



STAFF REPORT
ACTION REQUIRED

Toronto's 2013 Greenhouse Gas Inventory

Date:	December 17, 2015
To:	Parks and Environment Committee
From:	Chief Corporate Officer
Wards:	All
Reference Number:	P:\2016\Internal Services\E&E\Pe16001e&e (AFS #22169)

SUMMARY

This report provides an update on the City's progress towards meeting its greenhouse gas emissions reduction targets using data collected for the year 2013. City Council directed the Environment and Energy Division (EED) to provide annual updates on Toronto's greenhouse gas emissions in relation to the greenhouse gas emissions targets adopted by City Council, in 2007, in the report titled *Climate Change, Clean Air and Sustainable Energy Action Plan: Moving from Framework to Action* (the "Climate Change Action Plan").

Toronto's greenhouse gas emissions inventory was first published in 2007, utilizing data from 2004. In 2015, the methodology applied by Toronto to measure its greenhouse gas emissions was audited by experts contracted by the C40 Cities organization as part of the Compact of Mayors for Climate Change. Their audit identified that Toronto's inventory methodology met its standards for compliance with a global protocol called the Global Cities Protocol.

Overall, city-wide emissions in Toronto have dropped by approximately 24% since 1990 levels and about 18% since 2004 levels. On a corporate level, the City has reduced its emissions by 46% from 1990 levels and 25% from 2004. This is similar to the emission reduction levels reported in 2014 based on 2012 data, highlighting that yearly reductions are more incremental now that the phase out of the use of coal to generate electricity is complete. Opportunities to seek deeper carbon emissions reductions will be explored in the City's [TransformTO](#) project launched in early 2015.

It should be noted that the transportation emissions reported in this inventory are the same as reported in the 2008, 2011 and 2012 inventories despite efforts to update this information for 2013. The EED is working with Transportation Services to update and improve this part of the inventory for future reports. The lack of more current transportation information, also means that this report does not discuss changes in air quality because transportation emissions are considered to be a significant source of emissions that effect air quality and better data is required to more accurately discuss these emissions.

RECOMMENDATIONS

The Chief Corporate Officer recommends that:

1. The Parks and Environment Committee receive this report for information.

Financial Impact

This report has no financial impact. The proposed actions are consistent with the five-year business plan of the Environment and Energy Division.

The Deputy City Manager & Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

At its meeting of July 16-19, 2007 City Council adopted the *Climate Change, Clean Air and Sustainable Energy Action Plan: Moving from Framework to Action* (the "Climate Change Action Plan").

Included in the Climate Change Action Plan were directives that the EED continue to report on air quality and greenhouse gas emissions through a greenhouse gas inventory that will monitor the City's progress in meeting its climate change and clean air targets.

Toronto's first greenhouse gas inventory report was published in 2007 and reported on emissions occurring in the year 2004. Documents related to this inventory can be viewed at:

<http://www.toronto.ca/legdocs/mmis/2007/cc/minutes/2007-07-16-cc11-mn.pdf>

Second and third emissions inventory reports were published in 2013 and reported on emissions occurring in the years 2008 and 2011. Documents related to these inventories can be viewed at:

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PE21.5>

A fourth emissions inventory report was published in 2014 and reported on emissions occurring in the year 2012. Documents related to this inventory can be viewed at:

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PE28.4>

This report addresses greenhouse gas emissions for the year 2013.

