City of Winnipeg Corporate Greenhouse Gas Emissions Inventory and Forecast, 2014 to 2017

A. INTRODUCTION

Purpose

The purpose of this report is to provide an update the City's corporate greenhouse gas (GHG) inventory for the years 2014 through 2017. The report provides an update on the City's GHG emissions profile for the time period of interest, and presents the results of modelling exercises to forecast future emissions under different GHG emission reduction scenarios. Opportunities for further reductions in emissions are described as well.

B. CORPORATE GHG INVENTORY (2014-2017)

Energy Consumption and GHG Emissions by Source

Table 2 summarizes the City's energy consumption and GHG emissions by source. Electricity is the most significant source of energy consumed at about 36%, though it accounted for only a very small fraction (1% on average from 2014 through 2017) of total GHG emissions in each year presented. This is attributed to the relatively low emissions factor for electricity consumption resulting from Manitoba's predominantly hydroelectric power generation.[1]

Vehicle fuel (ethanol, biodiesel, aviation) accounted for roughly 34% of the City's energy consumption and was also the most significant source of GHG emissions from 2014 to 2017. Biodiesel fuel alone accounted for between 46% and 48% of the City's GHG emissions.

Natural gas accounted for 28% to 30% of the City's energy consumption, with associated GHG emissions amounting to between 31% and 34% of the total.

[1] According to the National Inventory Report 1990-2016 - Greenhouse Gas Sources and Sinks in Canada (Part 3). Annex 13. Issued in 2018, only the Province of Quebec currently shares an equally low emissions factor for electricity consumption.

Table 2: Energy and Greenhouse Gas Emissions by Source (2014-2017)

YEAR	ENERGY TYPE						TOTAL
	Electricity	Natural Gas	Ethanol Blend (E8.5)	Biodiesel Blend (B2)	Aviation	Solid Waste	
2014							
GJ	1,059,821	867,399	144,359	827,580	5,202	-	**2,904,360**
%	36%	30%	5%	28%	0%	-	100%
CO2e(t)	1,178	42,825	9,066	57,909	358	13,938	**125,273**
%	1%	34%	7%	46%	0%	11%	100%
2015							
GJ	1,014,138	752,790	137,266	811,942	5,769	-	**2,721,906**
%	37%	28%	5%	30%	0%	-	100%
CO2e(t)	1,127	37,167	8,620	56,814	397	14,282	**118,406**
%	1%	31%	7%	48%	0%	12%	100%
2016							
GJ	1,014,416	771,584	129,577	806,663	5,528	-	**2,727,769**
%	37%	28%	5%	30%	0%	-	100%
CO2e(t)	1,127	38,094	8,137	56,447	383	14,048	**118,236**
%	1%	32%	7%	48%	0%	12%	100%
2017							
GJ	988,344	827,512	127,859	801,327	7,799	-	**2,752,842**
%	36%	30%	5%	29%	0%	-	100%
CO2e(t)	1,098	40,856	8,029	56,072	543	12,318	**118,916**
%	1%	34%	7%	47%	0%	10%	100%

Energy Consumption and GHG Emissions by Sector

Table 3 presents the City's energy and GHG emissions by sector. The buildings sector accounted for a significant portion of the City's energy consumption (electricity plus natural gas) at about 38% of energy use. This translated to an average of between 24% and 27% of the City's GHG emissions.

While the vehicle fleet sector accounted for a similar proportion of the overall energy consumption, the GHG emissions associated with this sector were considerably higher. During the time period vehicle fleet emissions approximated about 55% of the City's total emissions.

The waste sector (water and sewage, corporate waste) accounted for about 20% of the City's emissions.[2]

[2] Corporate GHG emissions related to water and sewage take into account facility energy consumption (electricity, natural gas) only. This inventory does not consider emissions related to processing and biogas. These are captured in the community inventory.

