



City of Toronto

**2019 Corporate Consumption-Based
Emissions Inventory Report**

July 2023



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Glossary

Activity data	Activity data refers to the data associated with an activity that leads to GHG emissions. In this report, activity data includes the City of Toronto's 2019 operating and capital budgets.
Baseline	The reference year against which annual emissions reductions/increases are measured over time.
Consumption Category	In the corporate CBEI, emissions are broken out into five categories, organized by North American Industry Classification System (NAICS) sector. These categories are Transportation, Utilities, Supplies & Equipment, Services, and Construction & Maintenance.
CBEI	A consumption-based emissions inventory (CBEI) is a calculation of all GHGs associated with producing, transporting, and using products and services consumed by a particular community or entity in a given time (typically one year).
Carbon dioxide equivalent (CO ₂ e)	A unit that allows emissions of different greenhouse gases (such as carbon dioxide [CO ₂], methane [CH ₄], and nitrous oxide [N ₂ O]) to be expressed as a single unit of measurement.
Direct emissions	Emissions from sources that are owned or controlled by the City, such as fuel combustion in a furnace or vehicle.
Emissions	Refers to greenhouse gas emissions (see <i>GHG</i>)
Emission factor	An emission factor is a measure of the mass of GHG emissions (typically in CO ₂ e) relative to a unit of activity.
Global Warming Potential (GWP)	GWP measures how much a particular GHG contributes to global warming relative to carbon dioxide (CO ₂). It is used to convert tonnes of a GHG to tonnes of carbon dioxide equivalent (CO ₂ e) to express total emissions using a common unit.
Goods and services	The phrase "goods and services" refers to everything exchanged in the economy. This is distinct from either the "goods" or "services" categories of consumption, which refer specifically to a limited set of goods or services, respectively, which are not included in the other categories of construction and maintenance, utilities, or transportation.

Greenhouse Gases (GHGs)	Compound gases that trap heat and emit longwave radiation in the atmosphere causing the greenhouse effect.
Indirect emissions	Emissions that are the result of activities from assets not owned or controlled by the City of Toronto, but that are indirectly affected by City activities, such as fuel combustion in a power plant to provide electricity to the City, or emissions from fertilizer production used to grow crops purchased by the City.
Kilotonne (kt)	A kilotonne, abbreviated as kt, is a metric unit equivalent to one thousand (10 ³) tonnes.
Lifecycle emissions	Emissions associated with the full life of a good or service, including material extraction, processing, production, transport, sale, use, and disposal.
Megatonne (Mt)	A megatonne, abbreviated as Mt, is a metric unit equivalent to one million (10 ⁶) tonnes.
NAICS	North American Industry Classification System, a classification of business establishments used by government and businesses in Canada, the U.S., and Mexico.
Net Zero emissions	Net zero emissions occurs when the amount of greenhouse gases released into the atmosphere and amount removed from the atmosphere are equal.
Sector-based emissions inventory (SBEI)	Toronto's 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).
Sub-category	Each CBEI emissions category consists of multiple sub-categories
Tonne (t)	One metric tonne (1,000 kilograms)
Upstream emissions	Emissions associated with the production, transport, and sale of goods or services, prior to purchase by the ultimate consumer.
Use phase emissions	The burning of fossil fuels (such as gasoline or natural gas) for transportation or home heating energy

Executive Summary

The City of Toronto's 2019 corporate consumption-based emissions inventory (CBEI) totaled 2.4 megatonnes (Mt) of carbon dioxide equivalent (CO₂e), which is significantly larger than the City's corporate sector-based emissions inventory (SBEI) of 0.74 MtCO₂e. The corporate CBEI includes all emissions in the corporate SBEI, plus the emissions associated with construction and maintenance, indirect emissions from energy use and transportation, and the purchase of other goods and services not otherwise accounted for. These emissions are based upon data in the City of Toronto's Capital Budget, Operating Budget, and corporate SBEI, and are organized into five categories: Construction and Maintenance, Utilities, Transportation, Goods, and Services. Toronto's community-wide CBEI was 39 MtCO₂e, which puts the City's corporate CBEI at about six per cent of the total community-wide emissions.

The largest sources of corporate consumption-based emissions were construction and maintenance, utilities, and transportation. Overall, Scope 3 emissions comprised 72 per cent of corporate CBEI emissions, followed by Scope 1 emissions at 26 per cent and Scope 2 at two per cent. Among City divisions, TTC, Toronto Water, and Transportation Services were the greatest sources of consumption-based emissions, driven heavily by significant expenditures on capital projects.

If the City meets its sector-based corporate emission reduction targets set forth in the TransformTO Net Zero Strategy¹ (NZS), it can readily achieve a goal of 30 per cent reduction in corporate CBEI emissions by 2040, with an interim goal of 10 per cent by 2030. The City of Toronto has also adopted the Cool Food Pledge², committing to reduce the GHG emissions associated with its corporate food procurement by 25 per cent by 2030. The City can also readily achieve its Cool Food Pledge target of a 25 per cent reduction in emissions associated with food by shifting meals towards greater use of plant-based and fish and poultry alternatives, while still achieving recommended nutrition levels.

¹ <https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/>

² <https://coolfood.org/pledge/>

Introduction

In 2019, Toronto City Council declared a Climate Emergency and pledged to accelerate the City's climate action plan, including the development of a plan to measure, monitor, and reduce consumption-based (lifecycle) emissions³. In 2021, the City adopted⁴ the TransformTO Net Zero Strategy (NZS)⁵, and an associated TransformTO Net Zero Strategy Short-Term Implementation Plan 2022-2025⁶. The NZS Short-Term Implementation Plan, item 15B commits the City to conducting a consumption-based emissions inventory and identifying targets that would meaningfully reduce consumption-based emissions. This corporate CBEI report is part of that commitment.

What is a corporate CBEI?

A corporate CBEI is a greenhouse gas (GHG) inventory that captures all GHG emissions associated with the activities of an organization and its consumption of other goods and services. This corporate CBEI report is a baseline CBEI for the municipal corporation of the City of Toronto (the City), accounting for all emissions generated by the City's activities and other associated goods and services it procures for City Agencies, Boards, Commissions, and Divisions (ABCDs). This corporate CBEI does not include emissions from non-City entities, such as residents, businesses, or other non-municipal government institutions. In addition, it does not include emissions associated with employee commutes.

Emission categories

- Scope 1 emissions⁷ are those that occur as a direct result of activity by the City, such as the emissions associated with driving a City-owned vehicle (e.g. transit buses, police patrols, etc.).
- Scope 2 emissions are emissions that occur indirectly as a result of the City's use of electricity, steam, heat, or cooling.
- Scope 3 emissions are the indirect result of activities by the corporation, and include all emissions associated with producing or disposing of goods and

³ Item 6f: <https://secure.toronto.ca/council/agenda-item.do?item=2019.MM10.3>

⁴ <https://secure.toronto.ca/council/agenda-item.do?item=2021.IE26.16>

⁵ <https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173758.pdf>

⁶ <https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173757.pdf>

⁷ U.S. Environmental Protection Agency, "Scope 1 and Scope 2 Inventory Guidance" <https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>

services purchased by the corporation⁸. Most emissions in the corporate CBEI are Scope 3 emissions, which predominantly result from the purchase of goods, services, and capital expenditures by the City.

The City of Toronto has previously prepared a corporate sector-based emissions inventory (SBEI)⁹. The City's SBEI calculates emissions associated with the City's use of transportation fuels and natural gas (Scope 1); electricity, steam, and cooling (Scope 2); and from the emissions associated with the City's production of waste and wastewater (a portion of Scope 3). This corporate CBEI expands upon the corporate SBEI by including estimates of the Scope 3 emissions associated with the City of Toronto's purchases of various other goods and services (including food), based on budgeted expenditures for 2019, as well as Scope 3 emissions associated with the production of gasoline and natural gas used by the corporation. Some of the additional categories of emissions added in the corporate CBEI include emissions associated with the construction buildings and infrastructure, purchases of vehicles, contracted services, telecommunications and IT services, electronics and computer hardware, chemical supplies, and more.

A corporate CBEI is important because it allows for a more comprehensive review of all GHG emissions under the scope of influence of the City. By incorporating both sector-based emissions, capital expenditures, and additional Scope 3 categories from other purchased goods and services, a corporate CBEI allows the City to identify potential new opportunities for achieving significant emission reductions.

This approach aligns with, and is driven by, existing City policies aiming to maximize greenhouse gas reductions. In addition, when adopting the NZS, Toronto City Council also gave direction to identify ways that the City can support the reduction of the greenhouse gas emissions associated with food the City procures, and to report back in the second quarter of 2023 on the status of corporate and community food-related emissions and recommended actions for the TransformTO 2026-2030 Short-term Action Plan, including a goal to maximize local, organic and fair trade food procurement¹⁰. The City has prepared a detailed report analyzing food procurement and strategies, and this report also captures and summarizes

⁸ U.S. Environmental Protection Agency, "Scope 3 Inventory Guidance" <https://www.epa.gov/climateleadership/scope-3-inventory-guidance>

⁹ City of Toronto Greenhouse Gas Emissions Inventory 2019, page 13: <https://www.toronto.ca/wp-content/uploads/2021/10/8f2e-2019-Inventory.pdf>

¹⁰ Item 17: <https://secure.toronto.ca/council/agenda-item.do?item=2021.IE26.16>

high-level findings from that report, as part of the discussion around consumption-based emissions associated with food procurement.

Methodology Summary

In this report, the amount of goods and services consumed through City of Toronto corporate activities is estimated based upon data from the City's operating and capital budgets for 2019. The City opted to utilize annual budget data as opposed to annual expenditure data for this initial baseline report due to the ease of collecting budget data and the strong relationship between budget and expenditure data, and the challenges obtaining detailed expenditure data from City Agencies, Boards, and Commissions which would require further outreach and engagement by City staff. (For more information, see Appendix A: Corporate Consumption-based Emissions Inventory Methodology).

Each budget was filtered to exclude expenditures related to employee salaries and benefits, direct social programs, inter-departmental transfers, or other expenditures for which emissions have been previously calculated¹¹ in the SBEI or the City's food emissions analysis in the Cool Food Pledge Baseline Report. Of the \$8.4 billion operating budget, \$2.1 billion was classified and \$6.3 billion was excluded, including \$308 million in direct energy expenditures and \$2.6 million in food and beverage that was previously calculated (the remaining \$6 billion in non-procurement expenses were largely employee salaries and benefits). All of the \$4.9 billion capital budget was included.

Of these \$2.1 billion in operating and \$4.9 billion in capital budget expenditures, each line item was evaluated and assigned to a corresponding North American Industry Classification System (NAICS) code¹² based upon the details of the line item.