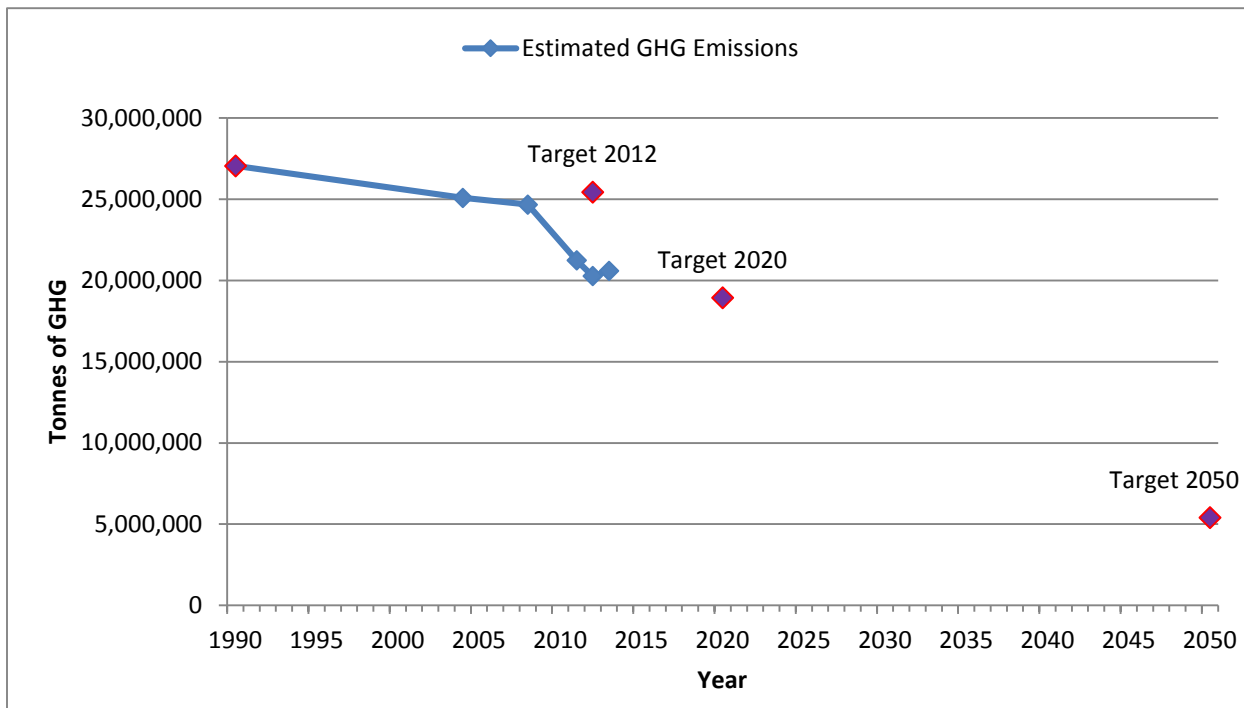
ISSUE BACKGROUND

The purpose of publishing annual greenhouse gas inventories is to:

- Quantify, to the best of our ability, the emissions occurring in Toronto, both city-wide and those associated with the City of Toronto as a corporate entity;
- Identify the primary sources of those emissions and whether there are changes occurring in the sources; and
- Provide the information necessary to help inform and set priorities in the development and implementation of appropriate policies and programs required to reduce greenhouse gas and air pollutant emission reductions.

With four years of inventory data points, the City is able to track how its emissions are changing and compare them to the targets that were set in the first Climate Change Action Plan (2007). This information is graphically represented below in Figure 1.

Figure 1: Toronto City Council Approved Emissions Targets (2007) and Progress



The 2007 targets were set as absolute targets rather than relative targets, meaning that they are set without the intention to adjust them according to yearly population growth or decline, economic growth or decline, or weather variability (e.g. hot summers that lead to more electricity consumption for air conditioning, and cold winters that lead to more natural gas consumption for space heating).

Toronto is well on its way to meeting its 2020 goal and is developing a more specific plan on how to reach this goal through [TranformTO](#), a project recently initiated to develop Toronto's 2020 Action Plan as well as to examine transformative change scenarios that will move Toronto towards becoming a low carbon city.

COMMENTS

Greenhouse gas inventories for the City of Toronto report on two sets of greenhouse gas emissions data – firstly, a broader set of data which accounts for emissions attributed to energy consumption and activities that take place within Toronto's boundaries or "by" Toronto (as in electricity consumption where the electricity is generated outside of the city's boundary) and secondly, a subset of this broader data which tallies what the City of Toronto as a corporate entity emits.

Overall, city-wide emissions have reduced by approximately 24% since 1990 levels and about 18% since 2004 levels. On a corporate level, the City has reduced its emissions by 46% from 1990 levels and 25% from 2004. These numbers are almost the same as what was reported in Toronto's 2012 [Greenhouse Gas Inventory](#) demonstrating a plateau effect.

Figure 2 shows the general breakdown of Toronto's emissions by emission source. Transportation sources continue to dominate the overall emissions picture for Toronto and are twice as high as any other source. It should be noted that the emissions for transportation represented in Figure 3 may also be underestimated due to the absence more current transportation data.

