivalent source in the buildings or transportation sectors. Process emissions in these sectors are not driven by fossil fuel use for energy production as in the buildings and transportation sectors, and consequently, measures to mitigate process emissions are likewise different than those to reduce buildings and transportation emissions.



[63] Water and wastewater emissions increased since the 2022 inventory for all years after 2019 due to an emissions estimation methodology change at Toronto's wastewater treatment plants, resulting in an increase in the reported process emissions estimate. Further detail is provided in Section 3.2.1.

3.2 Key drivers of corporate GHG emissions

Figure 14 shows the breakdown of corporate emissions by sector in 2023. Buildings, the largest source of corporate emissions, accounted for 38 per cent, followed by transportation emissions at 31 per cent, water & wastewater emissions[64] at 27 per cent, and waste emissions at four per cent. **Figure 15** shows that 2023 corporate emissions have been trending upwards since 2020 and have now surpassed pre-pandemic levels, with corporate emissions in 2023 being two per cent higher than in 2019. However, corporate GHG emissions per capita decreased slightly (5 per cent) over the same period, from 0.3 tCO_2e/person in 2019 to 0.28 tCO_2e/person in 2023.

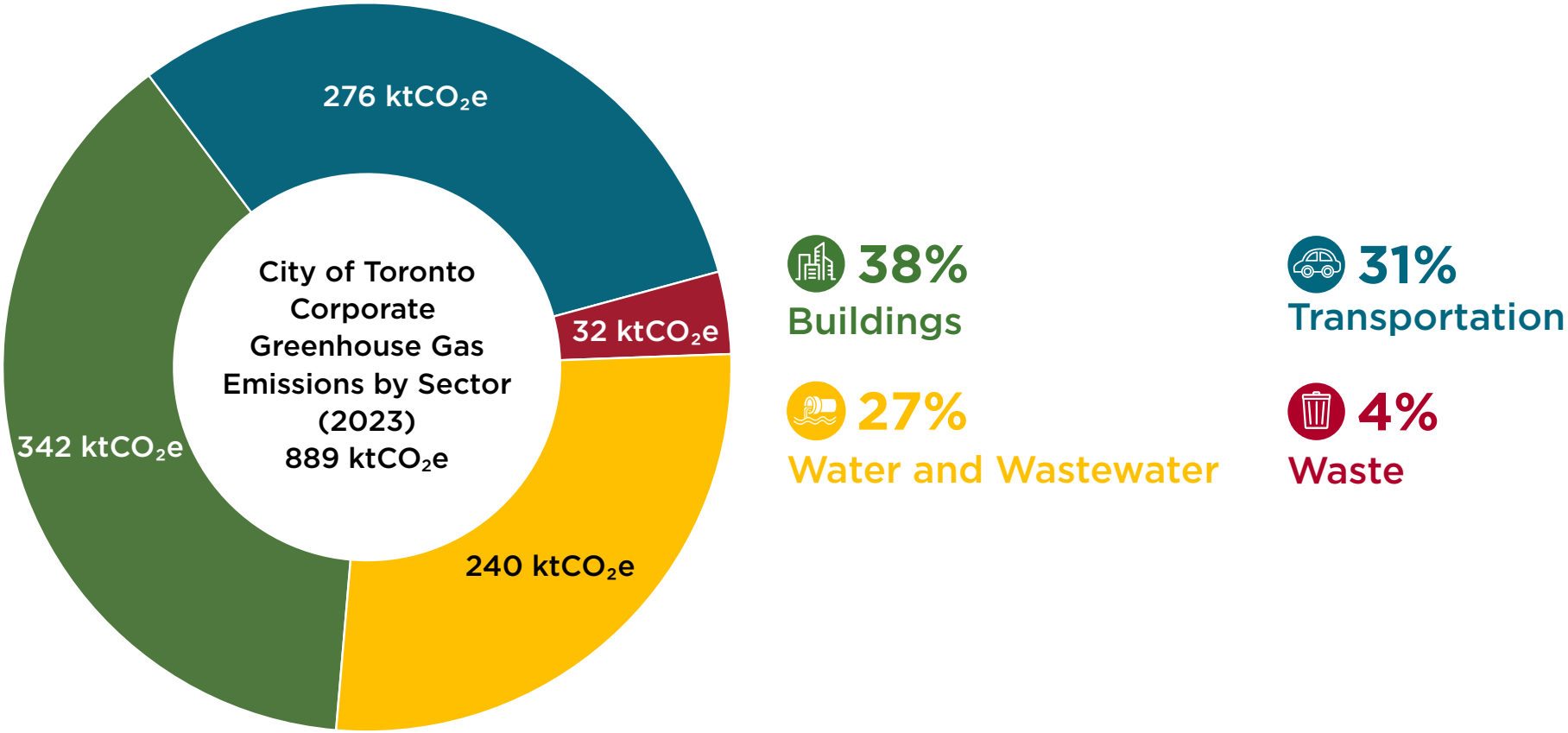


Figure 14: City of Toronto's percentage breakdown of corporate GHG emissions by sector (2023)

[64] Corporate "water and wastewater" sector emissions were reported in the "waste" sector in SBEI reports until 2021. Sectors are defined differently in the corporate versus community emissions report sections and associated figures. Therefore, Figure 14: City of Toronto's percentage breakdown of corporate GHG emissions by sector (2023) cannot be directly compared to Figure 4 Toronto's percentage breakdown of community-wide GHG emissions by sector (2023).