Emission factors for assigned NAICS codes were estimated using best available lifecycle emissions data from the United States Environmental Protection Agency's

¹¹ Further details on this process are specified in Appendix A: Corporate Consumption-Based Emissions Inventory Methodology

¹² NAICS is the standard industry classification system used in the US, Canada, and Mexico to provide common definitions and a common statistical framework for industrial analysis. See <https://www.statcan.gc.ca/en/subjects/standard/naics/2017v2/introduction>

(US EPA's) U.S. Environmentally Extended Input-Output Model (USEEIO)¹³, which matches NAICS codes with industrywide average emissions per dollar. USEEIO coefficients, which are based on U.S. dollars, were converted to Canadian dollars for use with the City's budget data using Bank of Canada conversion rates for 2019¹⁴.

The resulting total was combined with the baseline greenhouse gas emissions estimate from the City's Cool Food Pledge Baseline Report¹⁵. The Cool Food Pledge report results were generated using data from the three major food-procuring City divisions: Senior Services and Long-Term Care (SSLTC), Shelter, Support and Housing Administration (SSHA), and Children's Services (CS). In 2019, these three divisions purchased 3,004 tonnes of food, with an estimated associated consumption-based emissions total of roughly 46 kilotonnes (kt) of carbon dioxide equivalent (CO₂e). The food-related consumption-based results included in this report are from the Cool Food Pledge baseline results.

The 2019 corporate SBEI was adjusted to incorporate lifecycle emission factors from transportation fuels and natural gas, and also incorporated into the overall corporate CBEI.

For additional details on the methodology, see Appendix A: Corporate Consumption-based Emissions Inventory Methodology.

2019 Corporate Consumption-Based Emissions Results

Toronto's corporate CBEI in 2019 was roughly 2.4 MtCO₂e. In contrast, the 2019 corporate SBEI only accounted for roughly 0.74 MtCO₂e, roughly 31 per cent of the corporate CBEI (which includes the corporate SBEI). Toronto's corporate CBEI is roughly evenly split between emissions associated with the operating and capital budgets. Figure 1 shows this breakdown, with additional detail specifying emissions within the operating budget from energy and transportation (including electricity, natural gas, gasoline, diesel, and other transportation fuels, from the SBEI) and other procurement, as well as details on emissions within the capital budget from

¹³ <https://www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-models>

¹⁴ <https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/>

¹⁵ The Cool Food Pledge Baseline Report uses the World Resources Institute (WRI) Cool Food Pledge Calculator to estimate emissions from City food procurement: <https://www.wri.org/research/tracking-progress-toward-cool-food-pledge>

construction and other equipment and services (percentages may not add up to 100 per cent due to rounding). This information is reproduced in Table 1.

Figure 1. City of Toronto Consumption-Based Inventory: Operating vs Capital Budget Emissions Breakdown (2019)

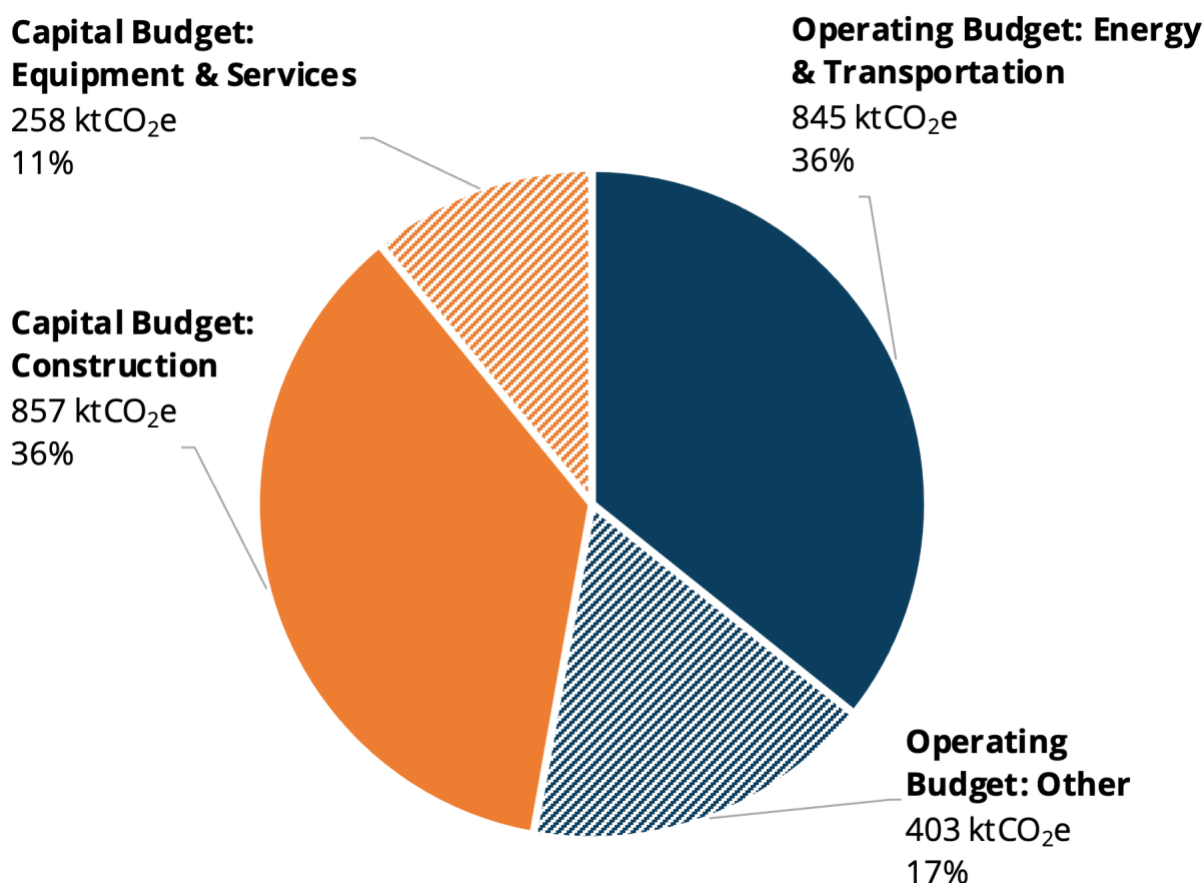


Table 1. City of Toronto Consumption-Based Inventory: Operating vs Capital Budget Emissions Breakdown (2019)

Budget Area	Emissions (ktCO ₂ e)	Per Cent
Operating Budget: Energy and Transportation	845	36%
Operating Budget: Other	403	17%
Capital Budget: Construction	857	36%

Capital Budget:		
Equipment & Services	258	11%
<i>Operating Budget Sub-Total</i>	<i>1,248</i>	<i>53%</i>
<i>Capital Budget Sub-Total</i>	<i>1,115</i>	<i>47%</i>
Total Emissions	2,363	100%

Toronto’s corporate consumption-based emissions are separated into five categories: Construction and Maintenance, Utilities, Transportation, Goods, and Services.

Construction and Maintenance emissions include all budget line items that were categorized under the construction sector (NAICS category 23), including construction of buildings (NAICS 236), heavy and civil engineering construction (NAICS 237), and specialty trade contractors (NAICS 238). Most of these emissions are from the capital budget.

Utilities emissions include all budget line items that were categorized under the utilities sector (NAICS 22), including water, sewage, and other systems (NAICS 2213), as well as all emissions from electricity and natural gas from the SBEI (adjusted to include Scope 3 emissions). Most of these emissions are from natural gas in the SBEI; natural gas is purchased through the operating budget.

Transportation emissions include all budget line items that were categorized under the transportation and warehousing sector (NAICS 48), including air travel (NAICS 481), truck transportation (NAICS 484), transit and ground passenger transportation (NAICS 485), and support activities for transportation (NAICS 488). Transportation emissions also includes all emissions from transportation fuels in the SBEI (adjusted to include Scope 3 emissions). Most of these emissions are from transportation fuels in the SBEI; these fuels are purchased through the operating budget.

Goods emissions include all budget line items that were categorized under the NAICS sectors for agriculture, forestry, fishing, and hunting (NAICS 11); mining, quarrying, and oil and gas extraction (NAICS 21); manufacturing (NAICS 31, 32, and 33); and wholesale and retail trade (NAICS 42, 44, and 45). These include live plantings (NAICS 1114), construction sand, salt, and gravel (NAICS 2123), animal

foods (NAICS 311), textiles and clothing (NAICS 313, 314, 315, and 316), wood and paper products (NAICS 321, 322, and 323), petroleum products (e.g., asphalt and plastic) and other chemicals (NAICS 324, 325, and 326), concrete and steel (NAICS 327 and 331), general hardware and other metal parts and supplies (NAICS 332), machinery and appliances (NAICS 333), computers and telecommunications equipment (NAICS 334), other electrical equipment and parts (NAICS 335), vehicles (NAICS 336), furnishings (NAICS 337), and miscellaneous products (NAICS 339). Goods also includes line items for which a best fit was found under various retail and wholesale categories due to data limitations, such as professional supplies (NAICS 4234), miscellaneous parts (NAICS 4239), building material supplies (NAICS 444), and other miscellaneous supplies (NAICS 453). The Goods category also includes emissions associated with food procured for the City's operations. Goods emissions are predominantly from the capital budget.

Services emissions include all budget line items that were categorized under the NAICS sectors for transportation services (NAICS 49); information (NAICS 51); finance and insurance (NAICS 52); real estate and rental and leasing (NAICS 53); professional, scientific, and technical services (NAICS 54); management of companies and enterprises (NAICS 55); administrative support and waste management and remediation services (NAICS 56); educational services (NAICS 61); health care and social assistance (NAICS 62); arts, entertainment, and recreation (NAICS 71); accommodation and food service (NAICS 72); other services (except public administration) (NAICS 81); and government (NAICS 92). These include postage, courier services, shipping and storage (NAICS 491, 492, and 493); computer software (NAICS 511); internet and phones (NAICS 517); banking fees (NAICS 522); property rentals (NAICS 531); vehicle and equipment rentals (NAICS 532); professional services (NAICS 541); miscellaneous business support services (NAICS 561); waste hauling (NAICS 562); educational expenses (NAICS 611); medical services (NAICS 621); entertainment expenses (NAICS 711); business travel accommodations (NAICS 721); catering (NAICS 722); maintenance and cleaning services (811 and 812); and membership fees and nonprofit grants (813). These Services emissions are predominantly from the operating budget.

Table 2 provides a breakdown of emissions by category and data source (operating budget, capital budget, and SBEI).