Figure 2: City-wide Greenhouse Gas Emissions by Source for year 2013

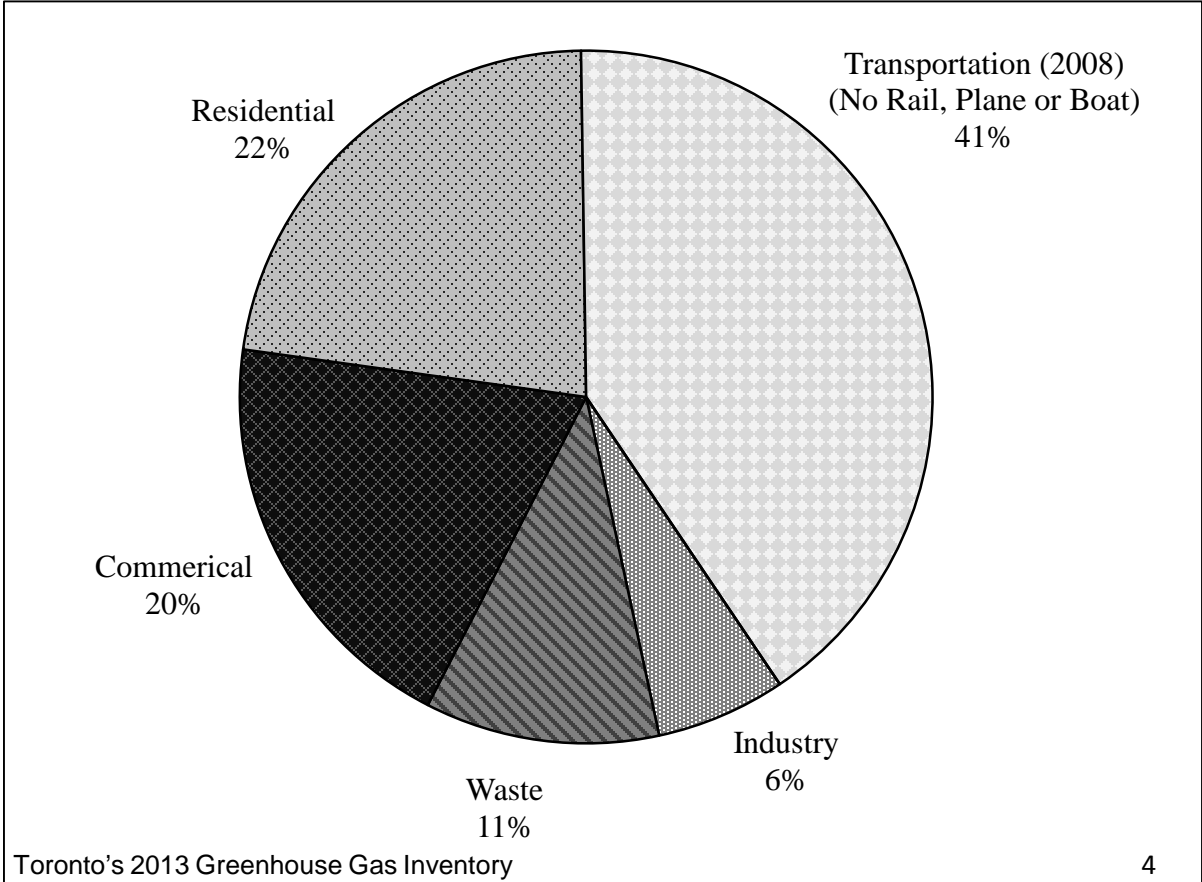


Table 1 below provides detail on the sources for emissions in Toronto.

Table 1: City-wide sources of Greenhouse Gas Emissions for Toronto from 1990 – 2013 (tonnes eCO₂)

Source	1990	2004	2008	2011	2012	2013
Electricity	5,569,300	5,622,760	5,217,000	2,714,586	2,671,212	2,169,947
Natural Gas	8,741,625	8,225,060	8,385,928	7,947,639	7,087,464	7,767,622
Transportation ¹	7,293,440	8,099,914	8,383,396	8,383,396	8,383,396	8,383,396
Waste Emissions from City-operated Landfills ²	1,815,751	1,009,545	875,757	727,066	702,553	750,946
Estimated Waste Emissions from Private Collection and Disposal ³	3,631,502	2,019,089	1,751,513	1,454,131	1,405,107	1,501,892
Transportation of Waste to City-operated Landfills	-	35,389	18,001	6,480	7,041	5,066
Estimated Transportation of Waste to City-operated Landfills ⁴	-	70,777	36,003	12,961	14,081	10,132
Total	27,051,617	25,082,534	24,667,599	21,246,259	20,270,854	20,589,001
Change from 1990	--	-7.28%	-8.81%	-21.46%	-25.07%	-23.89%
Change from 2004	--	--	-1.65%	-15.29%	-19.18%	-17.91%

This information is also graphically represented below in Figure 3 where it can clearly be seen that a levelling off of emissions is taking place.

¹ Transportation does not include emissions from boat, rail or airplane because these are mainly cross boundary emissions and may be considered beyond the control of local governments

² Waste emissions from City-operated landfills captures methane emissions from waste currently decomposing in landfills and also includes household waste being collected from 'contracted waste services' (ie. Non City employees)

³ Waste emissions from Private Collection and Disposal is estimated to be twice the amount that is collected by the City and therefore represents twice the City's emissions

⁴ An assumption is made that IC&I waste is deposited in City-operated landfills and therefore included in the City-wide inventory

Figure 3: City-wide sources of Greenhouse Gas Emissions for Toronto (tonnes eCO₂)