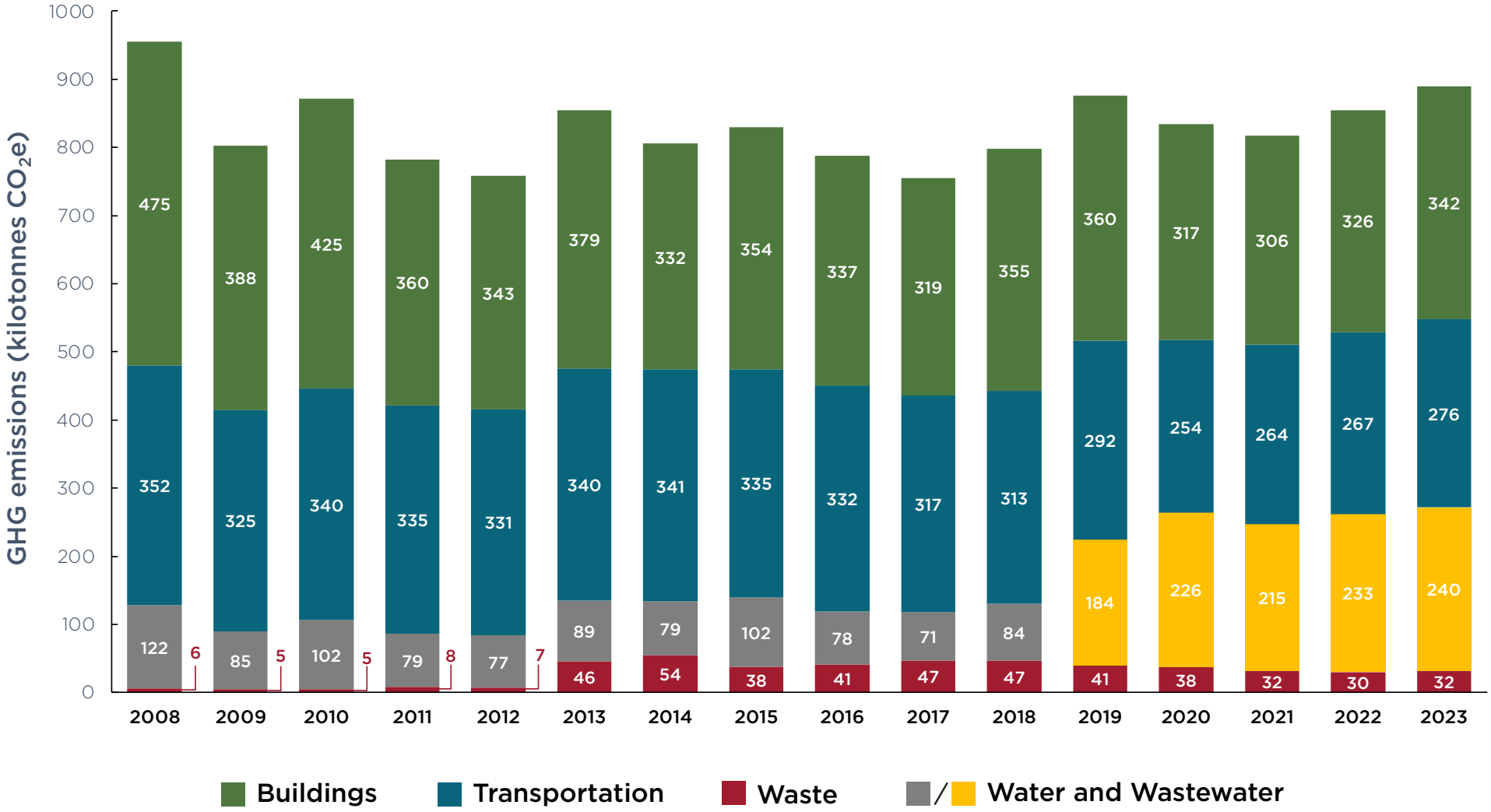


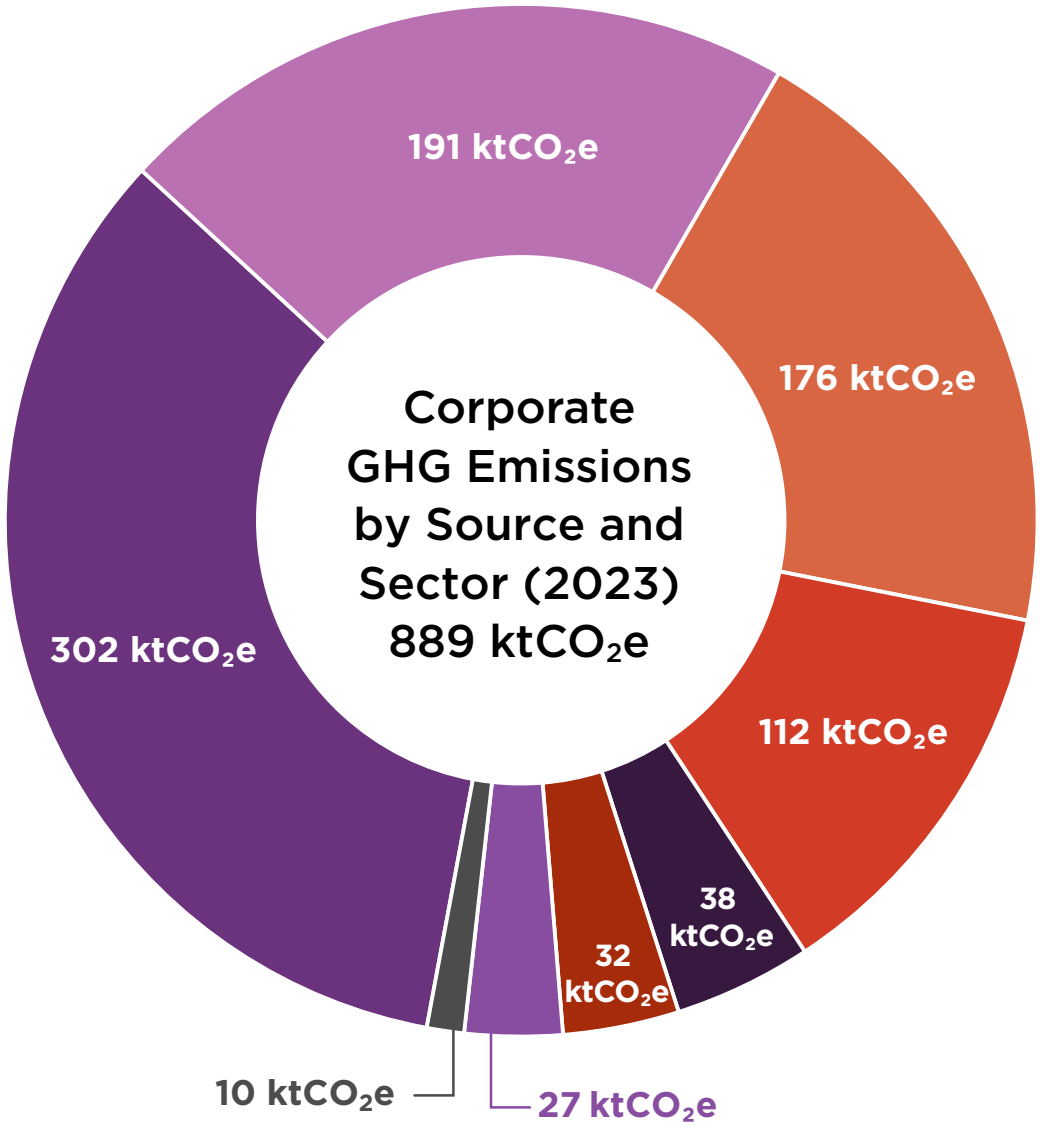
Figure 15: City of Toronto's year-over-year corporate GHG emissions by sector[65]

[65] "Water and wastewater" sector emissions were reported in the "waste" sector in SBEI reports until 2021. Wastewater treatment emissions, a component of "water and wastewater" sector emissions, are estimated using two different methods for the periods of 2008-2018 and 2019 onward. This is indicated by the different colours on Figure 15 (grey for 2008-2018 and yellow for 2019-2023). The 2019 emissions increase of 99 kt reported in the water and wastewater sector was not due to an actual increase in emissions from wastewater treatment. The larger estimates from 2019 onward were caused by changes to the emissions estimation methodology only. See Section 3.2.1 for further details.

Figure 16 depicts the sources contributing to emissions at the corporate level in 2023 and demonstrates that the corporation's use of fossil (natural) gas for space heating and predominantly fossil fuel-derived vehicle fuels (such as biodiesel) were primary sources of corporate emissions[66]. Fossil (natural) gas consumption (used primarily for space heating facilities, including housing) comprised 34 per cent of all corporate emissions and was the largest single source of emissions. Corporate emissions from fossil (natural) gas remained relatively stable in 2023 over 2022, increasing by only 0.6 per cent.

Emissions from biodiesel consumption by corporate vehicles accounted for 21 per cent of corporate emissions, followed by process emissions from wastewater treatment at 20 per cent. Emissions from electricity use by buildings, water supply and treatment, and TTC vehicles accounted for 13 per cent of corporate emissions. Corporate gasoline consumption accounted for four per cent of corporate emissions, while diesel use accounted for three per cent. Finally, other emissions sources (such as chilled water, steam, CNG, RNG, and propane) accounted for one per cent of corporate emissions.

[66] Process emissions associated with wastewater management are likewise a major source of corporate emissions. As discussed in Section 2.5.3, process emissions are managed differently than fossil fuel-driven emissions sources.



34%
Fossil (Natural) Gas (Buildings and Water and Wastewater Treatment)

21%
Biodiesel - B5, B10 & B20 (Transportation)

20%
Wastewater treatment process emissions - CH_4, N_2O & CO_2 (Water and Wastewater)

13%
Electricity (Buildings, Transportation and Water and Wastewater)

4%
Gasoline (Transportation)

4%
Waste treatment process emissions - CH_4, N_2O & CO_2 (Waste)

3%
Diesel (Transportation)

1%
Other - Chilled Water, Steam, Propane, CNG & RNG (Buildings and Transportation)