Table 2. City of Toronto Consumption-Based Emissions by Corporate Consumption Category and Data Source (2019)

Category	Operating Budget (ktCO₂e)	Capital Budget (ktCO₂e)	Total - Budget (ktCO₂e)	SBEI (ktCO₂e)	Total - All (ktCO₂e)
Construction and Maintenance	39	857	896	0	896
Utilities	11	2	13	531	544
Transportation	35	0	35	358	394
Goods	99	215	314	46	360
Services	129	41	170	0	170
TOTAL	313	1,115	1,428	935	2,363

Figure 2 shows the City of Toronto’s corporate consumption-based emissions in detail by category and scope, with details broken out in Table 3. Emissions associated with energy used for buildings and transportation indicated in Figure 1 and Table 1 are primarily comprised of the Scope 1 and 2 emissions of Utilities and Transportation, derived from the SBEI. These emissions from energy used for buildings and transportation also include some additional Scope 3 emissions associated with producing or transporting those fuels that were not originally included in the SBEI.

Figure 2. City of Toronto Consumption-Based Emissions by Corporate Consumption Category (2019)

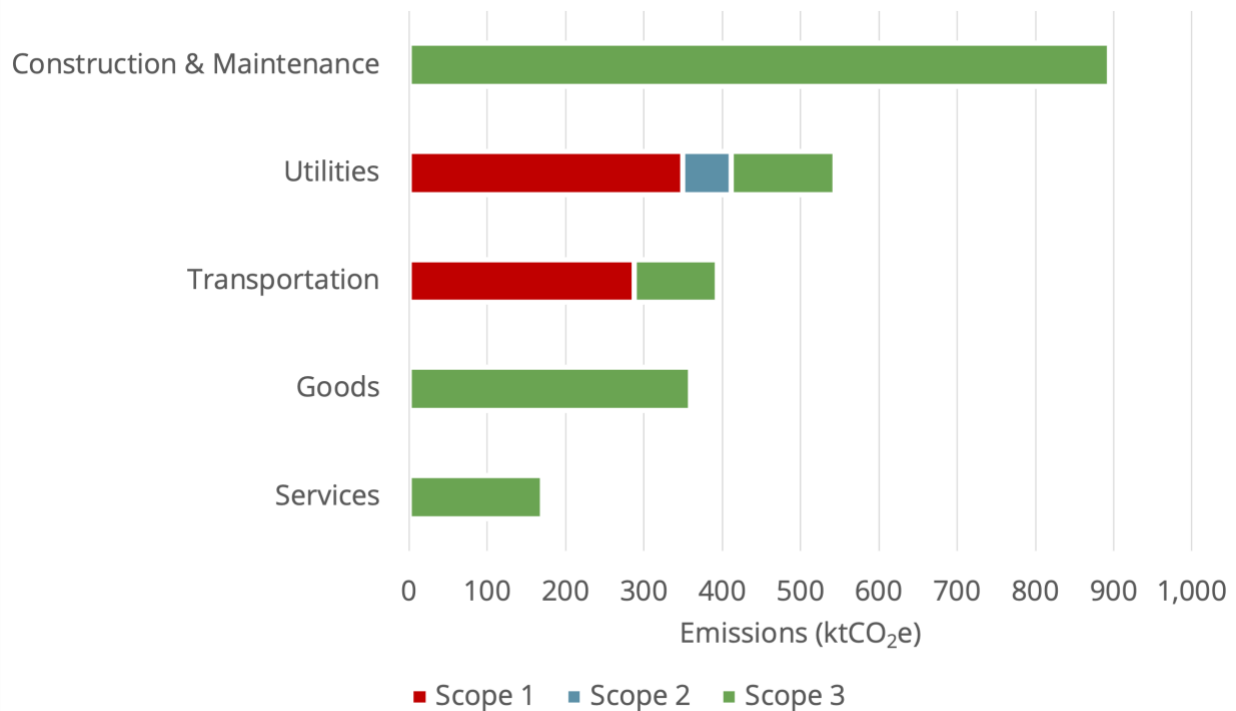
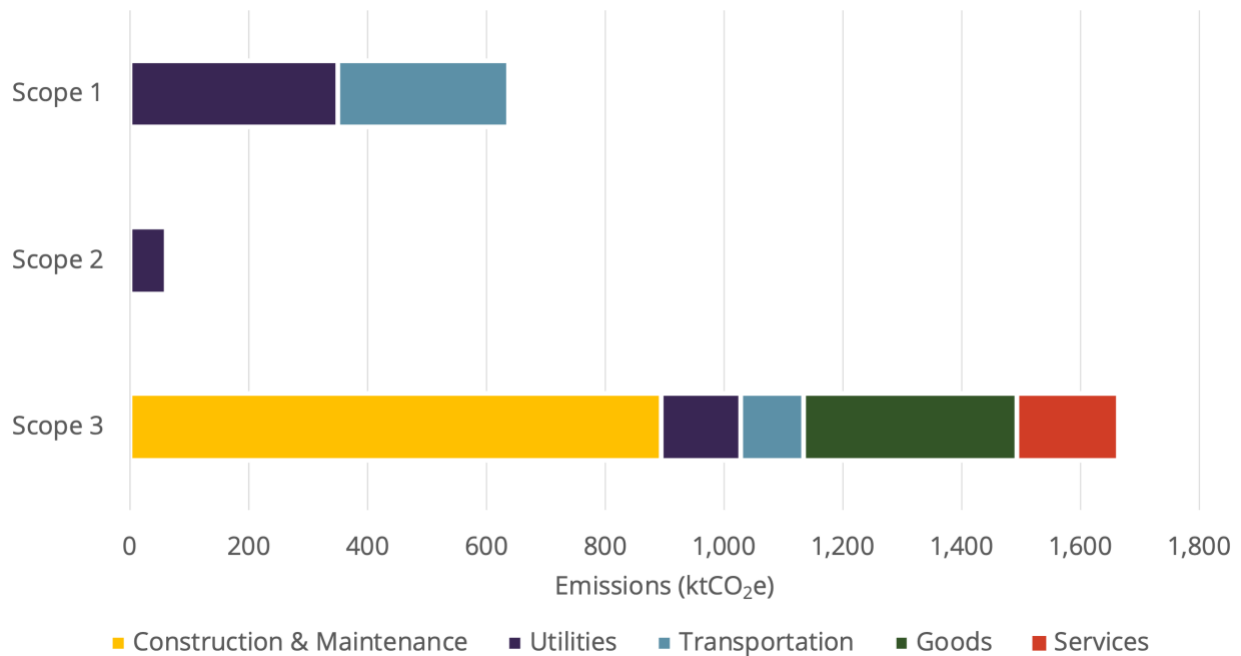


Table 3. City of Toronto Consumption-Based Emissions by Corporate Consumption Category and Scope (2019)

Category	Scope 1 Emissions (ktCO ₂ e)	Scope 2 Emissions (ktCO ₂ e)	Scope 3 Emissions (ktCO ₂ e)	Total Emissions (ktCO ₂ e)	Per Cent
Construction & Maintenance	0	0	895	896	38%
Utilities	350	61	133	544	23%
Transportation	287	0	106	394	17%
Goods	0	0	360	360	15%
Services	0	0	170	170	7%
TOTAL	637	61	1,664	2,363	100%

Figure 3 shows the full breakdown of corporate CBEI by Scope 1, 2, and 3. 70 per cent of the corporate CBEI emissions (1,664 ktCO₂e) are Scope 3, while 27 per cent (637 ktCO₂e) are Scope 1. Scope 2 emissions comprise roughly 3 per cent (61 ktCO₂e) of the corporate CBEI.

Figure 3. City of Toronto Corporate CBEI by Scope (2019)



Four city agencies, boards, commissions, or divisions (ABCDs) account for 69 per cent of emissions: the Toronto Transportation Commission, Toronto Water, Toronto Community Housing Corporation, and Transportation Services. The pie chart in Figure 4 compares the City’s corporate consumption-based emissions among these ABCDs with all other ABCDs to further detail the major sources of consumption-based emissions from corporate activities. Table 4 provides a detailed breakdown, while Table 5 provides a detailed breakdown of the “Other ABCDs” group.

Figure 4. City of Toronto Corporate Consumption-Based Emissions by ABCDs (2019)

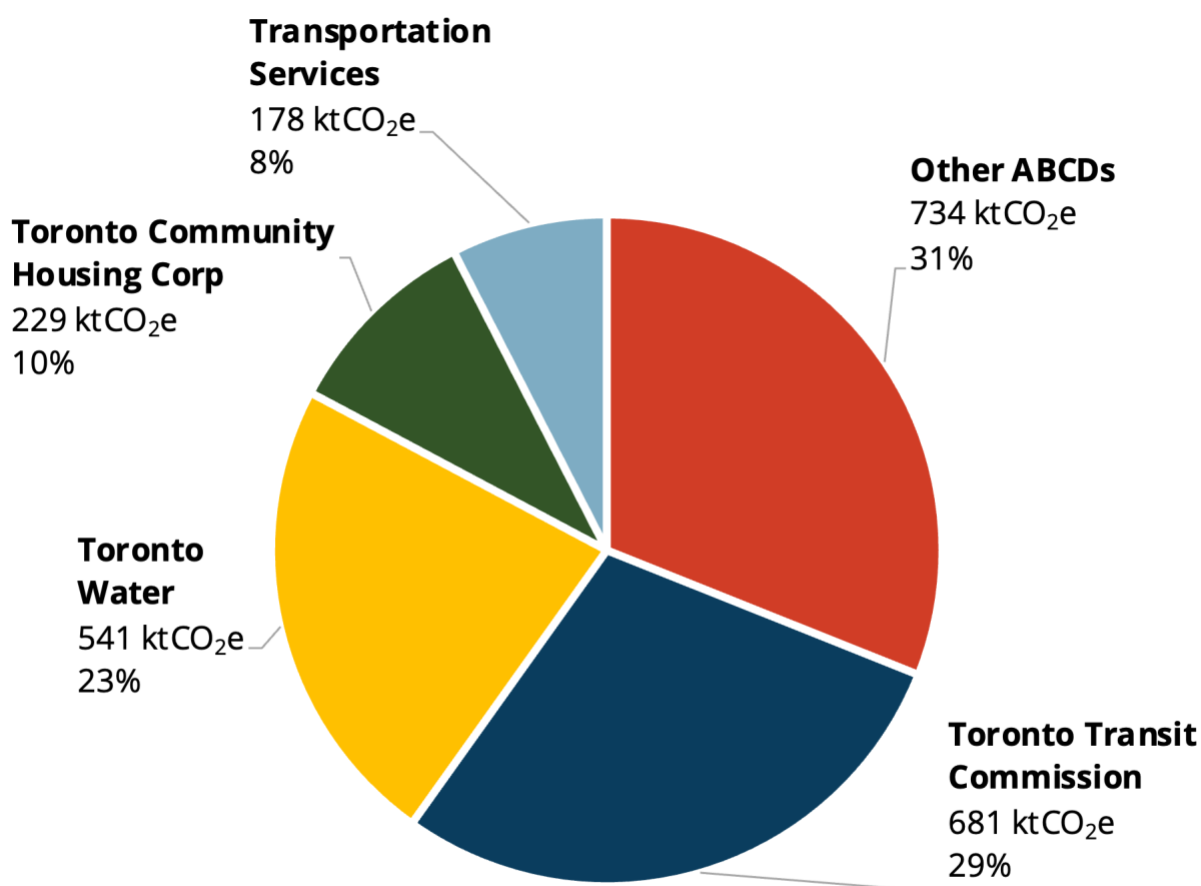


Table 4. City of Toronto Corporate Consumption-Based Emissions by ABCDs (2019)

