

APPENDIX III: Greenhouse Gas Inventory – The Village of Park Forest 2015

Introduction

Greenhouse gases (GHG) are atmospheric gases that trap energy in the form of heat from the sun and directly relate to the quality of our atmosphere and climate. Measured greenhouse gases (GHG) include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and three replacements for chlorofluorocarbons (HFCs, PFCs, SF₆). The first three GHGs are dominant and account for more than 98 percent of GHGs emitted nationally¹⁴. Carbon dioxide is produced primarily from the burning of fossil fuels, and it is the largest contributor to global warming. Methane is produced by waste decomposition (primarily in landfills). Various GHGs have different global warming potentials, or ability to trap heat in the atmosphere. In order to compare from different sources, greenhouse gases are reported together on a common standardized basis as metric tons of carbon dioxide equivalent (CO₂e (MT)).

The increase in greenhouse gases is directly related to the potential for accelerated climate change. Research has shown an unequivocal average temperature increase at the Earth's surface by 1.2 - 1.4°F since 1900. In the Upper Midwest, climate change is likely to result in more frequent and intense storm events and heat waves, as well as longer periods of drought. Communities are a significant and growing source of energy consumption and GHG emissions because of the concentration of people and buildings. On a global scale, communities are major players in GHG emissions: they are responsible for more than 70 percent of global energy-related carbon dioxide emissions. Therefore, communities represent the single greatest opportunity for tackling climate change¹.

Since 2010, the Village of Park Forest has tracked community-wide GHG emissions to measure future progress towards meeting established targets. The Village developed a community-scale GHG emissions inventory for the calendar year 2010 as part of the *Growing Green: Park Forest Sustainability Plan*. The 2010 base-year GHG inventory led the Village to establish a long-term GHG reduction target of 6 percent below 2010 levels by the year 2025. As part of the development of the *Climate Action and Resiliency Plan*, the Village updated the 2010 GHG inventory for the year 2015. This has enabled the Village to document the success of efforts to reduce GHG emissions since adoption of the *Sustainability Plan*.

When Mayor Ostenburg signed the *Chicago Climate Charter* in December 2017 at the North American Climate Summit, Park Forest committed to achieve a percent reduction in GHG emissions equal to the United States' nationally determined contribution to the Paris Agreement. In effect, this means that the Village committed to reducing GHG emissions to 26 percent below 2010 levels by the year 2025. The inventory presented within this report updates the community inventory for the 2015 calendar year, discusses trends between the 2010 and 2015 inventory years to show progress over time, and serves as a baseline for the Village's future reduction goals.

¹⁴ EPA. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006." 2008

GHG Emissions Inventory

A GHG emissions inventory is an estimate of GHGs emitted to, or removed from, the atmosphere over a period of time, by documenting the amount and source of greenhouse gas emissions in a given year. The base year inventory serves as a reference point for monitoring future performance and progress and tracking the effectiveness of Village strategies and actions. The Village conducted a GHG inventory at two levels, including a community-wide level and a government operations level. The community-wide GHG inventory tracks GHG emission sources such as energy used by buildings throughout the community, all modes of vehicular transportation used in the community, and solid waste generation, water use, and wastewater treatment from all residents and businesses in the community. The government operations GHG inventory tracks the GHG emissions generated by Village-owned and operated facilities and utilities, including energy used by Village-owned buildings, street lights and traffic signals, the vehicle fleet, employee commute, the water treatment buildings and operations, and process and fugitive emissions.

Purpose of GHG Emissions Inventories

The GHG emissions inventory provides the Village with an understanding of where GHG emissions are coming from and assists in creating a starting point for developing strategies that can effectively reduce GHG emissions. Both the community-wide and government operations emissions inventory provide the following benefits:

- Identify the greatest sources of GHG emissions within the Village boundaries.
- Understand emission trends over time.
- Track progress in reducing emissions.
- Quantify the benefits of activities that reduce emissions.
- Establish a basis for developing an action plan.
- Revise goals and targets for future reductions.

In addition, the government operations GHG inventory provides the following added benefits:

- Improve the ability to manage energy use and opportunities for cost savings.
- Lead by example, and create a starting point to communicate and share best practices with local businesses and other organizations.
- Increase transparency and accountability for the Village government.