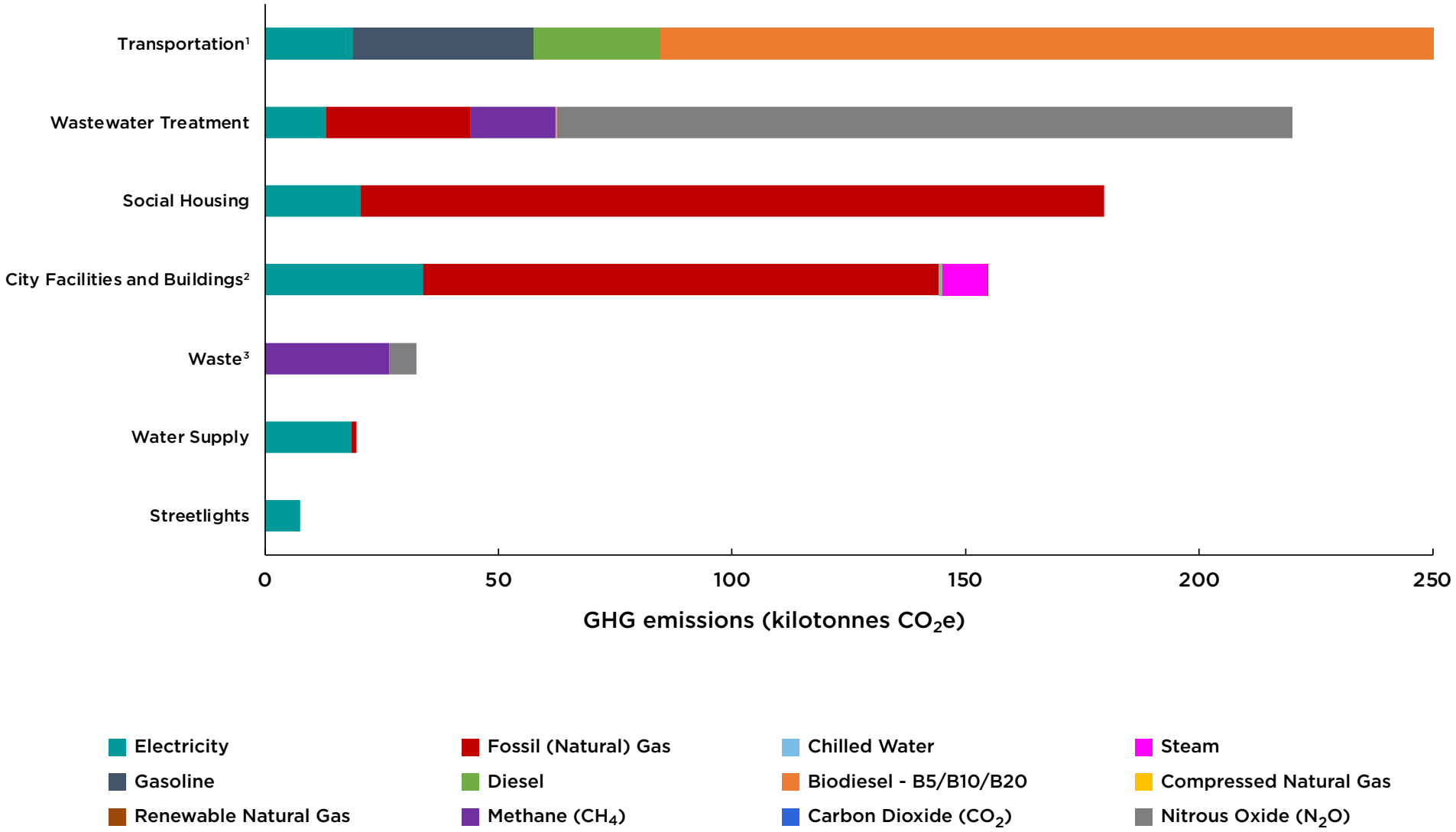
Figure 16: City of Toronto's corporate GHG emissions by source and sector (2023)

These emissions are also presented by detailed corporate subsector in **Figure 17**. This figure shows that City of Toronto government facilities and buildings (non-TCHC) accounted for 17 per cent of corporate emissions, while TCHC housing accounted for 20 per cent of corporate emissions. Overall, most GHG emissions from corporate buildings (89 per cent) come from fossil (natural) gas consumption.

Within the corporate transportation sector, diesel and biodiesel consumption accounted for 79 per cent of emissions, while gasoline emissions represented 14 per cent. Biodiesel emissions from TTC buses accounted for 69 per cent of corporate transportation emissions[67]. Diesel fuel use (including biodiesel) from the combined fleets of TTC, EMS, Fire, Police Services, and the City's corporate fleet contributed 25 per cent of all corporate emissions.

Nitrous oxide (produced through waste and wastewater treatment processes) accounted for 18 per cent of corporate emissions, followed by electricity at 13 per cent, methane (produced through landfill waste and wastewater treatment processes) at five per cent, and gasoline at four per cent.

[67] Beginning in 2018, the TTC changed its fuel source for all buses from diesel to biodiesel.



Notes

[1] Compressed Natural Gas and Renewable Natural Gas are included in Transportation but the values are too small to be visible at this scale
[2] Chilled Water and Renewable Natural Gas are included in City Facilities and Buildings but the values are too small to be visible at this scale
[3] CO_2 is included in Waste but the value is too small to be visible at this scale

Figure 17: City of Toronto's corporate GHG emissions by corporate subsector (2023)

3.3 Other sources of corporate emissions increases in 2023

Corporate emissions increased about four per cent in 2023 over 2022. The major sources of corporate emission increases are detailed below.

Energy use in corporate buildings

Some corporate buildings, such as those operated by the Corporate Real Estate Management Division, used more electricity for their operations and fossil (natural) gas during 2023 than 2022, resulting in an increase in emissions of approximately 7 $ktCO_2e$ (17 per cent) year over year. This increase in emissions was considerably higher than the five per cent increase in GHG emissions from 2022 to 2023 for corporate buildings overall (which include Transportation Services, Toronto Water, and TTC buildings, among others).

Biodiesel use in TTC buses

Overall emissions from biodiesel consumption in TTC buses remained a considerable source of emissions at 190 $ktCO_2e$ (21 per cent of total corporate emissions), remaining stable in 2023 compared to 2022. TTC is targeting an all-electric bus fleet by 2040[68], and the use of biodiesel as a lower-emissions fuel option is understood to support this transition in the interim to a zero-emission passenger fleet.

The TTC stopped using conventional diesel fuel (100 per cent diesel from fossil sources) in its buses and switched to using B5 biodiesel at the beginning of 2018. Fuel blend emission intensities (GHG emissions per litre of fuel used) are lower for fuel blends with higher percentages of biodiesel; in other words, emissions are lower per litre of B20 biodiesel used than B10, and even lower than B5. When TTC buses use greater amounts of B20 and B10 biodiesel instead of opting for B5 biodiesel, emissions are lower per litre of fuel consumed.

In 2021, TTC buses began using a combination of B5, B10 and B20 biodiesel, with an increasing share of B10 consumption in 2023. While both B10 and B20 biodiesel were used up to 2022, no B20 biodiesel was used during the 3 summer months in 2023 at the single bio-designed fuel bus garage due to tank related issues.

While over 90 per cent of emissions from biodiesel consumption in TTC buses come from the use of B5 biodiesel[69] (a fuel blend containing 5 per cent biodiesel and 95 per cent diesel from fossil sources), there were two per cent less GHG emissions from B5 biodiesel consumption in 2023 compared to 2022. Emissions from B10 biodiesel (a fuel blend containing 10 per cent biodiesel and 90 per cent diesel from fossil sources) increased by around 10 $ktCO_2e$, tripling in 2023 over 2022. Overall, switching TTC buses to biodiesel has led to a reduction in GHG emissions from diesel consumption of around 40 $ktCO_2e$ (17 per cent) in 2023 compared to the yearly average emissions from diesel consumption in TTC buses for the 2008-2017 period.

[68] City of Toronto (2023). Sustainable City of Toronto Fleets Plan. Available at: https://www.toronto.ca/legdocs/mmis/2023/ie/bgrd/backgroundfile-235807.pdf
[69] Government of Canada (2025). Biodiesel. Available at: https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/biofuels/biodiesel/3509

TTC subway and streetcar electricity use

Emissions from TTC subway and streetcar electricity use increased by 2 ktCO_2e (13 per cent) in 2023 over 2022, even though electricity use for these transportation modes decreased by five per cent. This increase in emissions is largely due to greater fossil (natural) gas power generation at the provincial level, reflecting the challenge of reaching emissions reduction targets while the municipality relies on a provincial electricity system that includes fossil fuel-generated power. However, TTC subways and streetcars remain almost "emissions-free" public transit modes, and their operation promotes further indirect reductions in GHG emissions from other sources by displacing private vehicle use.

Toronto Water electricity use for water treatment and supply

Emissions from electricity used to power water treatment, water supply, and wastewater treatment processes increased by 5 ktCO_2e (21 per cent) in 2023 over 2022, even though there was less electricity (one per cent decrease) consumption for these activities in 2023. Like other electricity emissions increases across the corporation, emissions increased in part due to greater fossil (natural) gas power generation at the provincial level.