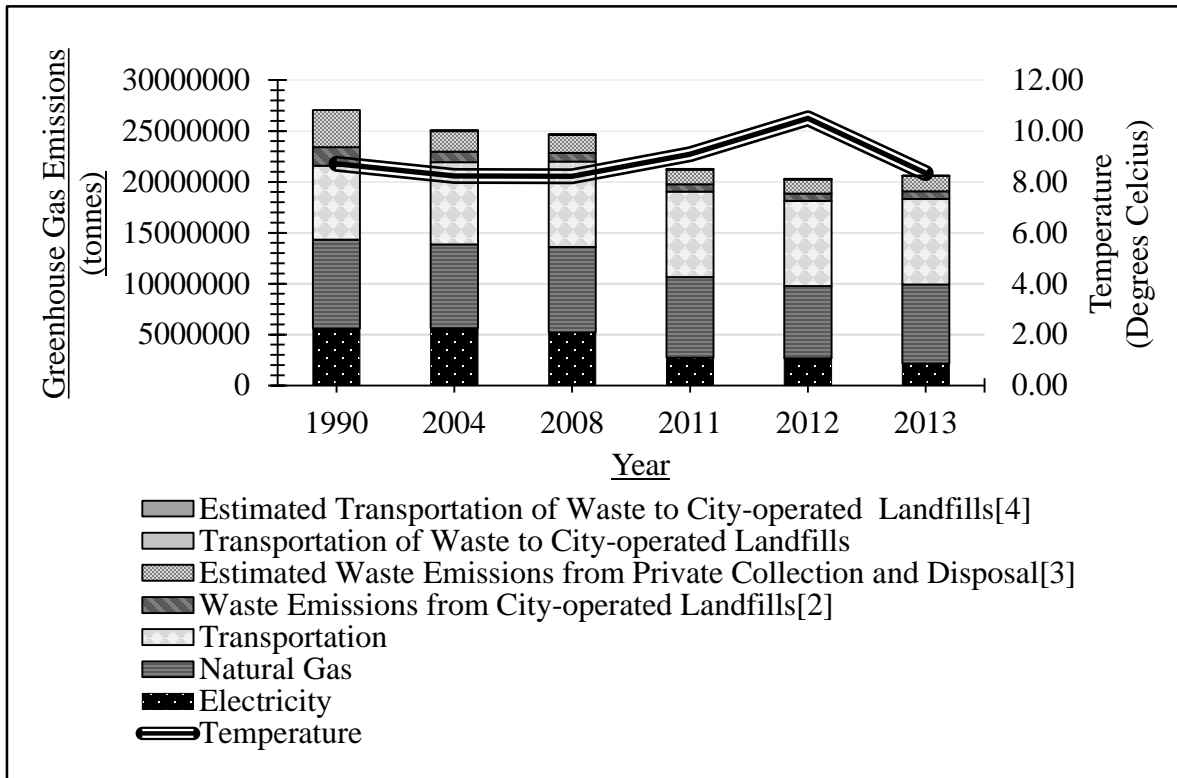
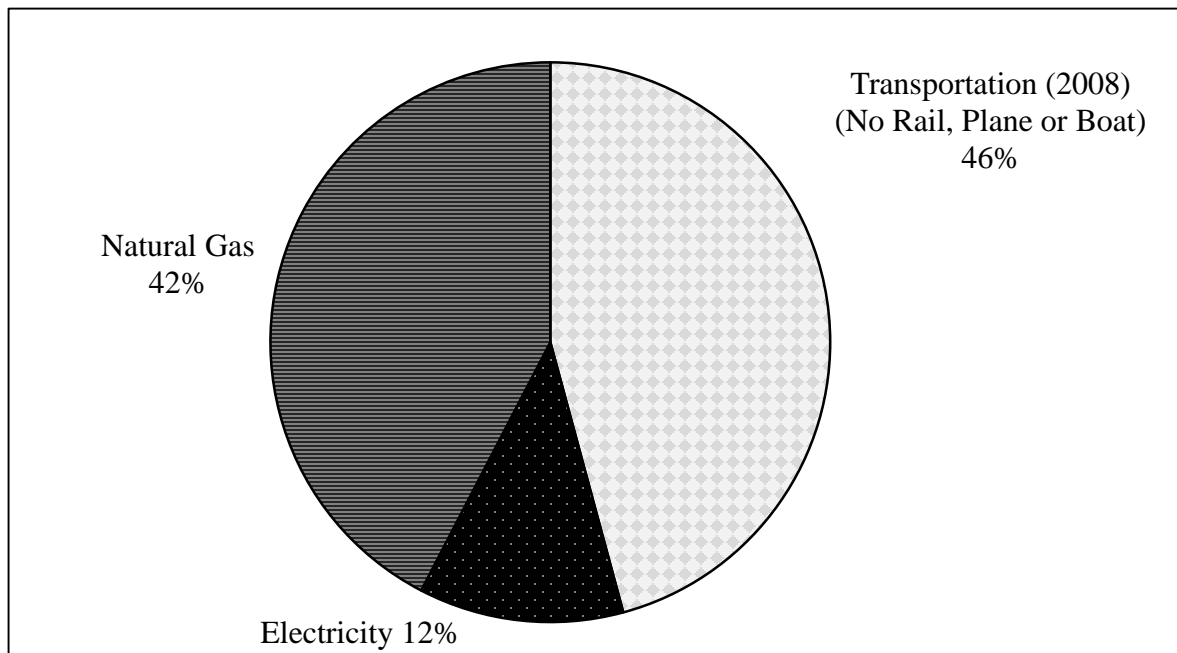


Figure 4 shows the general breakdown of the City's emissions by fuel type or energy source. It can be readily seen that emissions from transportation and from natural gas usage are the two biggest sources of emissions.