GHG Inventory Methodology

The Village of Park Forest's previous GHG emission inventory was conducted using the International Council on Local Environmental Initiatives' (ICLEI) Clean Air and Climate Protection (CACP) 2009 software. The current GHG inventory was conducted using ICLEI's ClearPath tool, which allows local governments to complete GHG inventories following the US Community Protocol and the Local Government Operations Protocol.¹⁵

¹⁵ ICLEI. *ClearPath online Software*. https://clearpath.icleiusa.org/community_scale/inventory_years/

Greenhouse gas emissions calculation, tracking, and management were conducted at the government operations and community scales. Emissions inventories are commonly expressed in metric tons (MT) of carbon dioxide (CO₂) equivalent per year (CO₂e (MT) /year), Carbon dioxide equivalent (CO₂e) is the universal unit for comparing emissions of different GHGs to CO₂ based upon the varying global warming potentials (GWP) of each gas¹⁶.

The 2015 emissions inventory was prepared using a combination of measured and estimated data, depending on the availability of data. Data were converted into greenhouse gas emissions using relevant emissions factors. Emission factors relate the amounts of greenhouse gases emitted by an action to a set amount of activity under that action. Factor Sets were created for some of the most common types of variables that are used this way: fuel economy and emissions rates for on-road transportation, grid electricity emissions factors, and waste characterization factors.

Emissions were calculated using the following equation:

$$\text{Amount of Activity} \times \text{Emissions Factor} = \text{GHG Emissions for the Action}$$

Data Sources

Data to conduct the community-wide greenhouse gas emissions inventory were obtained from various sources including the following:

- Community-wide electricity consumption data for 2015 was obtained from ComEd.
- Total on-road vehicle miles traveled (VMT) data was provided by the Center for Neighborhood Technology's "Park Forest Energy and Emissions Profile." This data set is for the year 2015.
- The composition of the vehicle classification on Park Forest's road links was obtained from CMAP's 2015 travel demand model.
- Community-wide natural gas consumption data for 2016 was obtained from Nicor.
- The total volume of water consumption in 2015 was obtained from the Village Water Treatment Plant Superintendent.
- The total volume of solid waste and waste composition was obtained from Homewood Disposal.
- The total volume of wastewater and wastewater treatment was estimated from data provided by the Thorn Creek Basin Sanitary District.

Data to conduct the government operations greenhouse gas emissions inventory were obtained from various sources including the following:

- Electricity and natural gas consumption data for 2015 was obtained from the Village records.
- Streetlights and traffic signals data for 2015 was obtained from ComEd.
- Vehicle Fleet data was obtained from the Department of Public Works.
- Employee commute data obtained from surveying the Village employees, based on total employee VMT and the average fuel economy and emissions rates of their vehicles.
- Records for process & fugitive emissions was obtained from the Recreation and Parks Department.

¹⁶ IPCC, 2007: *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Detailed Results - Community-wide GHG Inventory

In the base year 2015, Park Forest generated an estimated 192,076 metric tons of CO₂ equivalent emissions. Park Forest's largest single source of GHG emissions was the use of electricity and natural gas in residential buildings (*Figure 1*). With residential energy accounting for 39 percent of CO_{2e} emissions, and commercial energy at 16 percent, the community's consumption of energy in buildings (also known as "stationary source emissions") altogether accounted for 55 percent of GHG emissions. Following the building sector, on-road vehicles accounted for 40 percent of the GHGs attributable to the community in 2015. Emissions related to solid waste accounted for 4 percent, while emissions from water and wastewater treatment represented around 1 percent.

Stationary Source Emissions

Stationary energy-related emissions from buildings accounted for 55 percent of total community emissions in 2015. Since the majority of Park Forest's buildings are residential, residential buildings generate approximately 70 percent of the stationary energy sector emissions, commercial and government buildings provide an additional 28 percent and 2 percent, respectively (*Figure 2*). Stationary energy can also be analyzed according to the type of energy used. As shown in *Figure 3*, emissions from electricity and natural gas consumption in buildings are almost equal.

Mobile Source Emissions

Transportation sector emissions account for 40 percent of total community emissions. As shown in *Figure 1*, the majority of transportation emissions come from vehicle miles traveled by Park Forest residents. The Village's location at the edge of the metropolitan region and associated auto-dependence results in increased miles traveled by Village residents and, therefore, increased emissions.