Table 3: Energy and Greenhouse Gas Emissions by Sector (2014-2017)

YEAR	SECTOR					TOTAL
	Buildings	Vehicle Fleet	Streetlights	Water and Sewage	Corporate Waste	
2014						
GJ	1,124,636	977,141	204,254	598,329	-	**2,904,360**
%	39%	34%	7%	21%	0%	100%
CO2e(t)	34,216	67,333	227	9,560	13,938	**125,273**
%	27%	54%	0%	8%	11%	100%
2015						
GJ	994,643	954,977	204,381	567,904	-	**2,721,905**
%	37%	35%	8%	21%	0%	100%
CO2e(t)	28,959	65,831	227	9,108	14,282	**118,406**
%	24%	56%	0%	8%	12%	100%
2016						
GJ	1,017,598	941,769	182,770	585,632	-	**2,727,769**
%	37%	35%	7%	21%	0%	100%
CO2e(t)	29,341	64,967	203	9,678	14,048	**118,236**
%	25%	55%	0%	8%	12%	100%
2017						
GJ	1,033,948	936,985	166,750	615,159	-	**2,752,842**
%	38%	34%	6%	22%	0%	100%
CO2e(t)	30,432	64,644	185	11,336	12,318	**118,916**
%	26%	54%	0%	10%	10%	100%

2017 GHG Inventory

GHG emissions by source and sector for 2017 are displayed in Figures 1 and 2 below. Vehicle fuel (all types combined) accounted for approximately 54% of the City's GHG emissions. Natural gas GHG emissions represented about 34%, followed by water, sewage and corporate waste at 20%.

Breaking down emissions by sector for 2017, emissions from the City's vehicle fleet amounted to 54% of total emissions, with buildings at 26% and water, sewage and corporate waste at 20%.

Figure 1: GHG Emissions by Source (2017)

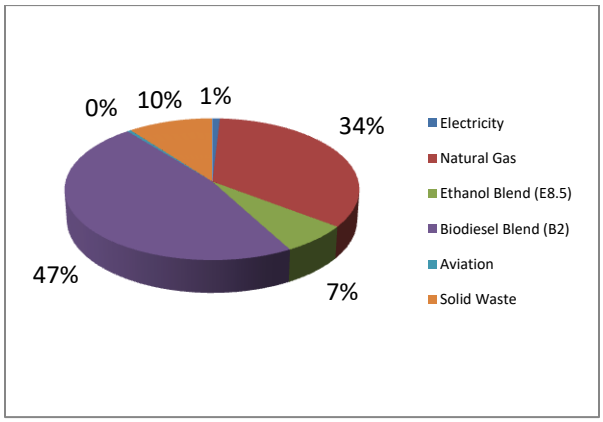


Figure 2: 2017 Corporate GHG Emissions by Sector (2017)

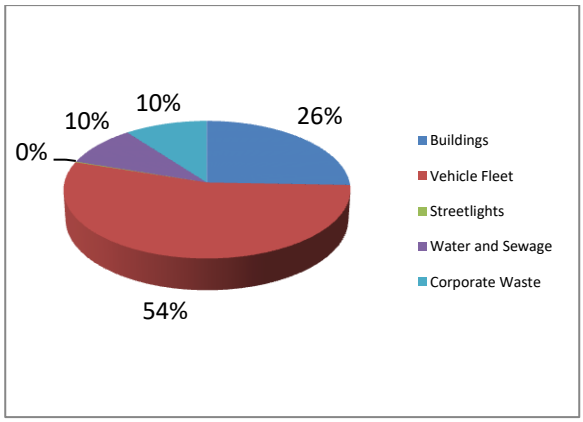
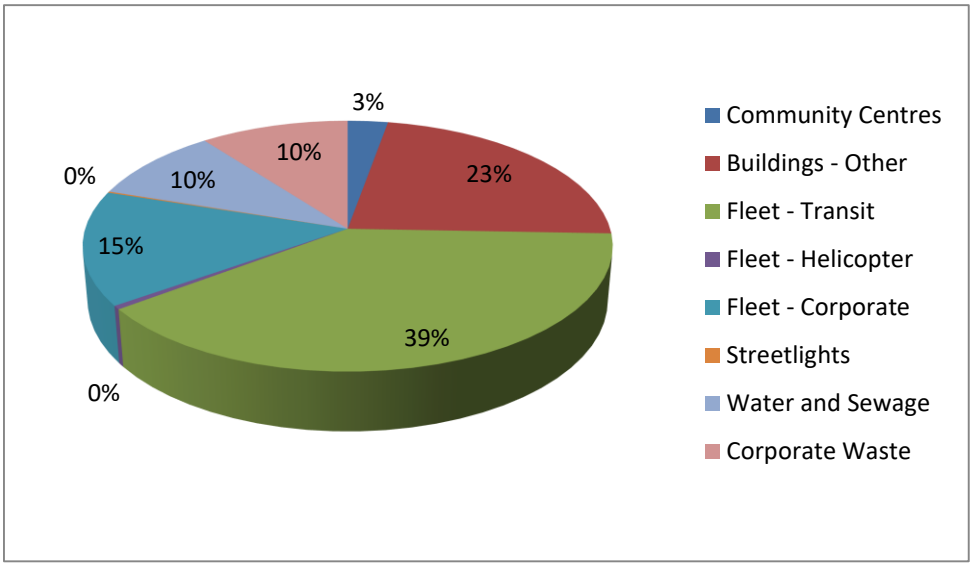