APPENDIX A: SECTOR-BASED VERSUS CONSUMPTION-BASED EMISSIONS INVENTORIES

The sector-based emissions inventory (SBEI) measures the GHGs attributable to emissions generated from activities taking place during one year (2023 in the case of this report) within the geographic boundaries of the City of Toronto, as well as some indirect emissions from waste produced in the city, and transmission of electricity into the city.

Complementary to the SBEI, the consumption-based emissions inventory (CBEI)[70] estimates the total GHG emissions associated with producing, processing, transporting, using, and disposing the goods and services consumed by a particular community or entity in a given time frame (typically one year). The emissions associated with purchases of goods and services by Toronto residents, such as food at the grocery store, consumer goods purchased at a store or online, larger items like personal vehicles, and services like medical treatments received, are all captured by a CBEI. Typically, the majority of GHG emissions associated to these products and services (such as production and transportation to their place of consumption) are generated outside of Toronto's geographic boundaries, instead being released wherever products or service-related equipment are manufactured or delivered from (see **Figure 18**). But because the consumption of these products and services happens in Toronto, these emissions occurring outside the city are captured in the CBEI. This differs from an SBEI, which accounts for emissions from activities occurring within the geographic boundary of Toronto regardless of where they are consumed (for example, a good produced in Toronto but exported for consumption elsewhere).

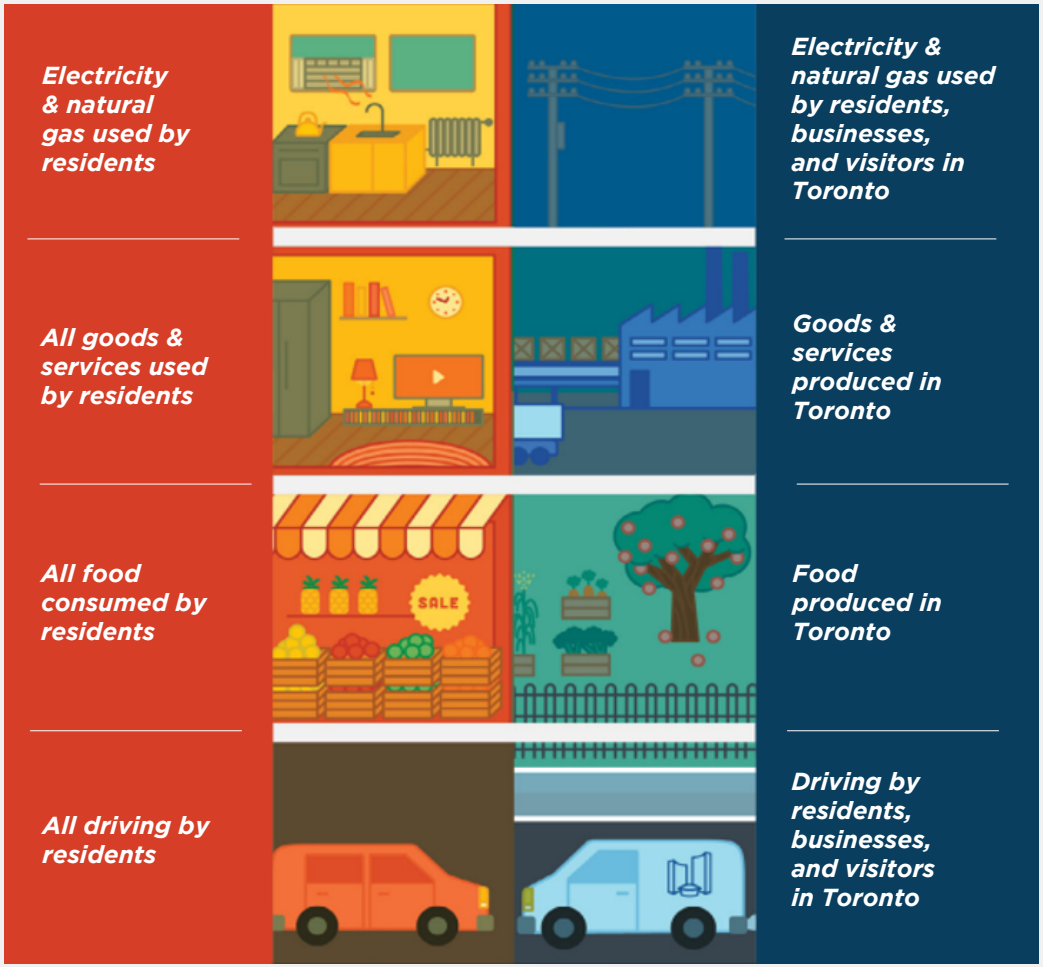
[70] City of Toronto (2023). Consumption-Based Emissions Inventory. Available at: https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/torontos-consumption-based-emissions-inventory/

CBEI vs. SBEI: What's the difference?

Toronto's CBEI and SBEI are complementary and partially overlapping. The examples below illustrate some of the key differences between the two.

Consumption-based Emissions Inventory (CBEI)

The community-wide CBEI estimates the total greenhouse gas emissions associated with producing, transporting, and using everything consumed by Toronto residents. These emissions can occur inside and outside of city limits.



Sector-based Emissions Inventory (SBEI)

Toronto's SBEI measures greenhouse gas emissions occuring due to activities taking place within Toronto city limits by businesses, visitors, and residents. Most of these emissions occur locally, but emissions from waste and electricity may occur elsewhere.

Figure 18: Graphical representation of sector-based versus consumption-based GHG emissions inventories

The complementary and overlapping nature of the SBEI and CBEI provide the City with opportunities to identify major GHG emission sources driven by local activities. The emissions sources can then be targeted for reduction, whether the emissions occur locally or globally. For example, in both inventories, transportation (specifically gasoline consumption) and fossil (natural) gas use in buildings are the two largest sources of emissions[71]. By supporting efforts to reduce and eventually eliminate emissions from fossil (natural) gas and gasoline, Toronto would be able to reach its sector-based emissions targets while also reducing its consumption-based emissions footprint. This support can be provided in part through municipal policies that enable engagement in non-automobile, low carbon transportation modes (like walking, cycling and taking transit), and that reduce fossil (natural) gas usage by supporting low emissions space heating option installation (like electric heat pumps). Further detail on the potential sector-based emissions impacts of reducing consumption-based emissions can be found in Toronto's CBEI.

[71] The full results of Toronto's CBEI are available at: https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/torontos-consumption-based-emissions-inventory/

APPENDIX B: DISCLOSURES

B.1 Global Protocol for Community-Scale GHG Emissions Inventories (GPC Protocol)

Toronto's community-wide emissions are calculated and reported as per the guidance in the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), version 1.1[72]. 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[73].

This sector-based GHG emissions inventory is based on the BASIC level of GHG emissions reporting, as defined by the GPC. BASIC level includes scope 1[74], 2 and 3 emissions from the stationary energy and transportation sectors, as well as scope 1 and 3 emissions from the waste sector. A summary of Toronto's 2023 GHG emissions aligned with the BASIC reporting sectors is shown in **Table 4**, reported in tonnes of carbon dioxide equivalent (tCO_2e). Please refer to **Table 5** for definitions of emissions scopes, as per the GPC.

[72] World Resources Institute (2021). Global Protocol for Community-Scale Greenhouse Gas Inventories: An Accounting and Reporting Standard for Cities Version 1.1. Available at: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

[73] The Global Covenant of Mayors for Climate and Energy (GCoM) is a group of over 10,000 cities that share a long-term vision to combat climate change, and work towards a low-emission and climate-resilient future. More information can be found at: https://www.globalcovenantofmayors.org/

[74] Emissions accounted for in Toronto's inventory that are labeled as Scope 1 do not include any fugitive emissions from refrigerants.