Waste Emissions

Waste emissions include those that may be attributed to solid waste. This sector comprises a relatively small proportion of Park Forest's emissions, at 4 percent. Solid waste includes paper products, yard waste, wood, textile, or other waste that is disposed from various sources. Solid waste emissions are determined by the type and amount of waste disposed. Due to the fact that solid waste is taken to landfills that are outside of the control of municipalities, many emissions models do not mandate that these emissions are included in the total emissions inventory. The amount of solid waste produced, however, is within the control of the municipality.

Water and Wastewater

Water and wastewater emissions are the least source of GHG emissions at 1 percent. Park Forest is dependent on groundwater for its potable water supply. The Village Water Department operates the Village's water collection, conveyance, and water treatment system. Wastewater is liquid waste that is discharged by commercial, residential, industrial, or institutional sources. Wastewater emissions are determined by the amount of wastewater discharged and the method of wastewater treatment. While the wastewater treatment center is outside of the control of the municipality, the community can reduce the amount of water use, and thereby reduce the amount of wastewater produced.

Detailed Results - Government GHG Inventory

In the base year 2015 an estimated 5,896 metric tons of CO₂ equivalent emissions were released through government operations. This represents 2.8 percent of the community-wide emissions. So, while it is important to address GHG emissions from government sources, it is even more vital to get the community involved in addressing GHG emission sources such as residential energy use, vehicular travel patterns, and recycling and waste disposal.

The largest single source of greenhouse gas emissions from government sources was the use of electricity and natural gas in Village-owned buildings and facilities (*Figure 4*), with building energy accounting for 36 percent of CO₂e emissions, the Water Plant at 27 percent, and street lights and traffic signals at 19 percent. The government's consumption of energy in buildings altogether accounted for 82 percent of the total GHG emissions. Following energy consumption from stationary sources, mobile source emissions from Village employees' commute and vehicle fleet accounted for 17.5 percent of the GHG emissions from government operations in 2015. Emissions related to process & fugitive emissions accounted for less than 1 percent.

Emissions Trends

Park Forest community-wide GHG emissions have decreased from 2010 to 2015 as shown in *Figure 5* and Table 1. While emissions from interim years have not been quantified, the two inventories indicate a steady decline in emissions during this period. Between 2010 and 2015, total emissions decreased by 3.6 percent. While the overall emissions decreased, the relative distribution of emissions by sub-sector changed minimally between the two inventory years. In each inventory, the largest sources of emissions are the residential and commercial energy and on-road transportation energy.

At the government level, GHG emissions have decreased from 2010 to 2015 as shown in *Figure 6* and Table 2. The two inventories indicate more progress toward emission reduction during this period at the government level than at the community-wide level. Between 2010 and 2015, total emissions generated at the government level decreased by 11 percent. While the distribution of emissions by sub-sector changed minimally between the two inventory years, the highest emission reduction was in buildings and facilities energy consumption. This is largely the result of the lighting upgrades which were conducted in most Village buildings. Also, measurable reduction of emission from water treatment facilities is shown in the *Figure 7*, which is the result of the Water Plant efficiency upgrades which took place in 2014/2015. Street lights and traffic light emission reduction is a result of replacing/upgrading street lights.

Given the progress the Village has made in reduction of GHG emissions at both the community-wide and government operations levels, and the Village's stated commitment to the Paris Climate Agreement goals (*Figure 7 & Figure 8*), the *Climate Action and Resiliency Plan* recommends a revision to the GHG emission reduction goal. While the 2010 base year will remain the same, the emission reduction target will be shifted from the original 2010-based target of 6 percent reduction by 2025, to the more ambitious target of 26 percent by 2025 consistent with the Paris Climate Agreement. This transition is compatible with the change in international emissions reduction targets. It should be noted, however, that the International base year is 2005 or similar (under the Paris Agreement), yet the Village's base year will remain 2010 since it is the earliest GHG inventory conducted. This change will also increase the accuracy in tracking the community's emissions performance and its contribution to global climate protection efforts.