Name	Operating Emissions (ktCO ₂ e)	Capital Emissions (ktCO ₂ e)	Total (ktCO ₂ e)	Per Cent
Toronto Transit Commission	419	314	734	31%
Other ABCDs	406	275	681	29%
Toronto Water	144	398	542	23%
Toronto Community Housing Corp	229	0	229	10%
Transportation Services	50	128	178	8%
TOTAL	1,248	1,115	2,363	100%

Table 5. City of Toronto Corporate Consumption-Based Emissions - Other ABCDs (2019)

Other ABCDs	Operating Emissions (ktCO₂e)	Capital Emissions (ktCO₂e)	Total (ktCO₂e)	Per Cent
Shelter, Support & Housing Administration	34.60	65.00	99.60	4%
Parks, Forestry & Recreation	53.68	33.30	86.98	4%
Fleet Services	43.14	19.13	62.27	3%
Solid Waste Management	45.75	13.98	59.73	3%
Facilities, Real Estate, Environment & Energy	7.11	45.16	52.27	2%
Toronto Police Service	35.40	9.18	44.58	2%
Long-Term Care Homes & Services	33.45	2.23	35.68	2%
Waterfront Revitalization Initiative	0.00	35.65	35.65	2%
Transit Studies	0.00	32.00	32.00	1%
Children's Services	21.02	4.33	25.35	1%
Toronto Zoo	23.67	1.61	25.29	1%
Corporate Real Estate Management	21.69	0.00	21.69	1%
Toronto Public Library	15.39	4.80	20.20	1%
Scarborough Subway Extension	0.00	20.13	20.13	1%
Non-Program Expenditures	12.88	0.00	12.88	1%
Toronto Employment & Social Services	12.14	0.25	12.39	1%
Toronto Parking Authority	6.75	4.62	11.38	<1%
Fire Services	8.69	0.81	9.49	<1%
Economic Development and Culture	5.78	3.08	8.86	<1%
Information & Technology	2.51	5.60	8.12	<1%
Toronto Public Health	6.45	0.35	6.80	<1%
Toronto Paramedic Services	5.42	0.40	5.82	<1%
Social Development, Finance & Administration	5.07	0.00	5.07	<1%

Other ABCDs	Operating Emissions (ktCO₂e)	Capital Emissions (ktCO₂e)	Total (ktCO₂e)	Per Cent
Toronto & Region				
Conservation Authority	1.22	3.65	4.87	<1%
Exhibition Place	1.96	1.50	3.46	<1%
Corporate Initiatives	0.00	2.92	2.92	<1%
Civic Theatres Toronto	0.00	2.42	2.42	<1%
City Clerk's Office	2.08	0.28	2.36	<1%
Association of Community Centres	1.94	0.00	1.94	<1%
Theatres	1.72	0.00	1.72	<1%
Office of the Controller	1.51	0.00	1.51	<1%
City Planning	0.53	0.81	1.34	<1%
Court Services	1.05	0.00	1.05	<1%
Toronto Employment and Social Services	0.95	0.00	0.95	<1%
Municipal Licensing & Standards	0.87	0.00	0.87	<1%
Non-Program Revenues	0.85	0.00	0.85	<1%
Financial Services	0.00	0.61	0.61	<1%
Engineering & Construction Services	0.54	0.00	0.54	<1%
City Council	0.51	0.00	0.51	<1%
311 Toronto	0.12	0.37	0.49	<1%
City Manager's Office	0.48	0.00	0.48	<1%
Affordable Housing Office	0.42	0.00	0.42	<1%
Toronto Building	0.40	0.00	0.40	<1%
Legal Services	0.38	0.00	0.38	<1%
Policy, Planning, Finance & Administration	0.29	0.00	0.29	<1%
CreateTO	0.25	0.00	0.25	<1%
Arena Boards of Management	0.25	0.00	0.25	<1%
Yonge-Dundas Square	0.24	0.00	0.24	<1%
Toronto District School Board	0.09	0.00	0.09	<1%
Office of the Chief Financial Officer	0.08	0.00	0.08	<1%
Auditor General's Office	0.04	0.00	0.04	<1%

Other ABCDs	Operating Emissions (ktCO₂e)	Capital Emissions (ktCO₂e)	Total (ktCO₂e)	Per Cent
Heritage Toronto	0.04	0.00	0.04	<1%
Office of the Ombudsman	0.02	0.00	0.02	<1%
Accountability Offices	0.00	0.01	0.01	<1%
Office of the Lobbyist Registrar	0.01	0.00	0.01	<1%
Mayor's Office	0.01	0.00	0.01	<1%
Integrity Commissioner's Office	<0.00	0.00	<0.00	<1%
TOTAL	419.45	314.19	733.65	31%

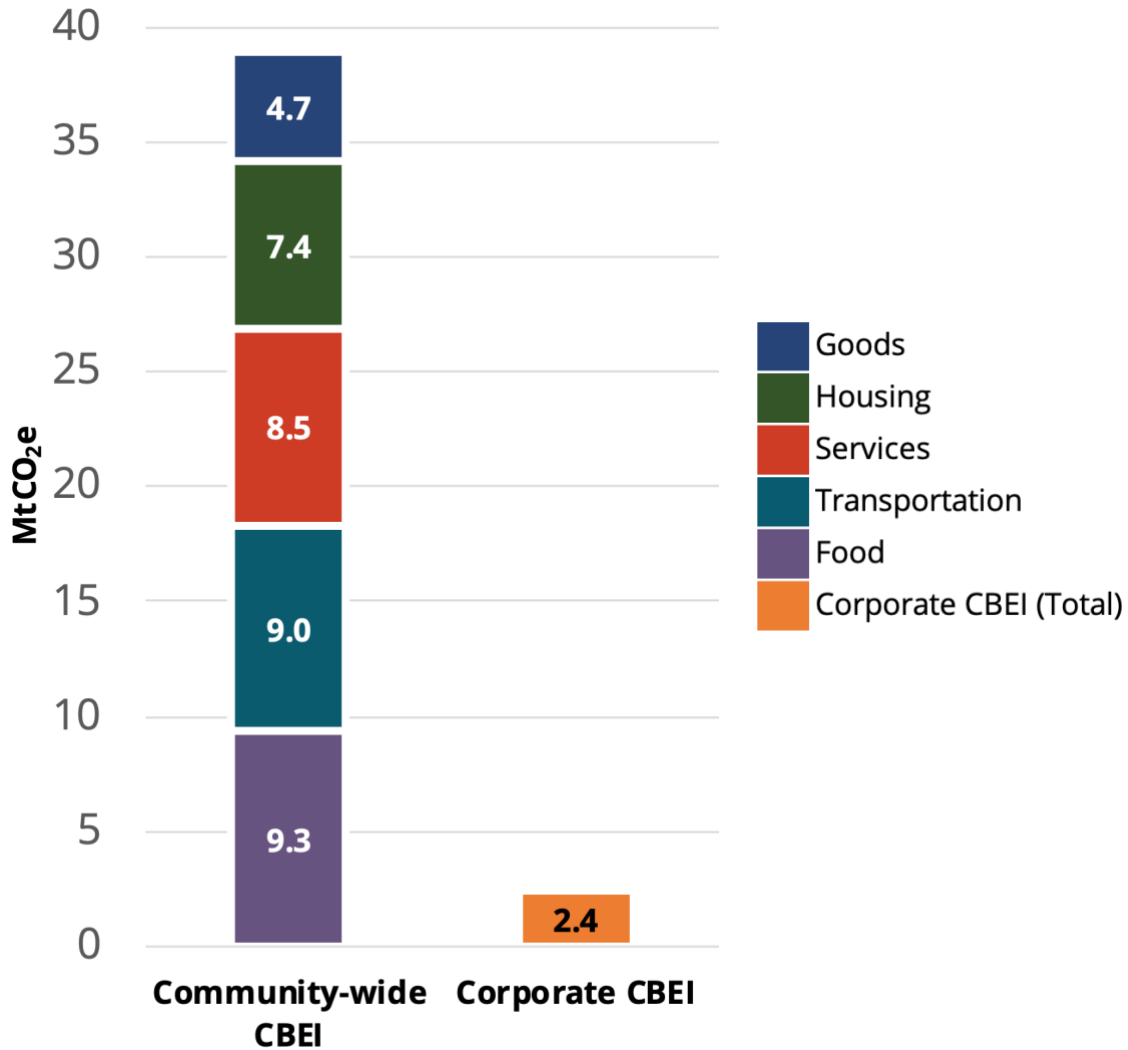
Some values may appear to be 0 due to rounding

Comparing Community-wide CBEI and the Corporate CBEI

In 2019, the average Toronto household generated roughly 34 tonnes of CO₂e. With 1,141,709 households in the city, the community-wide CBEI was roughly 39 MtCO₂e. With a corporate CBEI of 2.4 MtCO₂e, Toronto's corporate CBEI is roughly six per cent of the community-wide CBEI.

Figure 5 places the corporate consumption-based emissions inventory alongside the community-wide CBEI results. The corporate CBEI and community-wide CBEI are measuring different types of emissions, using different methodologies and do not overlap. However, this chart allows for comparing the overall magnitude of the emissions associated with the household consumption of all households in the city, versus the emissions associated with the activities and purchases of the corporation of the City of Toronto.

Figure 5. Toronto Community-wide vs. Corporate CBEI (MtCO_{2e}, 2019)



Discussion

Key Drivers of Consumption-Based Emissions

Overall, the key drivers of corporate consumption-based emissions are construction and maintenance, and energy used for buildings and transportation (primarily reflected in the Scope 1 portion of Utilities and Transportation). These account for 895 and 845 ktCO_{2e}, respectively, together making up roughly 70 per cent of total corporate consumption-based emissions.

Construction and maintenance is predominantly associated with the City's capital budget. Emissions in this category from activities in the operating budget only comprise 39 ktCO₂e, less than five per cent of the total. In the capital budget, of the remaining 856 ktCO₂e, linear infrastructure accounts for 430 ktCO₂e, or 50 per cent of capital budget construction & maintenance emissions (48 per cent of total construction and maintenance emissions). Construction and maintenance emissions are explored in further depth in the Buildings and Infrastructure Analysis report.