Figure 3 presents a more detailed breakdown that reflects the increased scope of data collection and analysis for the current inventory.

Figure 3: GHG Emissions by Sector (2017)



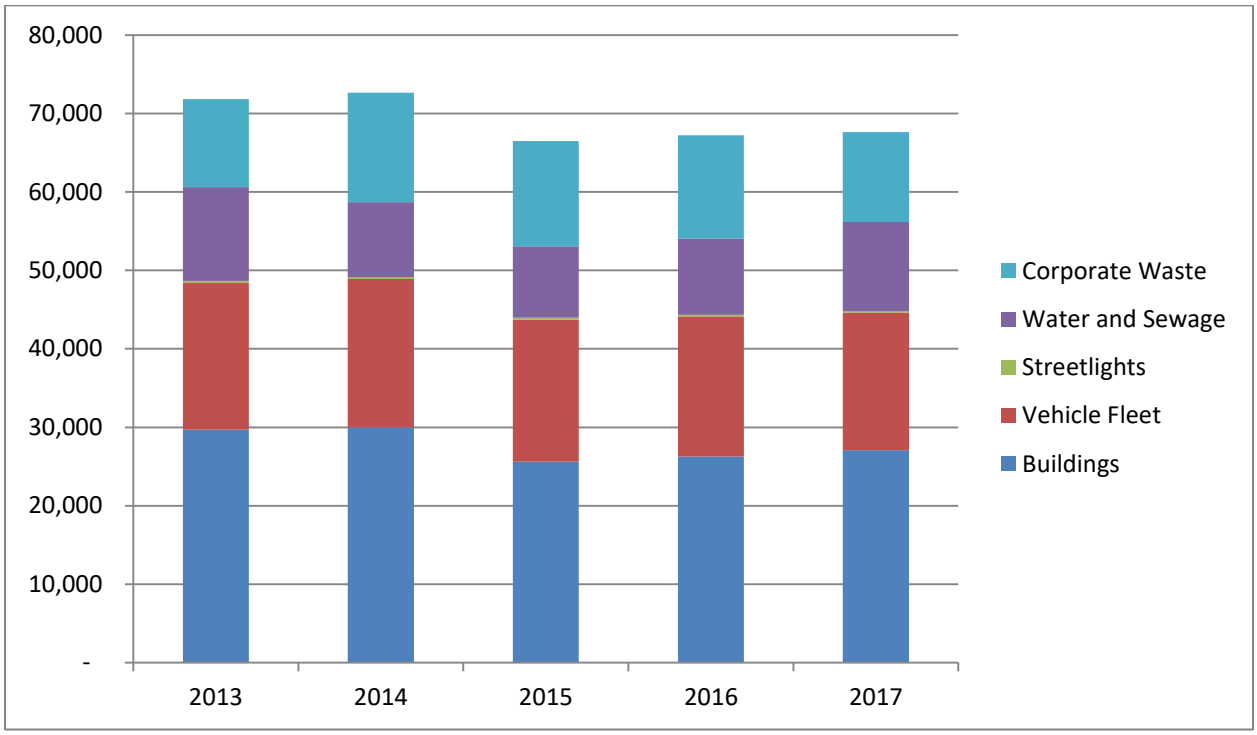
C. TRENDS AND KEY DRIVERS

The City developed its first inventory and forecast of corporate greenhouse gas emissions for the year 1998. Subsequent corporate GHG emission inventories were conducted for the years 2003, 2006, 2007, 2011 through 2013 and most recently 2014 through 2017.