Figure 4: City-wide Greenhouse Gas Emissions by Energy Source (2013)



Discussion of City-Wide Emissions Sources

Electricity and Natural Gas Consumption

Emissions generated from electricity consumption have declined significantly since Ontario's electricity was largely stripped of carbon intensive coal sources.⁵ More details on how emissions factors have changed since 1990 for electricity and natural gas and how they impact Toronto's emissions can be found in *Appendix A: Changes in Emissions Factors for Electricity and Natural Gas from 1990 to Present*.

Table 2 below details the community's consumption patterns for both electricity and natural gas. It shows that from a consumption perspective, electricity consumption has stayed relatively the same from the period of 2004 to 2013, even though Toronto has increased in population by approximately 150,000 people since 2004.

Table 2: Electricity and Natural Gas Consumption for Toronto⁶

Source	Electricity (kilowatt hour, kWh)	Natural Gas (cubic meters, m³)
1990	25,314,997,857	4,355,568,000
2004	25,558,000,709	4,323,001,973
2008	27,898,394,277	4,435,527,684
2011	26,253,247,548	4,203,705,477
2012	25,833,769,360	3,748,737,413
2013	25,619,209,181	4,089,610,452

Natural gas emissions have also seen a reduction since 2004. The fluctuation between 2011 and 2013 in electricity and natural gas can in some part be explained in terms of temperature variation. Generally speaking, with a higher annual temperature, there is an anticipated increase in electricity (increased air conditioning) and lower natural gas usage (for heating). The same is true for the opposite where a lower annual temperature would reduce electricity consumption and increase natural gas consumption.

Transportation

Transportation emissions reported in 2013 are the same emissions that have been reported in years 2008, 2011 and 2012. The EED is currently working with Transportation Services to identify how this data can be more frequently updated and improved. For the past several years, due to resource constraints, Transportation Services has not been able to provide a comprehensive update of vehicular volumes for use in this inventory, however, plans are underway to integrate data from different sources including from the MTO to improve data quality.

⁵ The End of Coal: Ontario's Coal Phase-out, <https://www.iisd.org/sites/default/files/publications/end-of-coal-ontario-coal-phase-out.pdf>, retrieved October 20, 2015

⁶ Electricity data is 'sales' data provided by Toronto Hydro. Natural gas data is also 'sales data' provided by Enbridge Gas

Therefore, estimating greenhouse gas emissions from internal combustion engines (eg. gasoline and diesel vehicles) lacks a desired level of granularity which would assist in quantifying emissions based on vehicle type.

Knowing the number and size of trucks as well as the number and size of cars making trips through the City would have a number of useful applications not only in terms of representing the emissions from transportation in the City's inventory more accurately but also in cross Divisional work. For example, the City is currently looking at the extent to which residents living near major highways and arterial roads might be exposed to vehicular emissions (see [Local Air Quality Studies](#)) or where high volumes of trucks that enter the City to supply local businesses may need prioritization within a [Complete Streets](#) framework.

Waste

Table 1 also identifies a marked decrease in waste emissions. This reduction in waste emissions can be attributed to improved technologies at the five City's landfill sites where landfill gas capture systems prevent high carbon emissions, in the form of methane gas, to be released to the air.

Between 2004 and 2013, the former Keele Valley and Brock West landfill sites captured just over 10 million tonnes of greenhouse gases. In 2013 alone, just over 715,000 tonnes of greenhouse gases were captured.

The waste collected from and disposed of in the private sector (eg. institutional, industrial and commercial) remains unknown in terms of weight and/or volume, composition, and in terms where the waste is collected and disposed. Despite this lack of information, waste collected from the private sector is assumed to be disposed of at City landfills and therefore is counted as part of the City's emissions.

Upcoming changes in the newly introduced Bill 151: Waste-Free Ontario Act (2015) may affect changes within the ICI sector. The proposed Act will encourage extended producer responsibility and boost waste reduction initiatives and recycling which may mean better and more transparent reporting of waste quantities from this sector.