Emissions associated with energy and transportation derives from the SBEI and is a part of the total emissions from the operating budget categorized to utilities and transportation. Emissions from natural gas use makes up 425 ktCO₂e, or 50 per cent, of these emissions. Transportation fuels make up another 358 ktCO₂e, or 42 per cent, while electricity accounts for only 61 ktCO₂e, or 7 per cent. Of their respective categories, natural gas makes up 78 per cent of utilities, followed by electricity at 11 per cent; transportation fuels account for 91 per cent of transportation emissions. (Other emissions in these categories include waste and water, for utilities; and business travel and courier services, for transportation).

Key Drivers – ABCDs

The single ABCD with the greatest consumption-based emissions associated with its operations was the Toronto Transit Commission (TTC), accounting for 681 ktCO₂e, or about 29 per cent of the total corporate CBEI. These emissions derived from a combination of emissions-intensive capital purchases (buses and subway cars), the construction & maintenance of tracks and bridges, and direct operations of diesel-powered buses.

While the TTC has more emissions than any other City division, it likely *avoided* far more emissions than it generated. In 2019, the TTC served more than 1 billion riders¹⁶. Based on data from the Transportation Tomorrow Survey¹⁷, the average transit trip by Toronto residents was 6.5 km in 2016, for a total estimated passenger kilometers traveled of 6.5 billion km.

¹⁶ American Public Transportation Association Transit Statistics, <https://www.apta.com/research-technical-resources/transit-statistics/>

¹⁷ Transportation Tomorrow Survey, http://dmg.utoronto.ca/pdf/tts/2016/2016TTS_Summaries_Toronto_Wards.pdf

Had these riders instead driven alone to their destinations, they would have generated 1.75 MtCO₂e¹⁸ - roughly 2.3 times more than the 754 ktCO₂e generated by TTC. TTC's operations resulted in a significant net savings of emissions, highlighting the importance of public transit service and infrastructure as effective strategies for reducing community-wide consumption-based emissions.

TTC is unique, however, when compared to other divisions in that its services primarily provide low-carbon alternatives for Toronto residents. Most City divisions do not result in substantial avoided emissions, because their focus is on providing services which are not emissions-reducing. For example, the division with the next highest level of emissions was Toronto Water, at 541 ktCO₂e. This comprised 22 per cent of total corporate consumption-based emissions. The bulk of these emissions - 397 ktCO₂e, or 73 per cent - derived from planned capital expenditures on water and wastewater infrastructure, with the remaining 144 ktCO₂e, or 27 per cent, deriving from operating activities, including 101 ktCO₂e (19 per cent) from sector-based emissions associated with the conveyance, treatment, and disposal of drinking water and wastewater.

Toronto Water has active efforts to reduce and avoid emissions, such as effective flaring of methane produced in wastewater treatment to minimize GHG emissions. However, its operations overall primarily focus on meeting public health needs by providing clean water and wastewater services to Toronto residents, businesses, and visitors. As such, rather than avoiding emissions, Toronto Water's 461 ktCO₂e of emissions supported the delivery (and subsequent treatment) of some 323,469,280 m³ of water¹⁹, or roughly 0.0014 tCO₂e per m³.

Toronto Community Housing Corporation (TCHC) was the third largest source of emissions, with 229 ktCO₂e. These emissions were exclusively from the SBEI, and almost entirely from the use of natural gas to heat buildings (216 ktCO₂e, or 94 per cent).

Transportation Services (178 ktCO₂e) is the last major ABCD. The overwhelming majority of emissions from Transportation Services comes from planned capital projects (128 ktCO₂e, or 72 per cent), of which construction and maintenance work

¹⁸ Using average vehicle fuel economy data from the City of Toronto 2019 Community-Wide CBEI Report, 269.7 g/VKT on a lifecycle basis.

¹⁹ City of Toronto Open Data Portal, Water Billing by Ward (2019): <https://open.toronto.ca/dataset/water-billing-by-ward/>

makes up 122 ktCO₂e (95 per cent of the division's capital project emissions; 69 per cent of the division's total emissions). These projects are primarily associated with the construction and maintenance of streets and sidewalks (including bridges and traffic signals).

No other ABCD comprised more than 5 per cent of total emissions. These four ABCDs together accounted for a combined 1,628 ktCO₂e, or 69 per cent of total corporate consumption-based emissions.

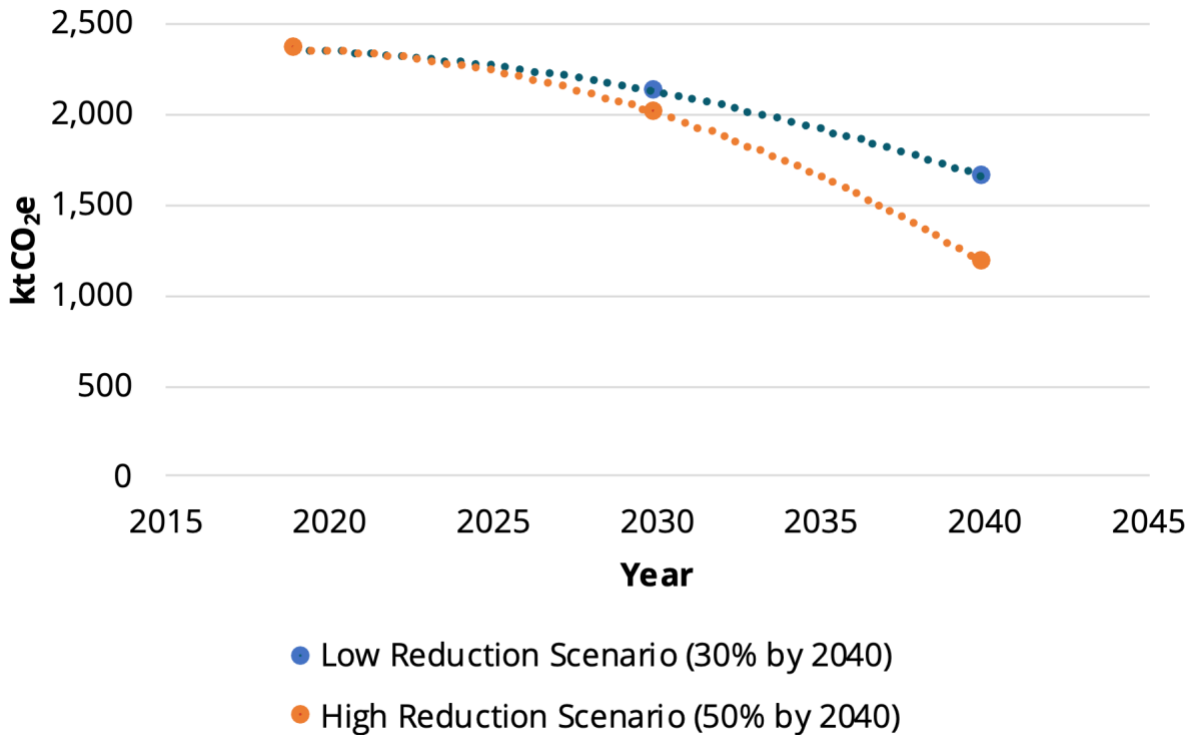
Reduction Strategies & Targets

Reduction Targets

At a minimum, the City of Toronto can feasibly achieve a 30 per cent reduction in corporate consumption-based emissions by 2040, with an interim target of 10 per cent by 2030, relative to a 2019 baseline. A potential stretch goal could be to achieve a 50 per cent reduction by 2040, with an interim target of 15 per cent by 2030²⁰, relative to a 2019 baseline. Figure 6 depicts these two potential paths.

²⁰ These policies should be adopted on a growth-adjusted basis, for emissions-generating activities: after adjusting for inflation, emissions should decrease when adjusted to a 2019 baseline level of activity, such as dollars of expenditures (for purchased goods & services emissions) or per unit of activity (e.g. passenger ridership, m³ of water delivered, building powered & heated, etc.) for City divisions.

Figure 6. Toronto Corporate CBEI Reduction Pathways



The City of Toronto already has a number of goals around reducing corporate emissions within the TransformTO NZS. These goals include achieving the following by 2030:

- City of Toronto corporate greenhouse gas emissions are reduced by 65 per cent over 2008 base year
- All City Agency, Corporation and Division-owned new developments are designed and constructed to applicable Toronto Green Standard Version 4 standard achieving zero carbon emissions, beginning in 2022
- Greenhouse gas emissions from City-owned buildings are reduced by 60 per cent from 2008 levels; by 2040, City-owned buildings reach net zero greenhouse gas emissions
- All City-owned facilities have achieved zero waste
- Generate and utilize 1.5 Million Gigajoules of energy from biogas
- Approximately 107,700 tonnes CO₂e per year are reduced through Organics Processing with Renewable Energy and Landfill Gas Utilization
- 50 per cent of the City-owned fleet is transitioned to zero-emissions vehicles
- 50 per cent of the TTC bus fleet is zero-emissions

- Greenhouse gas emissions from food the City of Toronto procures are reduced by 25 per cent

Direct emissions from the use of biodiesel, diesel, gasoline, and natural gas make up 33 per cent of the City's total corporate CBEI, with electricity comprising another 3 per cent. As a result, meeting these targets, and subsequently completing the transition to zero-emission vehicles and all-electric buildings throughout City operations by 2040, would achieve greater than a 30 per cent reduction in corporate consumption-based emissions. Additional "low-hanging fruit" for emissions reductions could come from reducing emissions associated with food procurement by moving to plant-based meals (a 25 per cent reduction in food emissions would reduce overall emissions by 0.5 per cent), or moving to 100 per cent carbon-free electricity (which would reduce emissions by 3 per cent).

Reduction Strategies

To achieve reductions in emissions greater than 30 per cent, the City would need to work to address emissions beyond utilities and transportation, such as construction and maintenance, goods, and services. Based on historical trends, economy-wide reductions in the emissions intensity of goods and services could be expected to contribute another 13 per cent in reductions by 2040, but this is not guaranteed.

The City of Toronto is already developing policies to reduce emissions associated with construction. Under the new proposed Toronto Green Standard (TGS) v4²¹, new corporate-owned construction must demonstrate an emissions intensity of less than 350 kilograms of CO₂e per square meter (kgCO₂e/m²), or 250 kgCO₂e/m² at the Tier 3 level²¹. In contrast, a recent study found that the average new commercial office / retail building in Ontario had an emissions intensity of 327 kgCO₂e/m², while other non-residential buildings had an average intensity of 457 kgCO₂e/m².²² As a result, the new TGS v4 policies might reduce emissions from new construction by up to 45 per cent.