The *Status Report on the Corporate Climate Action Plan* submitted to Council in 2016 included a 2013 GHG emissions inventory and updates on actions described in the afore-mentioned 2009 strategy. The report considered different emissions scenarios for forecasting purposes.

To compare against the 2013 corporate GHG inventory, it was necessary to remove the newly scoped emissions (for 2014 to 2017). Figure 4 presents the results of this exercise. Relative to 2013, the City's emissions have decreased by approximately 6%.

Figure 4: Summary of Adjusted Total Annual Emissions Trends (2013-2017)



A number of changes were made to the inventory starting in 2014. While these updates complicate comparisons with previously assembled inventories, they also provide improved accuracy and robustness to the inventory process. These changes included:

- Including Winnipeg Transit fuel data.
- Incorporating of City-owned, community-operated community centres.
- Incorporating aviation fuel used by *Air1* and by insect control contractors.

As shown in Figure 4 below, the City's total GHG emissions have generally decreased from 2014 to 2017, being as high as 125,273 tonnes eCO_2 in 2014 and as low as 118,236 tonnes eCO_2 in 2016.

Figure 4: Summary of Total Annual Emissions Trends from 2014 to 2017 (tonnes eCO_2)

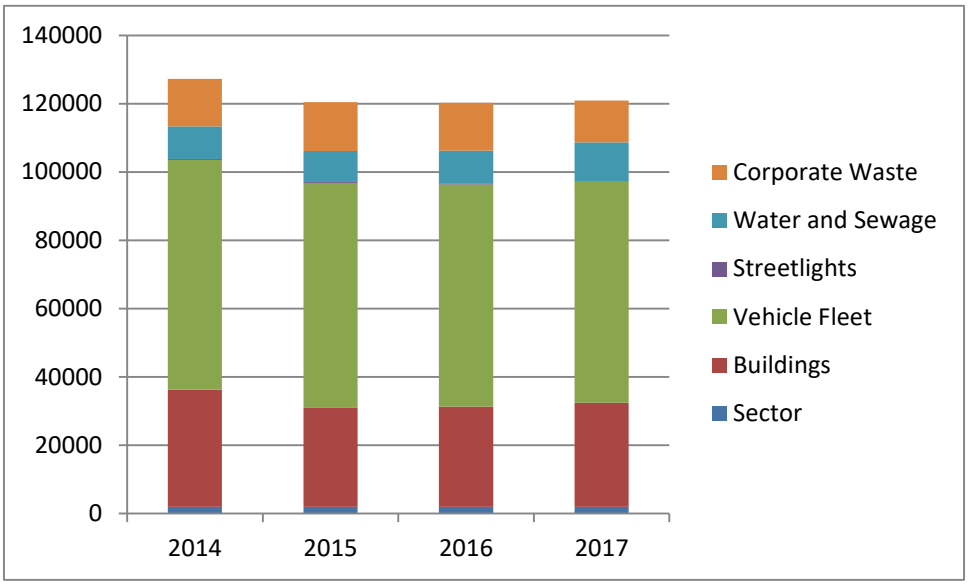


Table 4 provides a detailed breakdown, by sector, of the GHG emissions for this time period.

Table 4: GHG Emissions by Sector (2014-2017)

Sector	2014 (tonnes eCO_2)	2015 (tonnes eCO_2	% Change	2016 (tonnes eCO_2	% Change	2017 (tonnes eCO_2	% Change	% Change (Total)
Buildings	34,216	28,959	-15%	29,341	1%	30,432	4%	**-11%**
Vehicle Fleet	67,333	65,831	-2%	64,967	-1%	64,644	0%	**-4%**
Streetlights	227	227	0%	203	-11%	185	-9%	**-18%**
Water and Sewage	9,560	9,108	-5%	9,678	6%	11,336	17%	**19%**
Corporate Waste	13,938	14,282	2%	14,048	-2%	12,318	-12%	**-12%**
Total	**125,273**	**118,406**	**-5%**	**118,236**	**0%**	**118,916**	**1%**	**-5%**

From 2014 to 2017 GHG emission reductions were observed for most sectors with the exception of water and sewage, which showed an increase of 17% over the time period that was largely attributable to natural consumption at the NEWPCC. Table 4 provides a detailed breakdown of trends in GHG emissions by sector. During this time period, emissions have decreased by about 5%. Notable takeaways from the inventory include the following:

- GHG emissions in the buildings sector decreased by about 11%. A notable portion of this is attributable to a decreased number of facilities/properties in the City's inventory.
- Vehicle fleet emissions decreased by about 4% during the time period. This reflects in part a decrease in the use of personal vehicles by employees for business purposes. Specific measures

put in place by WFMA may also have contributed to this decrease (e.g., implementation of the Automatic Vehicle Location System to reduce fleet vehicle idling time).