Table 4: Toronto's BASIC 1990 (baseline year) and 2023 (current reporting year) community-wide GHG emissions

Sector	Emission sources	1990 GHG Emissions (tCO_2e)[a]	2023 GHG Emissions (tCO_2e)[a]
Stationary energy	Residential buildings (Scope 1,2, & 3)	5,256,910	4,430,898
	Commercial and institutional buildings and facilities (Scope 1,2, & 3)	5,958,825	3,336,081
	Manufacturing industries and construction (Scope 1,2, & 3)	2,488,459	961,516
	Fugitive emissions from oil and natural gas systems (Scope 1)	0	65,105
Transportation	On-road transportation (Scope 1, 2 & 3)	7,008,360	5,542,920
	Railways (Scope 1 & 2)	0	95,197
	Waterborne navigation (Scope 1 & 2)	0	1,189
	Aviation (Scope 3)	0	77,440
	Off-road transportation (Scope 1 & 3)	0	7,200
Waste	Solid waste generated in the city (Scope 1 & 3)	4,171,771	1,349,965
	Biological waste generated in the city (Scope 1 & 3)	0	20,264
	Wastewater generated in the city (Scope 1)	0	176,030
Total GHG emissions		24,884,325	16,063,806
Change in GHG emissions from the baseline year (1990)			-8,820,519
Total population		2,362,928	3,130,201
Total per capita GHG emissions (tCO_2e / capita)		10.53	5.13
Change in GHG emissions per capita from the baseline year (1990)			-51.27%
Percent change in GHG emissions from baseline year (1990)			-35.45%
Energy use (GJ)		0	362,695,009
Total per capita energy use (GJ / capita)			115.87

Notes

[a] Emissions noted as zero (0) tCO_2e in 1990 were not accounted for in the 1990 baseline estimate for a variety of reasons, such as lack of data availability.

Table 5: Scope definitions for Toronto's sector-based emissions inventory

Scope	Definition
Scope 1	GHG emissions from sources located within the City of Toronto's administrative boundaries
Scope 2	GHG emissions resulting from the use of grid-supplied electricity, heat, steam and/or cooling within the City of Toronto's administrative boundaries
Scope 3	All other GHG emissions that occur outside the City of Toronto's administrative boundaries as a result of activities taking place within the City of Toronto's administrative boundaries

In summary, Toronto's sector-based emissions 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 fossil (natural) gas and electricity.

- **Transportation emissions** represent emissions from on-road passenger vehicles, vehicles-for-hire, commercial and 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 versus regulated reporting, this section of the inventory presents the best data available at the time of collection.

- **Waste emissions** (primarily methane but also nitrous oxide and carbon dioxide) originating in public landfills constitute most of Toronto's waste emissions. In addition, there is a portion of emissions from organics and yard waste processing, and wastewater treatment processes. Emissions from privately managed waste are estimated within the total waste emissions value.

B.2 Toronto's "A List" score on GHG accounting and action reporting

As a Global Covenant of Mayors signatory, Toronto discloses its sector-based GHG emissions inventory and its climate mitigation and adaptation actions annually to the Carbon Disclosure Project (CDP)[75] to share Toronto's progress and benchmark against other cities facing similar challenges.

For the sixth year in a row, the City of Toronto was recognized on the 2024 CDP Cities "A" List for its leadership and transparency on climate action[76]. Toronto was one of 112 cities globally to receive an "A" rating.

[75] Carbon Disclosure Project (2025). About Us. Available at: https://cdp.net/en/about
[76] At the time of publication, the 2025 CDP results have not been released.

APPENDIX C: METHODOLOGY

Appendix C provides a high-level overview of the City's methodology to estimate its annual sector-based emissions, in alignment with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. For more detailed methodology information, please email City staff using the contact information provided at the end of this document.

As mentioned at the beginning of this report, the values reported annually in Toronto's SBEI report do not exactly match those in previous inventories because of updates to various datasets that occur over time, including after the publication of past inventories. The values reported here are the most up to date as of the publication of this 2023 SBEI.

C.1 Global Warming Potential (GWP)

GHGs released into the atmosphere have different warming effects depending on the unique qualities of each gas. To enable comparisons of the global warming impacts of different GHGs, the concept of Global Warming Potential (GWP) was developed[77]. The GWP measures how much a particular gas contributes to global warming relative to carbon dioxide (CO_2). It is used to convert tonnes of GHG to tonnes of carbon dioxide equivalent (CO_2e) and calculate total emissions across multiple GHGs using a common unit. The larger the GWP, the more a given gas warms the earth's atmosphere relative to CO_2 over a given time period. The time period usually used to establish GWPs is 100 years. The GWPs used by the City of Toronto are listed in **Table 6**.

Table 6: Global Warming Potential (GWP) of major GHGs

GHG	GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)	34
Nitrous oxide (N_2O)	298

[77] Government of Canada (2024). Global Warming Potentials. Available at: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html

C.2 Activity data and emission factors

The City uses the following equation, as prescribed by the GPC protocol, to estimate GHG emissions:

GHG emissions = Activity data x Emission factor

Activity data refers to the data associated with an activity that leads to GHG emissions. Examples of activity data are:

- Volume of fossil (natural) gas consumption
- GWh of electricity consumption
- Volume of gasoline used
- Kilometres driven (also referred to as vehicle kilometres travelled)
- Tonnes of solid waste sent to landfill

An emission factor is a measure of the mass of GHG emissions relative to a unit of activity. As discussed in Section 1.1, the City relies on Environment Canada's National Inventory Report (NIR)[78] as the primary source for emission factors. Typically, Environment Canada releases the NIR two years after a given calendar year (for example, the 2023 emission factors were released in 2025). The City also updates its previously reported annual emissions estimates when compiling the latest inventory upon revised emission factors becoming available for previous inventory years.

C.3 Community-wide buildings sector

Buildings sector emissions result primarily from fossil (natural) gas and electricity use. For both of these energy forms, emissions are calculated by multiplying activity data (such as fossil (natural) gas and electricity consumption data) by their corresponding emission factors, and are broken down into the following building type categories (as shown in **Figure 9**):

- Residential buildings (single-family and multi-unit residential buildings)
- Commercial and institutional buildings
- Industrial buildings

Fossil (natural) gas consumption data are provided to the City by Enbridge Gas, while electricity consumption data are provided by Toronto Hydro.

Additional Notes:

- Every year, Enbridge Gas provides the City with a gas distribution fugitive emission factor, which is in tonnes of carbon dioxide equivalent per cubic metre (CO_2e per m^3). The City multiplies this factor by total fossil (natural) gas consumption (cubic metres, m^3) to generate the total fugitive emissions.

[78] Environment and Climate Change Canada (2025). National inventory report : greenhouse gas sources and sinks in Canada. Available at: https://publications.gc.ca/site/eng/9.506002/publication.html

- Emissions associated with electricity transmission loss are estimated using the electricity generation and GHG emission details for Ontario provided annually in the NIR. Specifically, a transmission loss factor is estimated by subtracting the generation intensity (grams of carbon dioxide equivalent per kilowatt hour (g CO_2e per kWh) from the consumption intensity (g CO_2e per kWh) and then applying that factor to the total buildings sector electricity consumption activity data.

- The number of single-family homes required to convert to energy efficient homes either by building envelope retrofits or fuel switching from fossil (natural) gas heating to electric heat pumps needed to reduce emissions by 2.4 $MtCO_2e$ by 2025 (reduction required to meet Toronto's 2025 annual community-wide emissions target) was calculated by the following:

A. 2023 single-family fossil (natural) gas emissions [tCO_2e]	2,323,460 tCO_2e Source: Enbridge Gas Residential Consumption x NIR Emission Factor
B. 2023 single-family fossil (natural) gas customers	500,169 Source: Enbridge Gas Residential Customer Counts
C. Emissions per single-family customer [tCO_2e/customer]	4.65 (A/B)
D. Amount of GHG reduction needed by 2025 [tCO_2e]	2,377,427
E. Number of single-family fossil (natural) gas customers needed to reach net zero to achieve overall 2025 emissions target	**511,786 (more than 100 per cent of existing customers) (D/C)**
F. Mitigation potential from reaching net zero for all single-family fossil (natural) gas customers in 2023 [tCO_2e]	**2,323,460 (98 per cent of 2025 emissions reduction target) (B x C)**

C.4 Community-wide transportation sector

Transportation sector emissions in Toronto are classified primarily into the following sub-categories (as shown in **Figure 12** of the inventory):

- Passenger vehicles
- Commercial light vehicles
- Heavy vehicles
- Other vehicles (including waste trucks, rail, marine, and aviation)

Most of Toronto's transportation sector emissions come from on-road transportation. As discussed in Section 2.5.2, most on-road transportation emissions are estimated using a model developed by the University of Toronto, the Traffic Emissions Prediction Scheme (TEPs)[79]. The model has two main modules:

1. TEPs – I, designed for traffic volume prediction
2. TEPs – II, designed for traffic emissions prediction

TEPs – I estimates an Average Annual Daily Traffic (AADT) value, which is subsequently fed into TEPs – II to estimate traffic emissions associated with the AADT.