²¹ TGS v4 <https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/>

²² Mantle Developments, Ontario's first benchmarking of embodied carbon for large buildings: <https://mantledev.com/publications/ontarios-first-benchmarking-of-embodied-carbon-for-large-buildings/>

However, only about 39 ktCO₂e, or less than two per cent, of the City's consumption-based emissions derived from new construction in 2019 (based on operating permit data included in the Buildings and Linear Infrastructure Emissions Analysis report). While new buildings present a relatively straightforward opportunity for the City to reduce consumption-based emissions, and updates to the TGS should be adopted to further reduce emissions from new construction, this is unlikely to have a substantial impact on the City's corporate CBEI.

Meanwhile, 448 ktCO₂e (19 per cent) of emissions are from linear infrastructure. Linear infrastructure construction presents a much larger opportunity for potentially achieving emissions reductions than new buildings. For additional details, see the standalone Buildings & Infrastructure Analysis report.

Reducing Food-Related Consumption-Based Emissions and Maximizing Local, Organic and Fair Trade Food Procurement

The City of Toronto has adopted the Cool Food Pledge²³, committing to reduce the GHG emissions associated with its food procurement by 25 per cent by 2030.

In 2022, the City prepared "The City of Toronto's Cool Food Pledge Baseline Phase 2 Report" (Cool Food Pledge report). This report analyzed the City's procurement of food by three divisions: Seniors Service and Long Term Care (SSLTC); Shelter, Support & Housing Administration (SSHA); and Children's Services (CS), consisting of seven million meals served and 3,000 tons of food. These three divisions were the focus of this study because they are the primary purchasers of food among City of Toronto agencies, boards, commissions, and divisions.

This food procurement resulted in about 46 ktCO₂e (about two per cent of the total corporate CBEI). Of those emissions, nearly half were attributable to beef and lamb alone, which comprised only three per cent of total food purchased.

Based on this analysis, Toronto can readily meet its Cool Food Pledge target of reducing food-related emissions by 25 per cent by 2030, relative to a 2019 baseline, through shifting menus away from beef and lamb and towards plant-based options with some low-emission meats (such as seafood and poultry).

The Cool Food Pledge report outlines four specific menu shift strategies:

²³ <https://coolfood.org/pledge/>

- 1) Delicious center-of-plate meals with plant-based proteins, to make plant-based meal options as appealing as animal-based meals;
- 2) Increasing vegetables on the plate, shifting from a meat-centered plate with a side of vegetables to a vegetable-centric plate with meat on the side;
- 3) Blended meat dishes, which combine both meat and plant-based proteins; and
- 4) Shifting meat, goat and pork to more poultry or fish dishes.

There are multiple considerations to include when deploying these strategies, and any menu changes must be planned closely with front-line nutrition managers and staff who best know the City's clients. For instance, the Cool Food Pledge report noted that in long-term care, there are concerns that further reductions in beef and lamb could pose difficulties in ensuring residents are still able to get sufficient protein (since plant-based recipes typically require larger portion sizes to meet protein requirements, and larger quantities can be challenging for residents in long-term care to consume). In SSHA, clients are expressing desires for increased quantities of meat.

In addition to the Cool Food Pledge's commitment to reduce food emissions, the City of Toronto has also adopted a goal of maximizing local, organic and fair trade procurement²⁴. The Cool Food Pledge report also addresses this, proposing that the City:

- 1) Include local food purchasing priorities and environmentally responsible purchasing practices in the background information for all food procurement documents;
- 2) Require bidders to describe their approach to identifying any food products purchased that are "local" to Ontario; and
- 3) Require bidders to describe their ability to identify certified sustainable, fair trade, and organic food products purchased.

Because existing procurement rubrics do not include evaluation of these criteria, the Cool Food Pledge report also proposes adding scoring criteria that align with these requirements.

²⁴ Item 17: <https://secure.toronto.ca/council/agenda-item.do?item=2021.IE26.16>

The Cool Food Pledge report effectively identifies necessary steps and actions for the City to maximize its procurement of available local, organic, and fair trade food procurement.

Going beyond the Cool Food Pledge report's recommendations would be challenging, and opportunities are limited. If the City wanted to go further, the next steps would be to support the protection, development, and expansion of local food production. Due to Toronto's predominantly built-up and urbanized form, efforts around encouraging the development of additional local food production would likely be limited to processed food manufacturing, which are not a focus of the Cool Food Pledge or the C40 Good Food Cities Declaration²⁵. Toronto could also help protect local farmland through existing plans to encourage infill development, and by supporting regional, provincial, or national policies to limit farmland conversion and greenfield development.

Further Analysis and Progress Monitoring

The methodology used in this report is a high-level, top-down approach that is best used for highlighting areas of corporate consumption that are likely to be the largest contributors to emissions. However, because it relies on (U.S.) national average data, it does not reflect Toronto's specific purchasing choices; only the City's allocation of funds to different industry sectors. There are two potential approaches that the City of Toronto could explore to improve this methodology and better monitor, track, and reduce emissions in the future.

Life-Cycle Assessment

In order to effectively and quantifiably monitor, track, and reduce emissions associated with the corporation's consumption of goods and services, the City would need to require and evaluate product-specific lifecycle assessments (LCAs) when procuring major budget items (e.g. greater than \$1 million). A threshold of \$1 million would capture 84 per cent of operating budget procurement emissions (i.e. not including SBEI emissions), as well as 97.5 per cent of capital budget emissions.

A product-specific LCA would entail a custom analysis of the specific good or service being offered, and accounting for all GHG emissions involved in the production, transport, and sale or other provision of the good or service. Presently, Toronto's

²⁵ <https://www.c40.org/news/good-food-cities/>

corporate CBEI is limited in that only U.S. national average emission factors for a given industry sector are available for evaluating the GHGs associated with each budget line item. Deploying product-specific LCAs where available would better allow Toronto to track and monitor its corporate consumption-based emissions, and also enable the evaluation of competitive bidders to include quantifiable environmental factors (such as the emissions per dollar associated with a given good or service).

However, depending on implementation, an LCA-driven approach to procurement could potentially pose a significant barrier to procurement, as most vendors are likely unfamiliar with LCA tools. Preparing an LCA as part of a proposal could add significant time and cost for bidders, and would also require additional staff time to review LCA information when evaluating bids. The City of Toronto could conduct a pilot project that awards preference to bids with an LCA, but this would also require additional staff time for review and evaluation of the LCA.

Procurement-Based Approach

As an alternative to a strict product-driven LCA procurement process, the City of Toronto could update and strengthen its existing Environmentally Responsible Procurement (ERP) policy. The ERP policy was first adopted in 1999²⁶, though some divisions (such as TTC) did not implement it until 2008²⁷. However, the ERP is currently limited in its scope and application – not all RFPs issued by the City are subject to ERP policies.

An updated ERP should include the following:

- Detailed specifications, by product type, for strategies to achieve GHG reductions and other environmental goals, and associated procurement requirements;
- Requirements for disclosure of sustainability & GHG practices from suppliers' operations (e.g. corporate sustainability plans or certifications); and

²⁶ City of Toronto Purchasing & Materials Management Division, Environmentally Responsible Procurement (2007): https://www.toronto.ca/wp-content/uploads/2017/08/8e27-environment_procurement.pdf

²⁷ TTC, Green Procurement, <https://www.ttc.ca/doing-business-with-the-ttc/Procurement-and-Category-Management/green-procurement>

- Bidding preferences or minimum requirements around supplier and product sustainability metrics.

The City can look to a number of different programs and jurisdictions for examples to achieve this.

In 2016, the Toronto City Council adopted a Social Procurement Program (SPP)²⁸, to support small and diverse suppliers. This program applies to all procurements greater than \$3,000, with varying requirements depending on contract size and the potential opportunities for achieving workforce development goals. This tailoring of the SPP based upon contract needs is an effective approach to advancing City goals through procurement and should serve as a model for updating the ERP.

The federal Government of Canada also has a “Greening Government Strategy,” which includes strategies for green procurement²⁹. With support from the International Reference Center for Life Cycle Assessment and Sustainable Transition (CIRAIG), the federal government also prepared an inventory of emissions associated with procurement³⁰ and associated reports, including procurement recommendations. These are ultimately reflected in Public Services and Procurement Canada’s *Green Procurement Plans and Guide to Completion*³¹, which include detailed procurement checklists³² and separate scorecards for goods³³ and services³⁴ that the City of Toronto could use as a reference.

Lastly, other jurisdictions across North America have strengthened sustainable purchasing requirements:

²⁸ City of Toronto Social Procurement Program <https://www.toronto.ca/business-economy/doing-business-with-the-city/social-procurement-program/>

²⁹ Government of Canada, Greening Government Strategy: A Government of Canada Directive <https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html#toc3-5>

³⁰ Government of Canada’s Greenhouse Gas Emissions Inventory <https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/government-canada-greenhouse-gas-emissions-inventory.html>

³¹ <https://www.tpsgc-pwgsc.gc.ca/app-acq/ae-gp/pae-gpp-eng.html>

³² <https://www.tpsgc-pwgsc.gc.ca/app-acq/ae-gp/npaea-ngppa-eng.html>

³³ <https://www.tpsgc-pwgsc.gc.ca/app-acq/ae-gp/npaeb-ngppb-eng.html>

³⁴ <https://www.tpsgc-pwgsc.gc.ca/app-acq/ae-gp/npaeb-ngppbs-eng.html>

- 1) Vancouver, BC requires suppliers to meet environmental standards in a Supplier Code of Conduct³⁵;
- 2) Boulder County, CO has specific requirements for environmental purchasing of paper products, water, landscaping, and other products³⁶, and requires vendors to submit a sustainability questionnaire when responding to RFPs³⁷;
- 3) City of Portland, OR has detailed guidance and best practices for sustainable procurement of a wide range of product categories³⁸;
- 4) City and County of San Francisco, CA established detailed environmental and health issues to track for a wide range of product categories³⁹ and maintains an updated list of green products and purchasing specifications for other SF City departments to use⁴⁰; and
- 5) The U.S. Federal Government maintains a database of federal green purchasing requirements, including optional practices, by product and service category⁴¹. It is also developing new requirements for vendors to publicly disclose Scope 1, 2, and 3 emissions and set science-based emission reduction targets⁴².

While these other governments have strong sustainable procurement policies, none of those listed above have published a corporate CBEI, or other Scope 3 analysis, that measures and tracks the environmental impact of their purchases.