- The reduction in streetlight GHG emissions is a result of a city-wide switch to LED lighting.

Outcomes related to waste emissions were mixed. Emissions associated with water and sewage increased by 19% during the time period. Corporate waste on the other hand, which includes waste from all City facilities exhibited a decrease of 12% during the time period. Some of the reduction is a result of ongoing waste diversion programming implemented at the corporate level in accordance with the Corporate Waste Reduction Strategy (e.g., improved communication with departments, organics collection at 65 Garry).

Table 5 presents additional detail by sector that reflects the increased scope of emissions from 2014 onwards. With respect to the buildings sector, emissions from City-owned but community operated centres decreased by approximately 10% during the time period. Emissions from the rest of the City's building sector decreased by about 21%.

Table 5: GHG Emissions – Further Breakdown (2014-2017)

Sector	2014 (tonnes eCO_2)	2015 (tonnes eCO_2)	% Change	2016 (tonnes eCO_2	% Change	2017 (tonnes eCO_2	% Change	% Change Overall
City Buildings	29,983	25,637	-14%	26,258	2%	27,102	3%	-21%
Community Centres	4,233	3,325	-21%	3,083	-7%	3,330	8%	-10%
Transit	48,039	47,329	-1%	46,697	-1%	46,572	0%	-3%
Helicopter	358	397	11%	383	-3%	543	42%	52%
Fleet and Personal Vehicle Use for Business	18,936	18,106	-4%	17,887	-1%	17,530	-2%	-7%
Streetlights	227	227	0%	203	-11%	185	-9%	-18%
Water and Sewage	9,560	9,108	-5%	9,678	6%	11,336	17%	19%
Corporate Waste	13,938	14,282	2%	14,048	-2%	12,318	-12%	-12%
Total	125,274	118,410	-5%	118,236	0%	118,916	1%	-5%

Table 6 lists some of the key actions and activities that have contributed to changes in the City's corporate GHG emissions.

Table 6: Key Drivers of Change, 2013 to 201

Key Drivers	Detail	Year
Completion of New City Buildings or Significant Operational Changes	WFPS Station #11 on Portage @ Route 90	2013
	WPS West District Station at 2321 Grant Ave.	2013
	WPS Firing Range at 1745 Wyper Road	2013
	East Yard Public Works main building at 960 Thomas Ave.	2013
	Winnipeg Transit Garage at 600 Brandon Ave.	2014
	East Elmwood Community Centre	2015
	Garden City Community Centre	2016
	Dakota Community Centre Sports Field House	2017
	Windsor Park Library	2017
	East Yard Public Works complex operational increases	2017
Electricity Emission Factors	Emissions associated with the consumption of electricity from the provincial grid have decreased significantly since 2007. This is a consequence of the Provincial coal phase-out and average or above-average lake levels.	
Construction at Millennium Library	Work on the Millennium library parkade in 2013 resulted in a one-year spike in emissions of approximately 1,300 tonnes CO_2e.	
Changes in the City Vehicle Fleet	The number of fleets managed by the WFMA has steadily decreased since 2013.	
Use of Personal Vehicles for Business Purposes	The use of personal vehicles for business purposes has steadily decreased since 2010.	
Corporate Waste	City-generated waste has tended to fluctuate from year to year although waste from facilities specifically has increased steadily since 2010. Construction and demolition waste decreased significantly from 2014 to 2017.	
LED Traffic Signal Conversion	Efforts to convert traffic signals to LED have led to a continuous reduction in electricity use.	