Emissions from off-road vehicles and equipment in Toronto are calculated by multiplying the litres of fuel used (reported by the City of Toronto Fleet Services Division) by emission factors for energy mobile combustion sources (provided annually by the NIR).

Emissions from rail are calculated from three main sources:

1. Litres of diesel fuel supplied by Metrolinx for GO Train
2. Litres of diesel fuel supplied by Metrolinx for UP Express
3. Estimated electricity consumption used by TTC subway trains and above-ground streetcars

These activity data are then multiplied by emission factors from the NIR to produce the rail transportation emissions estimate. Additional notes:

- Emissions from aviation represent the monthly litres of fuel pumped into aircraft at Billy Bishop Toronto City Airport during a given year. This fuel consumption is then multiplied by the emission factors for energy mobile combustion sources.
- Emissions associated with Toronto Pearson International Airport are not captured in the City's annual inventory due to current constraints in acquiring data. The airport is also located within the municipal boundary of Mississauga (outside of Toronto), outside the geographic scope of the SBEI.
- Due to data limitations, emissions from marine transportation only capture City-owned fleet marine vehicles. Specifically, emissions from these vehicles are estimated by using the litres of fuel (reported by the City of Toronto Fleet Services Division) multiplied by emission factors for energy mobile combustion sources.

[79] University of Toronto (n.d.). Traffic Emission Prediction Scheme (TEPs). Available at: https://teps.ca/

- Using Geographic Information System (GIS) mapping and system route information, the number of kilometres travelled by GO Trains and UP Express trains within Toronto territorial boundaries versus the system-wide GO Train and UP Express routes are estimated. These estimates are used to determine the percentage of system-wide fuel used by GO Trains and UP Express within Toronto alone. This percentage is multiplied by the total litres of diesel fuel used annually by GO Trains and UP Express trains (fuel data supplied by Metrolinx). Due to data constraints, VIA Rail and CN/CP Rail are not captured in the City's inventory.
- Emissions from the TTC Bus Fleet are estimated using litres of fuel (supplied directly by the TTC) multiplied by the corresponding fuel emission factor, such as those for heavy-duty B5 biodiesel, B10, B20, or electricity use in the case of electric buses.
- The City accounts for the emissions from the litres of fuel used by waste trucks to transport publicly-managed waste to landfill sites. This fuel consumption is then multiplied by the emission factors for energy-mobile combustion sources.
- The City also estimates the litres of fuel used by private waste trucks to transport privately-collected waste to unidentified landfills outside the city boundary. This fuel consumption is then multiplied by the emission factors for energy-mobile combustion sources.
- The number of gasoline-powered passenger vehicles removed or displaced from the road necessary to reduce emissions by 2.4 $MtCO_2e$ by 2025 (reduction required to meet Toronto's 2025 annual community-wide emissions target) was calculated by the following:

G. 2023 passenger vehicle emissions [tCO_2e]	3,603,054 Source: TEPs model, University of Toronto
H. 2023 registered passenger vehicles in Toronto in 2023	1,102,668 Source: Ministry of Transportation of Ontario
I. Yearly emissions per passenger vehicle [tCO_2e/vehicle-year]	3.27 (F/G)
J. Amount of GHG reduction needed by 2025 [tCO_2e]	2,377,427
K. Number of passenger vehicles displaced from Toronto's roads needed to achieve overall 2025 emissions target	**727,581 (66 per cent of registered passenger vehicles) (J/I)**

C.5 Community-wide waste sector

The waste sector accounts for emissions from waste generated inside Toronto's city boundaries, and waste managed and treated at City-owned facilities inside and outside of the city boundaries. Emissions from the waste sector are broken down into three categories:

- City-owned landfill sites
- Private landfill sites
- Organic and yard waste processing facilities

The City manages five landfill sites which are accounted for in Toronto's sector-based GHG emissions inventory, but only two of which (Beare Road and Thackeray) exist within Toronto's geographic boundary. Further, of the five sites, only one facility (Green Lane) is an operating landfill. The rest are closed, meaning that waste generated in the present inventory reporting year was only transported to Green Lane.

Methane emissions from landfills continue for several decades (or sometimes even centuries) after waste disposal. Waste generated in a given year thereby contributes to GHG emissions in both that year and subsequent years. Likewise, methane emissions released from an open landfill in any given year include emissions from waste disposed of that year, as well as from waste disposed of in prior years. To account for these methane emissions, the City uses two approaches:

1. For Beare Road and Thackeray landfill sites, emissions are calculated using the Scholl-Canyon First Order of Decay (FOD) model, which is based on the tonnage of waste deposited into the landfill over its lifetime.
2. For Green Lane, Keele Valley, and Brock West landfill sites, landfill gas generation and flaring data are collected and are used, together with an industry-standard model for landfill emissions, by an external consultant for the City. The model estimates the amount of gas generated by the landfill(s); the sites' operators collect gas measurements at the flares. The estimated landfill emissions are calculated by subtracting the gas flared/destroyed (measured) from the amount of gas produced at the landfill (modelled).

The method to estimate privately managed waste in Toronto's annual sector-based inventory was developed because the City does not have access to data on the tonnage of waste (or emissions attributable to waste) collected by private firms and sent to unknown landfill locations. To provide an estimate of emissions associated with this privately managed waste, the City uses Ontario's provincial estimate of the amount of waste managed by municipalities as compared to the amount of waste managed privately. The most recently published ratio (2016) states that 40 per cent of waste is managed municipally, and 60 per cent is managed privately. As the City does not have information on the composition of this privately managed waste, the landfill gas collection efficiency of the receiving landfills, or these landfills' locations, the City currently assumes the following:

- Privately managed waste has the same composition as the waste the City sends to Green Lane landfill.
- The receiving landfills have the same landfill gas collection efficiency as Green Lane landfill.

- To estimate emissions from privately managed waste, the City applies the provincial ratio by assuming the emissions from the landfill currently receiving Toronto's municipally managed waste (Green Lane) are equivalent to 40 per cent of the total community-wide waste emissions. The City calculates the remaining 60 per cent of emissions, which the City assumes to be the emissions attributable to privately managed waste.

Emissions from the City's organics processing facilities are calculated using the total tonnage of collected green bin organics from the City's two facilities and private processing facilities located outside the City's boundary, and applying an emissions estimation formula and emission factors recommended by the GPC Protocol. Leaf & yard waste emissions are estimated for private facilities where the City sends this waste by using an emissions estimation formula and emission factors recommended by the GPC Protocol[80].

Carbon dioxide emissions from the decomposition of biomass in landfill waste are not reported as they are considered of biogenic origin, which is a type of emissions excluded from the inventory results per the GPC Protocol.

Waste collection vehicles' emissions are captured under transportation sector emissions, not waste sector emissions.