³⁵ City of Vancouver Sustainable Purchasing: <https://vancouver.ca/green-vancouver/sustainable-purchasing.aspx>

³⁶ Boulder County Green Purchasing & Zero Waste: <https://bouldercounty.gov/environment/sustainability/green-purchasing/>

³⁷ Sample RFP with questionnaire: Boulder County Consumption-Based Emissions Inventory, pages 12-16: <https://assets.bouldercounty.gov/wp-content/uploads/2022/05/RFP-7348-22.pdf>

³⁸ City of Portland Sustainable Procurement Policy: <https://www.portlandoregon.gov/bfrs/article/695574>

³⁹ City & County of San Francisco, Targeted Product Categories List Environmentally Preferable Purchasing 2006-08: https://sfenvironment.org/sites/default/files/policy/sfe_th_targeted_product_categories_envres_007-06-coe.pdf

⁴⁰ City & County of San Francisco, Buying Green: <https://sfenvironment.org/city-purchasing-buying-green>

⁴¹ Green Procurement Compilation: <https://sftool.gov/greenprocurement>

⁴² Inside Energy & Environment, "US Government Proposes Rule Requiring Major Federal Contractors to Disclose Greenhouse Gas Emissions and Establish Science-Based Emission Reduction Targets" <https://www.insideenergyandenvironment.com/2022/11/us-government-proposes-rule-requiring-major-federal-contractors-to-disclose-greenhouse-gas-emissions-and-establish-science-based-emissions-reduction-targets/>

Beside the federal Government of Canada⁴³, few governments have prepared corporate CBEIs, and fewer still have published them. Some examples of government entities that have prepared corporate inventories which account for Scope 3 emissions from procurement include:

- 1) King County, WA, prepared an analysis of the emissions associated with its procurement of goods and services in 2009⁴⁴. No updates have been published since.
- 2) The City of London, England (a small municipality of roughly 1 square mile in the center of London, England, not to be confused with the Greater London Authority) published a Climate Action Strategy that includes an estimate of Scope 3 emissions and set targets for the City of London Corporation to reduce emissions⁴⁵. The City publishes and maintains a Climate Action Dashboard⁴⁶ tracking progress.
- 3) The University of California, Berkeley prepared a supply chain carbon footprint based on the university's procurement expenses in 2009⁴⁷. However, this inventory has not been updated since⁴⁸.

Overall, while a stronger ERP would not as readily lead to quantified emission reductions as would be achieved with detailed LCAs for all procurement, a strengthened ERP would be easier to implement and follow, has substantial precedent and resources for the City to draw upon, and can still achieve many of the same goals and objectives. Future work to develop the ERP can also incorporate

⁴³ Government of Canada, Greening Government Strategy: A Government of Canada Directive <https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html#toc3-5>

⁴⁴ King County, Implementation Plan for a Carbon Neutral King County Government, <https://kingcounty.gov/~media/services/environment/climate/documents/190228-operational-carbon-neutral-plan.ashx?la=en>

⁴⁵ City of London Climate Action Strategy, <https://www.cityoflondon.gov.uk/assets/Services-Environment/climate-action-strategy-2020-2027-20-10-20.pdf>

⁴⁶

<https://app.powerbi.com/view?r=eyJrIjoiOGVjNmNmYjltZWQwZS00ZDUyLTg3ZTctYWY2MGQ1YzQ4NTE3IiwidCI6IjlmZTY1OGNkLWlzY2QtNDA1Ni04NTE5LTMyMjlmZmZmE5NmJlOCJ9>

⁴⁷ Doyle, K. "Converting university spending to greenhouse gas emissions: A supply chain carbon footprint analysis of UC Berkeley" https://sustainability.berkeley.edu/sites/default/files/DoyleK_Thesis_UCB2009SupplyChainCarbonFootprint.pdf

⁴⁸ UC Berkeley Sustainability & Carbon Solutions: <https://sustainability.berkeley.edu/carbon-neutrality/greenhouse-gas-inventory>

estimating the GHG emission reduction and other benefits from the policy, allowing the City to calculate the ERP's effects and track progress towards achieving the City's corporate CBEI emission reduction targets.

Other Strategies

In addition to the strategies mentioned above, the City could also work with CIRAIG to update and improve Open IO Canada to be more widely and readily accessible. Open IO Canada aims to be an open-source input-output LCA model, with details at the province level, that could potentially replace the use of USEEIO for emission factors, providing the City with more locally accurate data. However, at present, the tool does not have a readily available table of supply chain GHG emission factors by industry with emissions per dollar to use for those emissions factors. In addition, no methodology documentation is available, and software documentation is limited. As a result, it is not yet suitable for widespread adoption.

For future monitoring using the current methodology, the City could either continue to use budget data, or switch to procurement data. Existing budget categorizations can be used in future years to assist with assigning NAICS codes and emission factors to future line items. Large language models (LLMs) can also be potentially helpful for assigning NAICS codes in the future, as LLMs which are built with knowledge of NAICS classifications can generate useful predictions of appropriate NAICS assignments based upon the details provided in budget or procurement line items.

Conclusion: Corporate Consumption-Based Emissions

In 2019, Toronto's corporate consumption-based emissions totaled 2.4 MtCO_{2e} – nearly triple the emissions associated with the City's corporate sector-based inventory alone. Toronto's community-wide CBEI was 39 MtCO_{2e}, leaving the City's corporate CBEI at about seven per cent of the total community-wide emissions.

The largest sources of corporate consumption-based emissions were construction and maintenance, utilities, and transportation. Within the utilities and transportation categories, most emissions were derived from the SBEI, associated with energy used for buildings or transportation.

If the City meets its sector-based emission reduction targets set forth in the NZS, Toronto can readily achieve a goal of 30 per cent reduction in corporate CBEI

emissions by 2040, with an interim goal of 10 per cent by 2030, relative to a 2019 baseline. The City can also readily achieve its Cool Food Pledge target of a 25 per cent reduction in emissions associated with food by shifting meals towards greater use of plant-based and fish & poultry alternatives.

Appendix A: Corporate Consumption-based Emissions Inventory Methodology

The corporate CBEI was generated using the City of Toronto's 2019 Capital and Operating budgets, retrieved from the Toronto Open Data Portal, and combined with the City's existing SBEI and the Cool Food Pledge report. This process involved multiple steps:

- 1) Preparing City budget data, first by City staff and then with additional preparation work completed by EcoDataLab;
- 2) Adjusting SBEI data to incorporate life-cycle emission factors and identify emissions by scope; and
- 3) Combining all emissions to produce a cohesive inventory.

City of Toronto staff budget data classifications for Corporate CBEI

The City of Toronto's 2019 Corporate CBEI uses activity data in the form of the 2019 annual municipal budget (combination of the operating and capital budgets). The City's budget data is publicly available from Toronto's Open Data Portal⁴⁹. The operating budget dataset used is the "Budget - Operating Budget Program Summary by Expenditure Category,"⁵⁰ and the capital budget dataset used is the "Budget - Capital Budget & Plan By Ward (10 yr Approved)"⁵¹.

To produce the baseline Corporate CBEI for 2019, the City opted to utilize annual budget data as opposed to annual expenditure data. Expenditure data is more ideal to use as it reflects actual expenses incurred by the City, instead of planned expenditures (as in the budget data). Budget data represent estimated expenses only and are therefore less accurate than expenditure data. There is a strong relationship between budget and expenditure data, as established through variance analysis of City of Toronto divisions' budgets and expenditures performed by City staff⁵². Comparing the budget versus the trial balance sheet (i.e. expenditures), staff consistently report a difference of less than ten per cent, and,

⁴⁹ <https://open.toronto.ca/>

⁵⁰ <https://open.toronto.ca/dataset/budget-operating-budget-program-summary-by-expenditure-category/>, "approved-operating-budget-summary-2019" file

⁵¹ <https://open.toronto.ca/dataset/budget-capital-budget-plan-by-ward-10-yr-approved/>, "2019-2028-capital-budget-and-plan-details" file

⁵² City staff examine City divisions' annual budgeted versus actual expenditures, however, they do not perform the same analysis of City Agencies, Boards, and Commissions.

most consistently, report an approximately five to seven per cent discrepancy. The uncertainty associated with this level of discrepancy (five to seven per cent) is considered acceptable for the calculation of the City's first Corporate CBEI. Future iterations of the Corporate CBEI will aim to utilize expenditure data as opposed to budget data to enhance the accuracy of the CBEI results. Challenges associated with using expenditure data include obtaining detailed expenditure data from City Divisions through an internal data collection process, as well as detailed expenditure data from City Agencies, Boards, and Commissions which will require further outreach and engagement by City staff.

Operating budget data

The annual operating budget contains the following data fields⁵³ for budget line items:

- Program - Name of program, division or agency
- Service - A detailed account of key offerings that are associated with each program currently delivered by a division.
- Activity - A sub-set of the defined service, which includes unique processes and a discrete output delivered to the client(s)
- Category Name - Category of Expense / Revenue
- Sub-Category Name - Sub-Category of Expense / Revenue
- Commitment item - Commitment items classify budget transactions into revenue and expenditure items
- Expense/Revenue - Indicate whether this item is Expense or Revenue
- Year - Recommended or Approved Budget of the budget year (e.g. 2019)

The following steps were applied to the above data set:

- 1) **Remove non-expense line items:** The operating budget data were filtered to remove line items with Expense/Revenue field values of "Revenue," as these do not represent activity data (i.e. spending) by the City. The data were also filtered to remove line items with Year values less than or equal to \$0, as these likewise do not represent activity data.
- 2) **Remove selected Sub-Category Names:** Line items with the following Sub-Category Names were removed, as these do not represent activity data (i.e.

⁵³ Source: Toronto Open Data.

spending) by the City that is relevant to the consumption-based emissions inventory approach:

Table 6. Operating budget line item values excluded from the Corporate CBEI

Field	Excluded values
Sub-Category Name	Casual salaries
	Contributions to capital
	Contributions to reserves/reserve funds
	Craft trade salaries
	Debt charges
	Part time salaries
	Permanent salaries
	Temporary salaries
	Blank cells

These Sub-Category Name values were excluded from the Corporate CBEI because they are budget items that result in consumption behaviours outside the purview of the corporation of the City of Toronto’s budgetary process. For example, salaries represent a transfer of funds from the City to employees, who then allocate their salaries to goods and services of their choosing. Emissions associated with employees’ spending is outside the boundary of the corporate CBEI, and is instead captured within the community-wide CBEI. Similarly, contributions to capital, reserves/reserve funds, and debt charges are not considered within the boundary of the corporate CBEI as they are not direct expenditures on City goods or services.

- 3) **Categorize each line item by applicable emissions factor:** To assign emissions factors to the activity data, the nature of each operating budget line item was examined. Each line item has a combination of Category Name, Sub-Category Name, and Commitment Item, within each Program, Service, and Activity type. This combination of descriptive field values was used to categorize the type of spending associated with each line item.

Where needed, additional descriptive information beyond what is provided in the operating budget dataset was retrieved from the City of Toronto’s Cost Element Guide (2015), an internal document prepared by the Accounting

Services Division that describes revenues earned and expenditures incurred for the various Commitment Items in the operating budget.