D. FORECAST

Forecasting corporate emissions is a challenging task. The energy impact of future growth and change remains uncertain, and is subject to change and estimation. Annual emissions are also subject to weather conditions. The following forecasts are intended to illustrate only the expected overall trend rather than a precise analysis of future greenhouse gas emissions from corporate operations.

Table 7 provides an overview of the forecast emissions for each of the business-as-usual, planned, and additional action scenarios. Details for each of the scenarios is provided below as well.

Table 7: Forecast GHG Emissions by Scenario (to 2030)

Sector	2014 (tonnes eCO_2)	Business As Usual (tonnes eCO_2)	Planned Actions (tonnes eCO_2)	Additional Actions (tonnes eCO_2)
Buildings	34,216	39,691	36,691	29,426
Vehicle Fleet	67,333	78,106	64,001	55,787
Streetlighting	227	263	263	209
Water, Sewage and Corporate Waste	23,498	26,493	20,646	14,545
Total	**125,273**	**144,553**	**117,055**	**99,967**

Three different scenarios were modelled for this inventory, using 2014 as the baseline year:

- The Business as Usual forecast assumes that energy use and emissions would change simply as a result of Winnipeg's annual growth rate of 1%. It assumed no new reduction actions, minimal progress on the WFMA Green Fleet Plan, minimal energy efficiency requirements for City buildings, no upgrades to sewage treatment plants, and no significant changes to corporate solid waste. Under this scenario, emissions are forecast to increase to by 21.6% to 144,553 tonnes CO_2e by 2030.
- The Planned Actions scenario estimated the impact if all known and approved actions were fully implemented by 2030 including achievement of the Green Fleet Plan's targeted 17.65% reduction (below 1998), and expansion of the Brady Road Resource Recovery Centre's landfill gas collection system. In this scenario, emissions are forecast to decrease by 1.6% to 117,055 tonnes CO_2e by 2030.
- The Additional Actions scenario was more ambitious and considered all major new City buildings being carbon neutral, advanced building energy conservation and efficiency programming (combined 20% reduction in emissions), and incorporation of building renewable energy options (10% reduction). With respect to vehicle fleet, it also incorporated greater reductions in fleet emissions, including roll-out of 20 electric buses. Significant corporate waste reductions were also considered. In this scenario, emissions would decrease by 20.2% to 99,967 tonnes CO_2e by 2030.

E. GENERAL METHODOLOGY

To date, the City of Winnipeg has been measuring corporate emissions from municipal operations in general accordance with the Partners for Climate Protection (PCP) Protocol: Canadian Supplement to the International Emissions Analysis Protocol. It offers modern guidance on good practice emissions accounting for local governments in Canada. The City has committed to adhering to the Global Protocol for Community-Scale GHG Emissions (GPC). This protocol has an expanded scope of GHG reporting and includes, for example, off-road transportation (rail, air) and contracted services. Subsequent inventories will be refined to align with the GPC protocol.

Greenhouse gas inventories provide an imperfect measure of corporate emissions, and are subject to continuous improvement in scope of reporting, increased transparency, and robustness as the City improves its tracking and data collection methods. Alignment with modern reporting protocols and emission factors adjustments also require periodic inventory revisions. Consequently, inventory revisions are often necessary to provide the most robust and accurate data possible.

Many of these inconsistencies will be resolved with future updates to this inventory. This update was subject to the following changes (2014 forward):

- Inclusion of Community Centres;
- Inclusion of Winnipeg Transit fuel consumption;
- Addition of aviation fuel associated with Winnipeg Police Service operations and the City's insect control activities.

Additional refinements to the City's inventory are expected in the future, including emissions resulting from contracted local services (e.g., waste hauling, snow removal and spring cleaning). Limited data made available from two waste hauling contractors for 2017/2018 suggest that emissions associated with that service alone could be in excess of 5,000 tonnes eCO_2 annually. The City has begun to incorporate appropriate language into bid opportunities and contracts so that appropriate data will be available for future iterations of the corporate GHG inventory. Table 8 provides additional detail regarding scope, protocol requirements, accounting method, and the relative contribution (where possible) to the City's inventory.