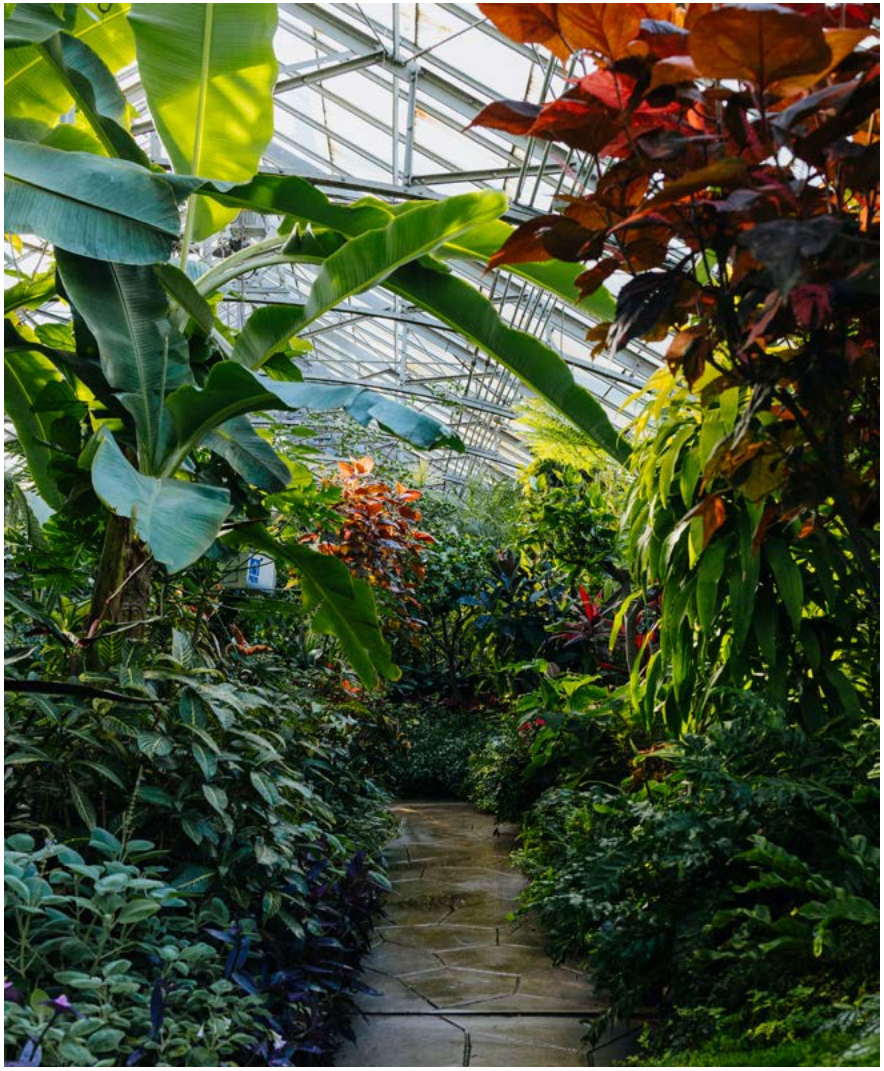
[80] See Appendix B.1 Global Protocol for Community-Scale GHG Emissions Inventories (GPC Protocol).

C.6 Corporate emissions

Generally, the City follows the same principle described previously in calculating community-wide emissions (as per the GPC Protocol), with some additional notes below:

- Most of the City's corporate activity data, specifically energy consumption, is managed by the Corporate Real Estate Management (CREM) Division. CREM monitors the utility bills of all City-owned buildings, facilities, yards, etc. through an energy management software called EnergyCAP. EnergyCAP also includes utility bill information from Toronto Community Housing (TCHC), the largest social housing provider in Canada and the second largest in North America. TCHC is owned by the City of Toronto.
- To calculate fossil (natural) gas and electricity emissions, the City applies the same emission factors used in the community-wide inventory, obtained from the NIR. For steam and chilled water, the City uses emission factors from Enwave (the City's district energy supplier).
- Electricity emissions are handled slightly differently for corporate and community emissions. Specifically, the electricity consumption data provided by CREM already incorporates transmission losses. The City uses this value directly, multiplies it with the appropriate NIR emission factor, and does not perform a separate transmission loss emissions calculation step (as is done for community-wide electricity emissions).
- The electricity use of Bike Path (lighting), Signal (traffic signals) and Streetlights are also managed and monitored in EnergyCAP.
- The City's Fleet Services Division (FSD) manages the City's corporate marine, off-road and on-road transportation fuel consumption. The FSD receives fuel consumption activity data from the following City agencies: Toronto Police Service, Toronto Fire Services, Toronto Paramedic Services, TCHC, Exhibition Place, Toronto Zoo, Toronto Parking Authority and Toronto Public Library. Lastly, the TTC reported its fuel consumption and electricity use for transit vehicles directly. This activity data is multiplied by the corresponding NIR emission factors based on the vehicle types.
- The City estimates corporate waste emissions based on the percentage of total waste transported to Green Lane that is attributable to corporate operations, as measured by annual corporate waste tonnage received at Green Lane. This percentage is applied to the total emissions from annual waste transported to Green Lane.
- To estimate transportation-related emissions for corporate waste sent to Green Lane, the City applies this same percentage to the litres of fuel consumed by all long-haul trucks travelling to Green Lane. This provides an estimate of corporate waste-related transportation emissions outside the City boundary.

- Electricity and fossil (natural) gas use by City water supply and treatment and wastewater treatment facilities is reported in the corporate water and wastewater treatment sector[81].
- Municipal wastewater is treated anaerobically at the City's four wastewater treatment plants. The City's water engineers calculate the annual carbon dioxide, methane and nitrous oxide emissions attributed to the wastewater treatment at these plants. Wastewater treatment process emissions are reported in the corporate water and wastewater treatment sector.
- For details on estimating corporate emissions associated with the City's waste and organics processing facilities, please see Appendix C.5 Community-wide waste sector.



[81] A small amount of electricity and fossil (natural) gas use emissions at water and wastewater treatment buildings resulting from building heating, cooling, and electricity use that are not associated with industrial processes are reported in the corporate buildings sector. However, the remaining (majority of) emissions reported for electricity and fossil (natural) gas use at water and wastewater treatment buildings is a combination of building function- and industrial process-related emissions, and it is not currently possible to separate and report these emissions in each the buildings and water and wastewater sectors.

APPENDIX D: HEATING AND COOLING DEGREE DAYS

Fluctuations in fossil (natural) gas and electricity consumption are sensitive to weather conditions, specifically expressed in terms of Heating Degree Days (HDD) or Cooling Degree Days (CDD)[82]. HDD is a quantitative index used to estimate the energy demand needed to heat a home or business, while CDD is a quantitative index used to estimate the energy demand needed to cool a home or business.

HDD is equal to the number of degrees Celsius (°C) a given day's mean temperature is below 18°C. For example, if the daily mean temperature is 12°C, the HDD value for that day is 6 HDD. If the daily mean temperature is above 18°C, the HDD value for that day is set to zero. When this exercise is performed every day of the year and aggregated, it provides a total value of HDD for a given year.

CDD follows a similar calculation process as HDD, except it refers to the number of degrees Celsius a given day's mean temperature is above (instead of below) 18°C. At this temperature, people inside a building no longer want the building heated, but instead begin to consider cooling the building.

A high number of degree days (HDD and/or CDD) generally results in higher levels of energy use for space heating or cooling.

Table 7[83] shows that Toronto's winter was warmer in 2023 than in 2022, while the summer was cooler in 2023 than in 2022. **Figure 19** further shows that Toronto's 2023 HDD was 12 per cent lower than the city's 25-year HDD average, which means building heating needs were below average in 2023. As for cooling needs, Toronto's 2023 CDD was nine per cent lower than the city's 25-year CDD average and 20 per cent lower than in 2022, which means air conditioning needs were considerably lower in 2023 than the previous year. This implies that Toronto experienced a relatively warm winter and a cool summer in 2023 compared to recent years.

[82] Datasets gathered from Environment and Climate Change Canada, see: https://toronto.weatherstats.ca/charts/hdd-yearly.html and https://toronto.weatherstats.ca/charts/cdd-yearly.html
[83] Ibid.