Discussion of City Corporate Emission Sources

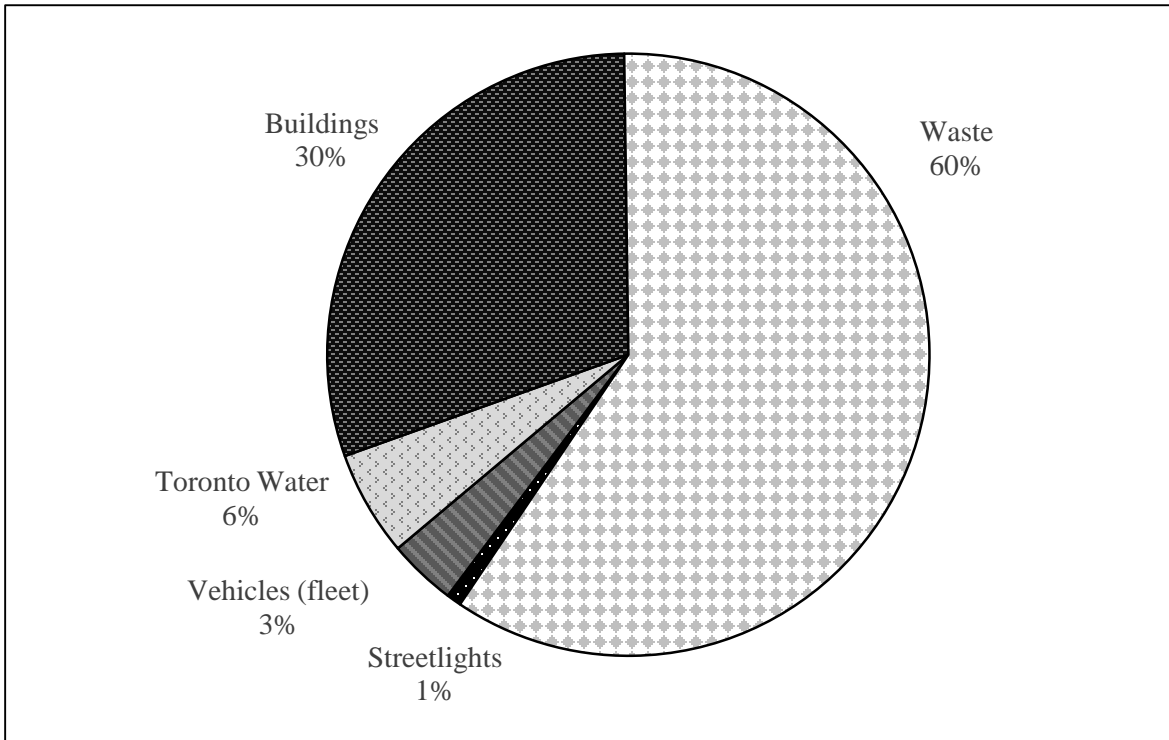
The greenhouse gas emissions produced by the activities of the City as a corporate entity are estimated to represent 6.1% of all emissions in Toronto and have stayed relatively the same since 2004. Overall, Toronto as a corporation has reduced its emissions by 46% from 1990 levels and by 25% from 2004.

Figure 5 below shows the breakdown of emissions from City operations. Electricity is consumed at City-operated facilities, office buildings and by streetlights. Natural gas consumption includes any City-operated facility, office buildings and buildings managed by the Toronto Community Housing Corporation (TCHC).

Emissions from to City vehicle usage are derived from fleet fuel consumption records.

Emissions from waste include not only what the Corporation produces as waste but also what the City has "care and control of" which means emissions from all waste that is generated in the City's boundary.

Figure 5: Sources of Greenhouse Gas Emissions for City Corporation



Landfill emissions make up about 60% of the City's total emissions. Note that these emissions, as an absolute amount and not as a percentage of the total City Corporate emissions, are the same as the emissions reported for community-wide waste however, due to inventory protocol, the City counts these emissions as part of its corporate inventory. Second to landfill emissions are the emissions from buildings which make up about 30% of all corporate emissions.

There is no doubt that additional emissions reductions potential are yet to be realized in City buildings. Recently, under the Ontario Green Energy Act Regulation 397/11, the City of Toronto was required to develop and publish a five-year [Energy Conservation and Demand Management](#) plan which it did so by July 1, 2014 covering the years of 2014 to 2019. This plan forecasts the opportunities for energy savings in approximately 528 City facilities with an estimated reduction of facility energy consumption equating to an annual cost savings of 17 million dollars.

Figure 6 below shows the change in corporate emissions since 1990 according to emission source. Similar to the city-wide emissions found in Figure 3, it is clear from the past three years of data that the greenhouse gas emissions city-wide and on a corporate level emissions have plateaued.