Line items were categorized by the North American Industry Classification System (NAICS)⁵⁴ industry codes that correspond to the type of spending specific to each line item, in order to match it to emission factors from the U.S. EPA's U.S. Environmental Extended Input-Output Model (USEEIO)⁵⁵. USEEIO bridges the gap between consumption activity data (dollars) and emissions (tCO₂e). Each industry code has an associated emissions factor, which can then be multiplied by the dollar amount of a given line item to estimate consumption-based emissions for that budget line item. These emission factors represent "cradle-to-gate" or upstream emission factors, including all emissions that occur in the life cycle of a material, product or service up to the point of sale by the producer. USEEIO is the U.S. EPA's recommended data source for organizations looking to calculate Scope 3 emissions from purchased goods and services⁵⁶, and the use of a "cradle-to-gate" emission factor is the recommended approach under the GHG Protocol for calculating emissions from purchased goods, services, and capital goods⁵⁷.

The majority of budget line items less than one million dollars in value were not assigned USEEIO commodity codes at the individual level by staff in order to focus efforts on processing line items with the largest potential CBE impact. These smaller budget items account for approximately six per cent of the operating budget's total value (considering only those line items included up to this step of the analysis, or six per cent of approximately \$13.7 billion in operating budget costs). Certain line items less than one million dollars in value were assigned USEEIO commodity codes by virtue of belonging to the same unique combination of Category Name, Sub-Category Name, and Commitment Item, within each Program and Service, as larger (at least one million dollar value) line items, and thus were batch categorized along with those larger line items.

⁵⁴ <https://www.statcan.gc.ca/en/subjects/standard/naics/2017v2/introduction>

⁵⁵ <https://www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-models>

⁵⁶ U.S. EPA Scope 3 Inventory Guidance, <https://www.epa.gov/climateleadership/scope-3-inventory-guidance>

⁵⁷ World Resources Institute Greenhouse Gas Protocol "Technical Guidance for Calculating Scope 3 Emissions (version 1.0)" https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

Categorized activity data from the operating budget were then reviewed by EcoDataLab. After review and discussion with the City, some NAICS codes were updated with alternative codes that more accurately reflected the category of expenditure. EcoDataLab subsequently reviewed and classified all other uncategorized line items based upon guidance and information provided by the City, using a bulk classification approach based on Category Name, Sub-Category Name, and Commitment Item. In some instances, large language models were queried to assist with identifying the most appropriate NAICS codes for certain commitment items, with human review and verification.

- 4) **Determine which line items are “Services to employees” and “Services to residents”:** Though not typically part of a Corporate CBEI, the analysis included identifying operating budget line items that would be considered “services to employees” or “services to residents.” These were categories where the City is making an expenditure on behalf of employees or residents that would already be captured in the community-wide CBEI, but the City still has an opportunity to influence that services’ emissions.

Services to employees include payment of comprehensive medical insurance coverage, while services to residents include waste hauling services.

Overall, employee health care expenses accounted for 3 ktCO₂e, while emissions associated with waste hauling were estimated at 40 ktCO₂e. However, the emissions associated with waste hauling are likely heavily driven by the emissions associated with the waste itself, and not the operations and activities involved in hauling. The emissions associated with hauling operations alone are likely to be roughly one-third of the total emissions, based on other NAICS categories which are similarly equipment-intensive but do not involve GHG-emitting materials (such as furniture).

These services to employees and residents were not found to be significant enough to warrant further analysis.

- 5) **Apply USEEIO emission factors.** EcoDataLab then applied the USEEIO and weighted average emission factors to calculate emissions. A CAD to USD

conversion factor was also applied from the Bank of Canada⁵⁸, as was an inflation adjustment factor using U.S. Consumer Price Index (CPI) data for 2019 relative to 2021, to adjust for the 2019 USEEIO emission factors being based upon 2021 U.S. dollars⁵⁹.

Capital budget data

The capital budget was more straightforward to categorize, as there are fewer data fields associated with each line item, and the available line item information (by “Project”) does not provide as much detail as some of the operating budget line items.

The annual capital budget contains the following data fields⁶⁰ for budget line items:

- Program/Agency Name - Name of program, division or agency
- Project Name - Name of construction project
- Sub-Project Name - Name of construction sub-project
- Year 1 - Current budget year (e.g. 2019)
- Year 2 - Planned budget year 2 (e.g. 2020)
- Year 3 - Planned budget year 3 (e.g. 2021)
- Year 4 - Planned budget year 4 (e.g. 2022)
- Year 5 - Planned budget year 5
- Year 6 - Planned budget year 6
- Year 7 - Planned budget year 7
- Year 8 - Planned budget year 8
- Year 9 - Planned budget year 9
- Year 10 - Planned budget year 10
- Total 10 Year - Sum of Year 1 to 10
- Ward Number - Ward identification number. Includes all individual wards and City Wide projects, indicated by “CW.”
- Ward - Ward name. Includes all individual wards and City Wide projects.
- Category - Type of project. Includes: State of Good Repair, Service Improvement and Enhancement, Legislated, Growth Related, and Health and Safety.

⁵⁸ <https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/>

⁵⁹ Scaling factor is roughly 0.94, from <https://data.bls.gov/cgi-bin/surveymost?cu> “U.S. city average, All items - CUUR0000SA0”

⁶⁰ Source: Toronto Open Data.

The following steps were applied to the above data set:

- 1) Remove non-expense line items:** The capital budget data were filtered to remove line items with 2019 values less than or equal to \$0, as these do not represent activity data (i.e. spending) by the City. This removed 1,794 records and left 1,292 line items remaining.
- 2) Categorize each line item by applicable emissions factor:** To assign emissions factors to the activity data, the nature of each capital budget line item was examined. Each line item has a combination of Program/Agency Name, Project Name, Sub-Project Name, Category, and 2019 value. This combination of descriptive field values was used to categorize the type of spending associated with each line item.

Table 7: Data fields in annual capital budget used by City of Toronto to classify line items for emissions calculations

Data Fields Used for City of Toronto Categorization
Program/Agency Name
Project Name
Sub-Project Name
Category
Year 1/2019

Line items were categorized by the NAICS⁶¹ commodity codes that correspond to the type of spending specific to each line item, as in the operating budget methodology. However, unlike the operating budget line items, most of the capital projects did not link to the EEIO Commodity Codes due to the nature of the capital projects, which do not correspond to typical municipal residents' spending categories. Where possible, line items (i.e. projects) were linked to the appropriate EEIO commodity code based on the EEIO Commodity Descriptions; this was possible for 86 of 1,292 line items of value greater than one million dollars⁶².

⁶¹ <https://www.census.gov/naics/>

⁶² As with the operating budget, City staff focused on classifying capital budget expense line items of one million dollars of greater value in the Year 1/2019 data field. Following this step, EcoDataLab categorized all expense items in the 2019 capital budget.

For the remaining line items, City staff created a system to assign project classifications and sub-classifications to each line item based on available project information. This facilitated EcoDataLab’s subsequent determination of appropriate emission factors to associate with each line item.

Table 8 shows classification system used by City staff, where the value in field FINAL EEIO Commodity Code represents the highest classification level assigned by City staff, the value in E&C Class1 represents the second-highest classification level, and E&C Class2 represents the most detailed classification level.

Table 8: Classification system applied to capital budget line items by City of Toronto

FINAL EEIO Commodity Code	E&C Class1	E&C Class2
Building & Facilities	Electric-HVAC-Mechanical	
Building & Facilities	New	
Building & Facilities	Tech	
Building & Facilities	Upgrade Renos Repairs	
Infrastructure	Landfill Sites	
Infrastructure	Major	
Infrastructure	Water	Chemicals
Infrastructure	Water	
IT System & Upgrades		
Lighting & Signals		
Not Sure		
Plans & Studies		
Plans Studies Assessments	Plan	
Property Acquisitions		
Rail	Rail line New	
Rail	Rail line Upgrade	
Rail	Systems	
Road	Bike Lanes	
Road	Bridge New	
Road	Bridge Upgrades	
Road	Highway Upgrades	
Road	Painting Signs & Markings	

Road	Road New	
Road	Road Upgrades	
Road	Sidewalk Upgrades	
Road	Upgrades	
Signage		

Through batch categorization of line items based on the values of fields in Table A2, City staff applied EEIO commodity codes or City-developed classifications to 1,041 of 1,292 projects (line items)⁶³, which accounted for roughly 99 per cent of the capital budget expenses, and left 251 projects unclassified.

Classified activity data from the capital budget were then reviewed and, after discussion with the City, some NAICS codes were updated with alternative codes that more accurately reflected the category of expenditure. EcoDataLab subsequently reviewed and classified additional line items based upon guidance and information provided by the City to classify 100 per cent of the capital budget data. In some instances, large language models were subsequently queried to assist with identifying the most appropriate NAICS codes for certain line items, with human review and verification.

Apply USEEIO emission factors. Similar to the operating budget approach, EcoDataLab then applied the USEEIO emission factors to calculate emissions. A CAD to USD conversion factor was applied from the Bank of Canada⁶⁴, and adjusted for inflation using U.S. Consumer Price Index (CPI) data for 2019 relative to 2021, to adjust for the 2019 USEEIO emission factors being based upon 2021 U.S. dollars⁶⁵.

Incorporate SBEI and Food Emissions

Emissions from the SBEI and the Cool Food Pledge report were also incorporated to prepare the complete corporate CBEI.

⁶³ Batch categorization resulted in classification of all projects equal to or greater than one million dollars in Year 1/2019 value, as well as many projects worth under one million dollars.

⁶⁴ <https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/>

⁶⁵ Scaling factor is roughly 1.1135, from <https://data.bls.gov/cgi-bin/surveymost?cu> "U.S. city average, All items - CUUR0000SA0"

The existing corporate SBEI data was classified as Scope 1, 2, or 3 based upon fuel source, and Scope 3 lifecycle emissions were calculated for transportation fuels and natural gas. Transportation fuel lifecycle emissions were calculated as an additional roughly 25 per cent, based upon data from the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model from Argonne National Laboratory⁶⁶. Natural gas scope 3 emissions were calculated as leakage of natural gas, using the Ontario provincial average natural gas leakage rate found by The Atmospheric Fund of 2.7 per cent⁶⁷.

Emissions from the SBEI were assigned based on City division as allocated in the original SBEI. For assigning to category of consumption, transportation fuels were assigned to the “Transportation and Warehousing” NAICS sector, while building energy, water, and waste was assigned to “Utilities”.

Emissions from food were assigned to City divisions based upon their share of meals provided, using data from the Cool Food Pledge Baseline Report.

⁶⁶ <https://greet.es.anl.gov/>

⁶⁷ <https://taf.ca/publications/new-guidelines-on-fugitive-methane/>