Table 7: Annual Heating Degree Days (HDD) and Cooling Degree Days (CDD) in Toronto (1997 to 2023)

Year	Heating Degree Days	Cooling Degree Days	Heating difference from the previous year	Cooling difference from the previous year
1997	4,036	236		
1998	3,225	373	-20.09%	58.05%
1999	3,541	438	9.80%	17.43%
2000	3,829	263	8.13%	-39.95%
2001	3,422	389	-10.63%	47.91%
2002	3,633	515	6.17%	32.39%
2003	3,984	324	9.66%	-37.09%
2004	3,801	226	-4.59%	-30.25%
2005	3,797	533	-0.11%	135.84%
2006	3,383	380	-10.90%	-28.71%
2007	3,721	433	9.99%	13.95%
2008	3,839	273	3.17%	-36.95%
2009	3,838	197	-0.03%	-27.84%
2010	3,504	437	-8.70%	121.83%
2011	3,649	425	4.14%	-2.75%
2012	3,219	480	-11.78%	12.94%
2013	3,797	337	17.96%	-29.79%
2014	4,106	262	8.14%	-22.26%
2015	3,769	349	-8.21%	33.21%
2016	3,464	564	-8.09%	61.60%
2017	3,518	345	1.56%	-38.83%
2018	3,765	516	7.02%	49.57%
2019	3,929	340	4.36%	-34.11%
2020	3,516	495	-10.51%	45.59%
2021	3,340	464	-5.01%	-6.26%
2022	3,676	434	10.06%	-6.47%
2023	**3,226**	**348**	**-12.24%**	**-19.82%**

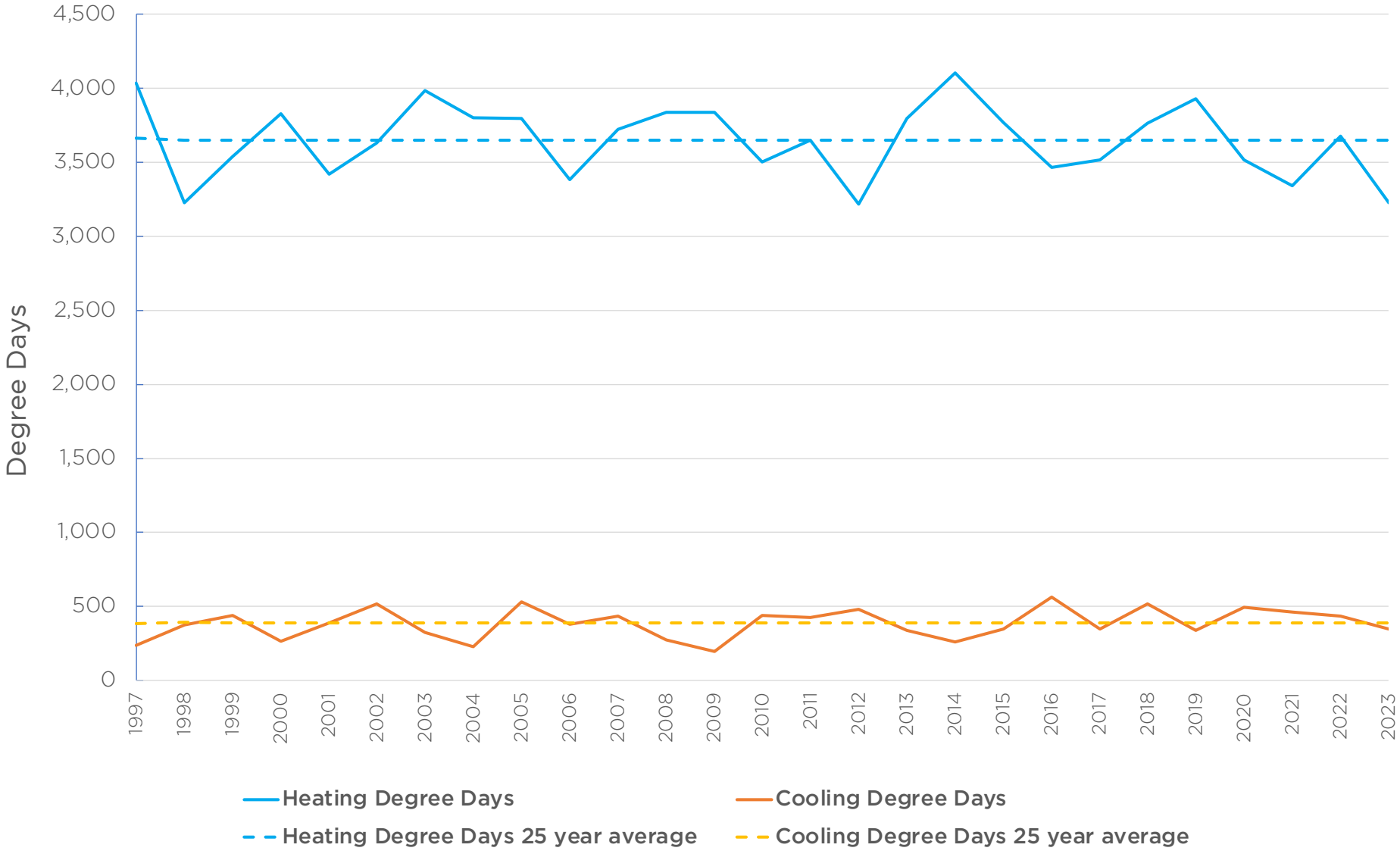
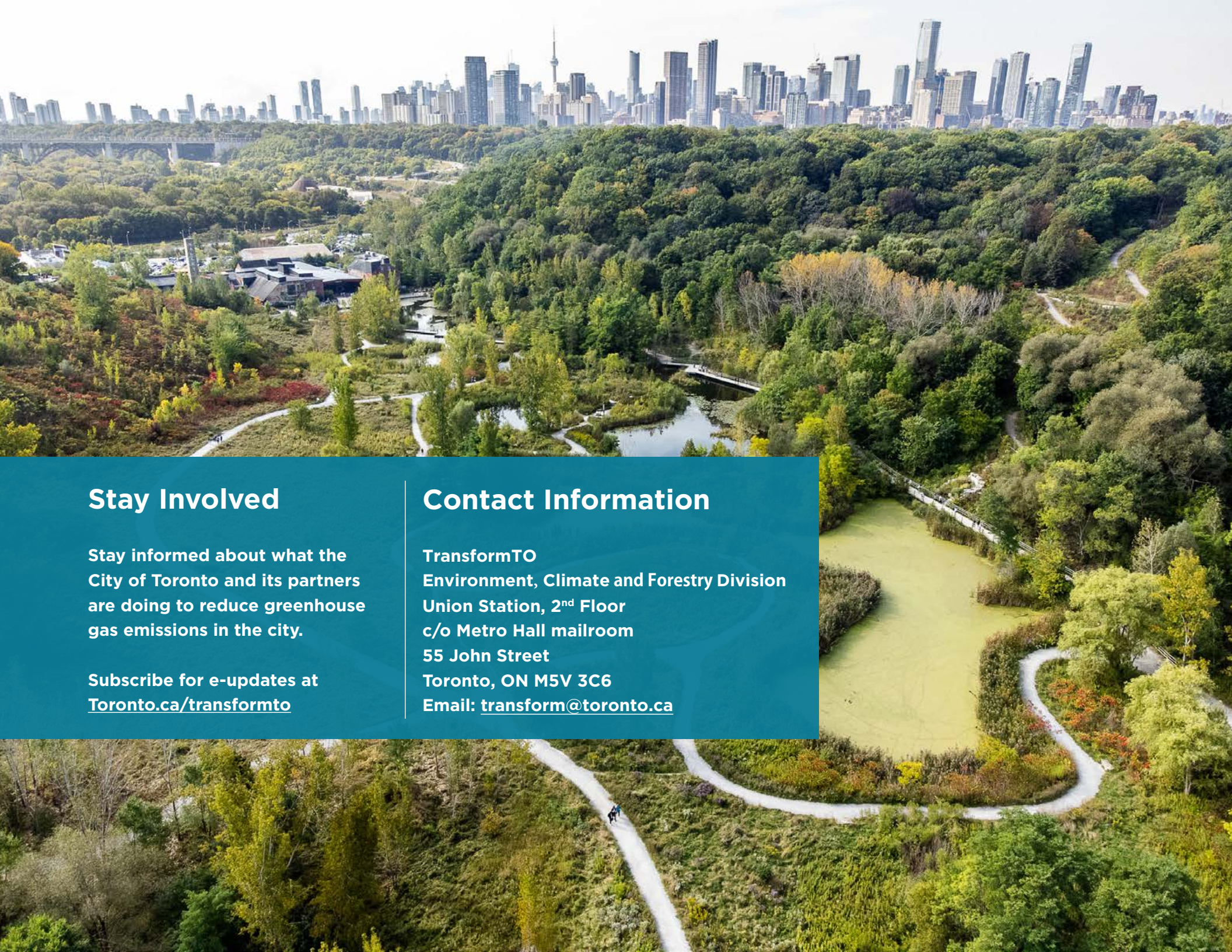


Figure 19: Annual Heating Degree Days (HDD) and Cooling Degree Days (CDD) in Toronto



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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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