Figure 6: Greenhouse Gas Emissions for City Corporation from 1990 – 2013

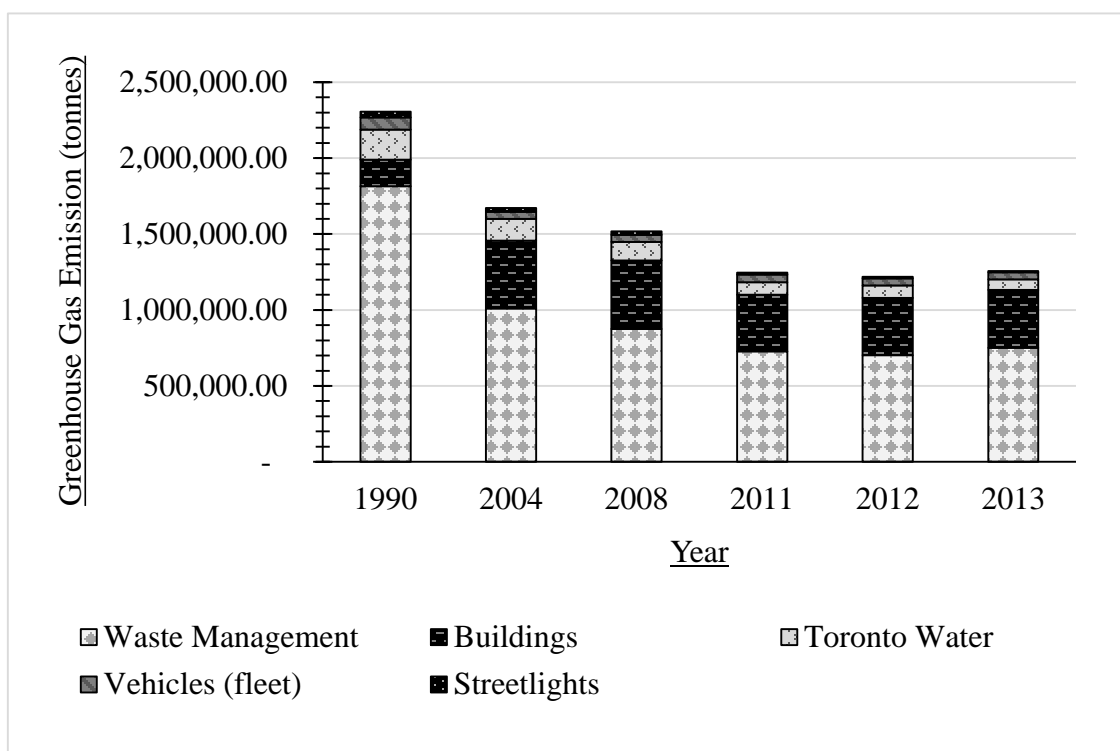


Table 4 below provides details on the corporation's electricity and natural gas consumption. Electricity consumption which powers City operations has remained relatively stable from 2004 to present. Natural gas consumption, however, exhibits much more variable behavior. The variability can be primarily attributed to data collection anomalies and billing timing.

Table 4: Energy Consumption for City Corporation

Source	Electricity (Kilowatt hour, kWh)	Natural Gas (cubic meters, m ³)	Fleet Fuel Diesel (Liters, l)	Fleet Fuel Unleaded (Liters, l)
1990	883,641,153	88,293,161	6,604,611	11,951,502
2004	1,614,058,625	123,299,471	7,716,341	3,144,701
2008	1,573,649,419	146,642,153	11,098,881	4,777,299
2011	1,557,497,974	156,154,808	12,219,643	4,522,832
2012	1,557,095,708	157,778,126	11,185,829	3,620,370
2013	1,569,841,195	167,855,357	11,190,224	4,009,908

Updates on Issues Raised in 2012 Inventory

A number of issues were raised in Council's Decision on July 8, 2014 (PE28.4) regarding the quality of data used in the 2012 Greenhouse Gas Inventory. The EED would like to update Council on data improvements and other related activities underway:

1a. The proposed energy reporting and benchmarking requirement considered by Council on July 7-9, 2015 (PE4.2) that would apply to large commercial and multi-residential buildings, once adopted and implemented, would greatly improve the accuracy of the current City building file which would then, in turn, lead to more accurate reporting on energy consumption and emissions.

1b. In January 2015, EED staff met with staff from the Transportation Planning Branch of MTO to discuss how to work together to improve the data collected on provincial highways surrounding the City with particular attention to Toronto's participation in MTO's Commercial Vehicle Survey.

1c, d. In February 2015, EED staff met with Enbridge Gas to amend their data amalgamation categories while at the same time protecting data privacy so that large gas consumers could be separated from residential users for analysis.

1g. In 2015, EED staff met three times with Transportation Services staff to discuss different ways in which transportation data could be reported more regularly. Dedicated staff resource issues and more accurate classification of vehicles arose as major issues to be addressed.