Table 8: Summary of Anticipated Inventory Revisions (2018)

Emissions Sector: Sub-Sector	Protocol Interpretation	Accounting Method
Fleet		
Other contracted city services (e.g., snow clearing)	Required	Future inclusion*
Other travel (e.g., air travel)	Optional	Not currently measured
Other vehicles (e.g., ice surfacing equipment)	Required	Future inclusion
Employee commute to/from work	Optional	Not currently measured

Corporate GHG reduction targets will be established after a comprehensive baseline year is established that accounts for all required emission sectors.

F. OPPORTUNITIES

A number of sector-specific undertakings have been put in place to support the City's efforts to reduce its GHG emissions. Some of these are City-led initiatives and others have been developed through partnerships with industry, academia and other organizations. The following describes primary opportunities for reducing corporate greenhouse gas emissions. It includes initiatives already in place that were identified in the previous Status Report on the Corporate Climate Action Plan (2016) and relevant actions identified in Winnipeg's Climate Action Plan under Strategic Opportunity #1 – Corporate Leadership.

Buildings

The buildings sector accounted for 38% of energy use and 26% of emissions in 2017. Emission reduction opportunities will include:

- The City's *Green Building Policy: New City-owned Buildings and Major Additions* (adopted 2011).
- The City's *Green Building Policy for Existing City-owned and Leased Buildings* (adopted 2011).
- The majority of the City's owned buildings have been entered into Portfolio Manager which provides capacity to monitor energy consumption, estimate GHG emissions, and undertake analyses.
- With support from Race to Reduce, the Office of Sustainability offered a number of free lobby events and info sessions to City staff members to discuss energy efficiency and other sustainability initiatives.
- Green Lease Strategy
- Exploration of renewable energy sources that directly displace natural gas use.

Streetlighting

Streetlighting accounted for 6% of corporate energy use and 0% of emissions in 2017. Opportunities remain for upgrades to park and pathway lighting although as noted above, associated emissions are very low given the City's reliance on predominantly renewable hydro-electricity.

Vehicle Fleet

The City's vehicle fleet accounted for 34% of energy use and 54% of emissions in 2017. Emission reduction opportunities will include those identified in the *Winnipeg Fleet Management Agency's Green Fleet Plan* (adopted 2010):

- Right Sizing the fleet.
- Purchase the most fuel efficient light duty, and lowest greenhouse gas emitting vehicles where operationally feasible.
- Replace older diesel engines with low emitting diesel engines.
- Evaluate and use alternative fuels.
- Implement and enforce a corporate anti-idling policy and install idle reduction technologies.
- Deploy fuel efficient driver training.
- Evaluate new advanced vehicles and technologies.
- Investigate maintenance and management practices to reduce fuel use.
- Inclusion of personal vehicle use, rental vehicles, and outsourced work.
- Transportation demand management.
- Communication and outreach.

Other initiatives include the following:

- The Electric Bus Demonstration project task force confirmed a number of benefits from electric buses and suggested a step-wise approach to transit electrification.
- The City's Electric Vehicle Pilot is currently underway, consisting of a trial of two electric vehicles and two level three charging stations.
- The Intuitive Routing System program is being implemented by the City's Parking Authority.
- Through the Office of Sustainability, the City continues to be engaged in active transportation programming like *GoManitoba*, employee commuting surveys, and Commuter Challenge.
- Inclusion of language in bid opportunities for contracted fleet services to facilitate collection of fuel consumption data and enhanced sustainable procurement requirements to reduce the carbon footprint of contracted fleet services.

Waste

Waste accounted for 10% of emissions in 2017. Emission reduction opportunities will include:

- Seeking out additional opportunities to implement enhanced waste reduction programs at other City facilities. To date, initiatives are underway at the Planning, Property and Development department (65 Garry Street and 185 King Street), and City Hall (510 Main)

- Expansion of the Brady Road Resource Management Facility landfill gas system. Funding for this initiative, which will bring the facility's methane collection efficiency to 75% will contribute to reductions in the City's GHG emissions.
- Opportunities will be explored to divert waste associated with other streams including, construction and demolition, as well as garden and leaf litter from the City's parks and open spaces.

Other

Other actions and opportunities underway to help the City reduce its corporate GHG emissions include the following:

- Ongoing meetings of the Climate Change Working Group
- Ongoing corporate GHG inventory work
- Enhanced internal communication efforts
- Winnipeg's Climate Action Plan describes a number of Key Directions and Actions that relate specifically to corporate leadership on GHG reductions.