1h. With reference to obtaining more accurate waste data from the private sector, as mentioned above, the newly introduced Bill 151: Waste-Free Ontario Act (2015) may affect changes within the ICI sector. The proposed Act will encourage extended producer responsibility and boost waste reduction initiatives and recycling which may mean better and more transparent reporting of waste quantities from this sector.

2a, b. With reference to the frequency of publishing of more detailed greenhouse gas inventories, it is anticipated that for the year 2015, TransformTO will incorporate updates of the inventory as part of modelling Toronto's emissions into the future. A report to Council will be ready by Q4, 2016.

3a. In October 2014, the EED and TPH submitted a joint letter on behalf of the City to Environment Canada regarding the Federal Government published in the Canada Gazette, Part I, *Regulations Amending the On-Road Vehicle and Engine Emission Regulations and Other Regulations Made Under the Canadian Environmental Protection Act, 1999* (proposed ORVEER amendments). Among other comments, the City supported the government drafting regulations specific to heavy duty vehicles and their engines.

3c. In October 2014, the EED coordinated a response on behalf of the City regarding the Ontario Energy Board's new Demand Side Management guidelines. In summary, the City encouraged the OEB to be consistent with the Ministry of Energy's "Conservation First" principles in their consideration of all cost-effective natural gas conservation measures.

4 (all). To accelerate the City's actions to address carbon emissions reductions, on May-5-7, 2015, City Council approved the Terms of Reference for TransformTO (PE3.6) and work is underway on the modelling portion of the project which will form the technical basis for further consideration.

It should be noted that in Fall 2015, in preparation for compliance with the Compact of Mayors, the information provided for the 2013 inventory was audited by experts from C40-Cities. The auditors identified that Toronto's inventory methodology met its standards for compliance with a global protocol called the Global Cities Protocol.

It should also be noted for Council's information, that the City of Toronto uses a 'sector-based' inventory method. Sector-based inventories track local emissions from the energy used in homes, businesses and through the operation of vehicles. Sector-based inventories also account for emissions from waste that sit in landfills emitting methane gas. However, sector-based inventories do not account for "lifecycle" emissions which include the consumptive activities used to extract, produce, transport, use, and dispose of a product or good. Accounting for lifecycle emissions on a city-wide basis is an inventory method currently being used by other major cities around the world. Using a lifecycle method, the City of Portland has found that when taking into account a lifecycle inventory, their city-wide emissions would double. Acknowledging lifecycle emissions is important as an exercise in advancing the understanding of Toronto's contribution of emissions in a global context.

CONCLUSION

Toronto has shown that despite increased population and economic activity, greenhouse gas emissions reductions can be achieved, however, since 2011, yearly reductions have been incremental. Toronto has demonstrated a firm commitment to identifying where emissions reductions can be focused at the corporate level, however, big changes will need to occur at the community level for Toronto to successfully reach its 2050 reduction goal.

A process is already underway to model and analyze where deep reductions may be targeted with additional analyses highlighting the co-benefits and co-harms of 'transformative reductions' on the economy, on social well-being and on resident health. The anticipated outcomes of the City's TransformTO project will be documented closely in future greenhouse gas inventories.

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SIGNATURE

Josie Scioli
Chief Corporate Officer

Appendix A:
Changes in Emissions Factors for Electricity and Natural Gas from 1990 to Present

Table A: Change in City Community Electricity Consumption, Emissions Factors for Electricity and Related Greenhouse Gas Emissions for 1990, 2004, 2008, 2011-2013.

	Electricity (kWh)	Change from 1990	Electricity (g/CO₂e)	Electricity Emissions (tCO₂e)	Change from 1990
1990	25,314,997,857	--	220.0	5,569,300	
2004	25,558,000,709	0.96%	220.0	5,622,760	0.96%
2008	27,898,394,277	10.21%	187.0	5,217,000	-6.33%
2011	26,253,247,548	3.71%	103.4	2,714,586	-51.26%
2012	25,833,769,360	2.05%	103.4	2,671,212	-52.04%
2013	25,619,209,181	1.20%	84.7	2,169,947	-61.04%

Table B: Change in City Community Natural Gas Consumption, Emissions Factors for Natural Gas and Related Greenhouse Gas Emissions for 1990, 2004, 2008, 2011-2013

	Natural Gas Consumption (m³)	Change from 1990	Natural Gas (g/m³)	Natural Gas Emissions (tCO₂e)	Change from 1990
1990	4,355,568,000	--	2007	8,741,625	--
2004	4,323,001,973	-0.75%	1903	8,225,060	-5.91%
2008	4,435,527,684	1.84%	1891	8,385,928	-4.07%
2011	4,203,705,477	-3.49%	1891	7,947,639	-9.08%
2012	3,748,737,413	- 13.93%	1891	7,087,464	-18.92%
2013	4,089,610,452	-6.11%	1899	7,767,622	-11.14%
2014	4,395,375,560	0.91%	1899	8,348,379	-4.50%