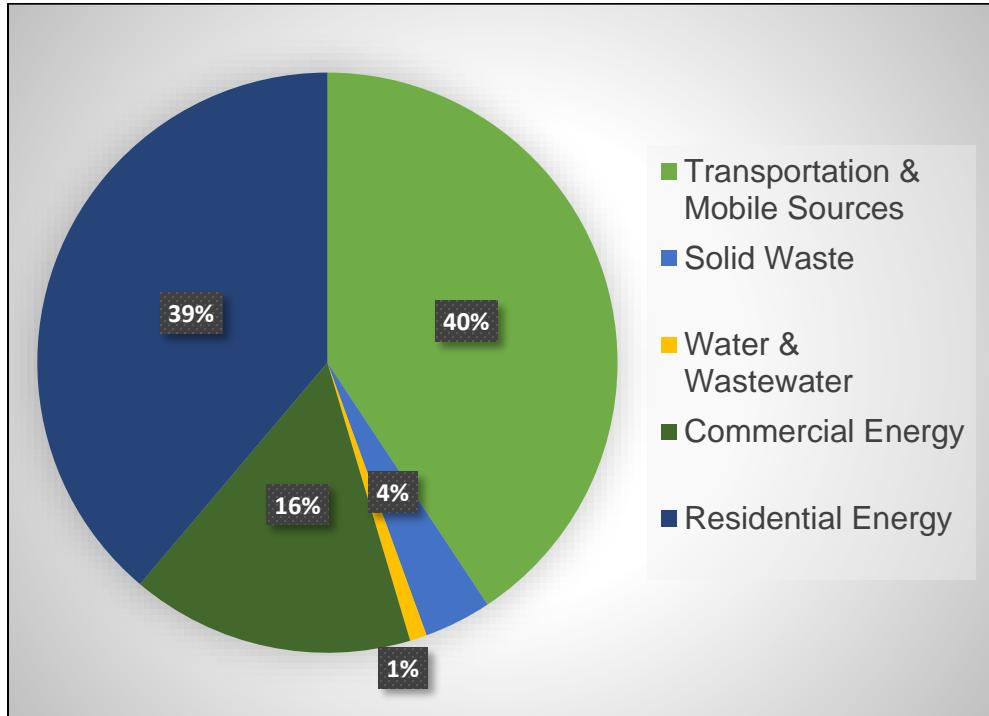


Figure 1: Park Forest Community-Wide GHG Emissions

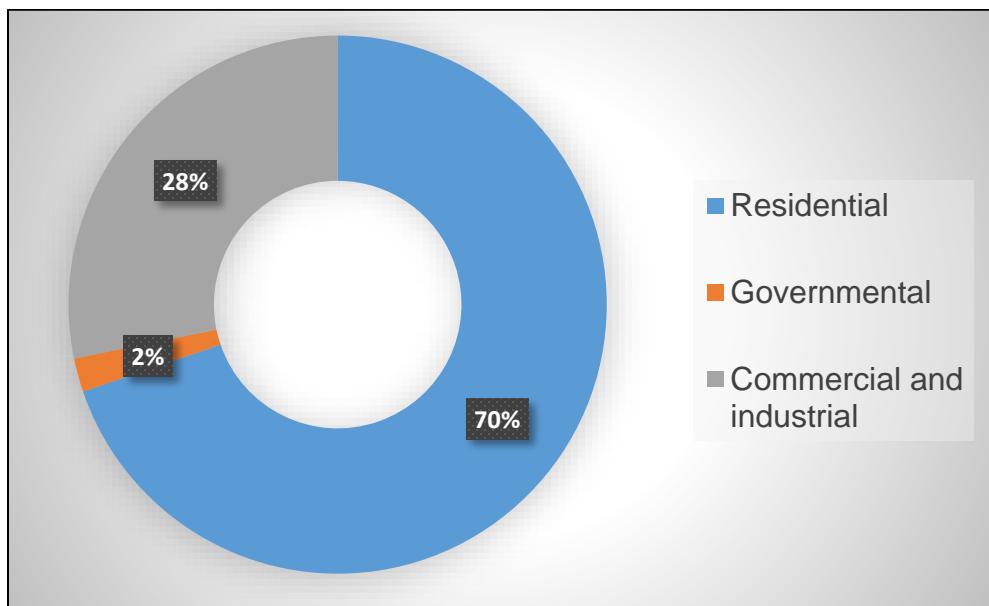


Figure 2: Stationary Source Emissions by Sub-Sector

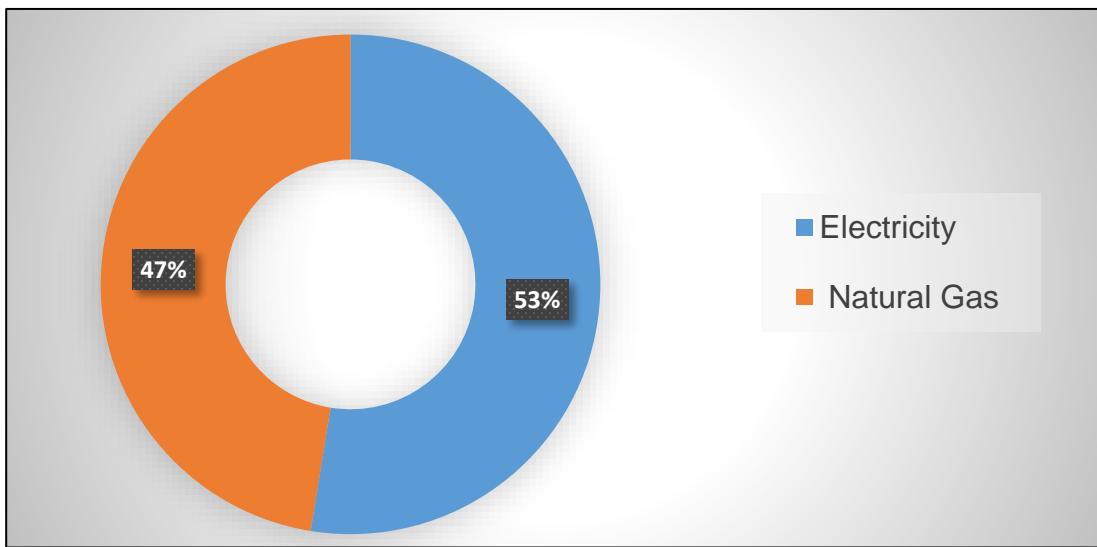


Figure 3: Stationary Source Emissions by Energy Source

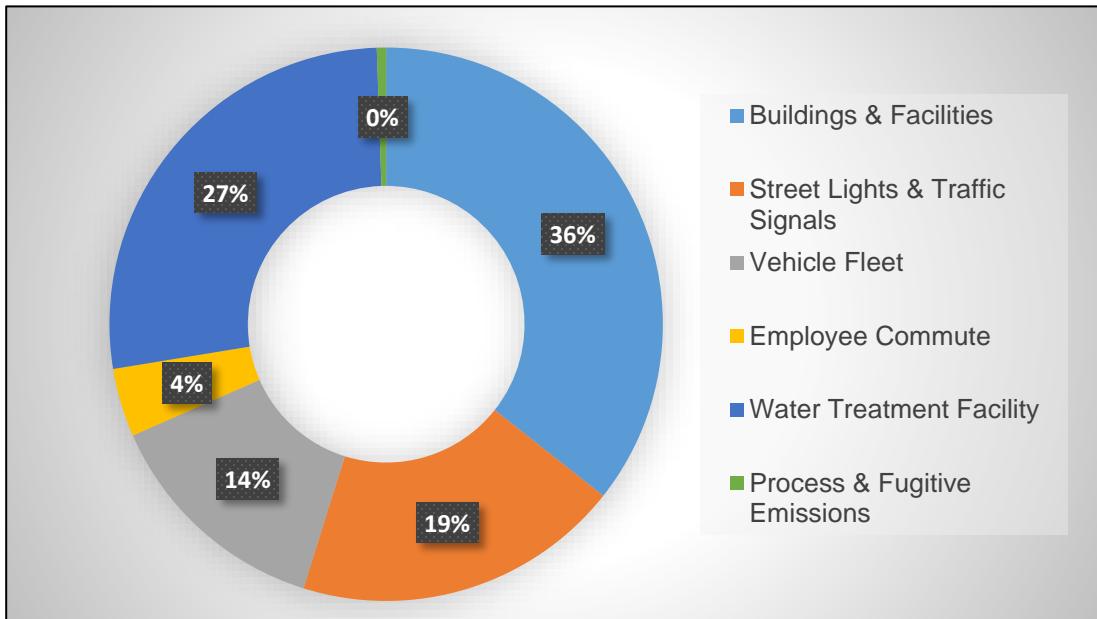


Figure 4: Park Forest Government Inventory

Year	Transportation & Mobile Sources	Solid Waste	Water & Wastewater	Commercial Energy	Residential Energy	Total GHG emission (MT)
2010	78523	8856	2229	28931	80895	199434
2015	78112	7211	1824	31864	73065	192076

Table 1: Community CO2e (MT) Emissions by Sector 2010 - 2015

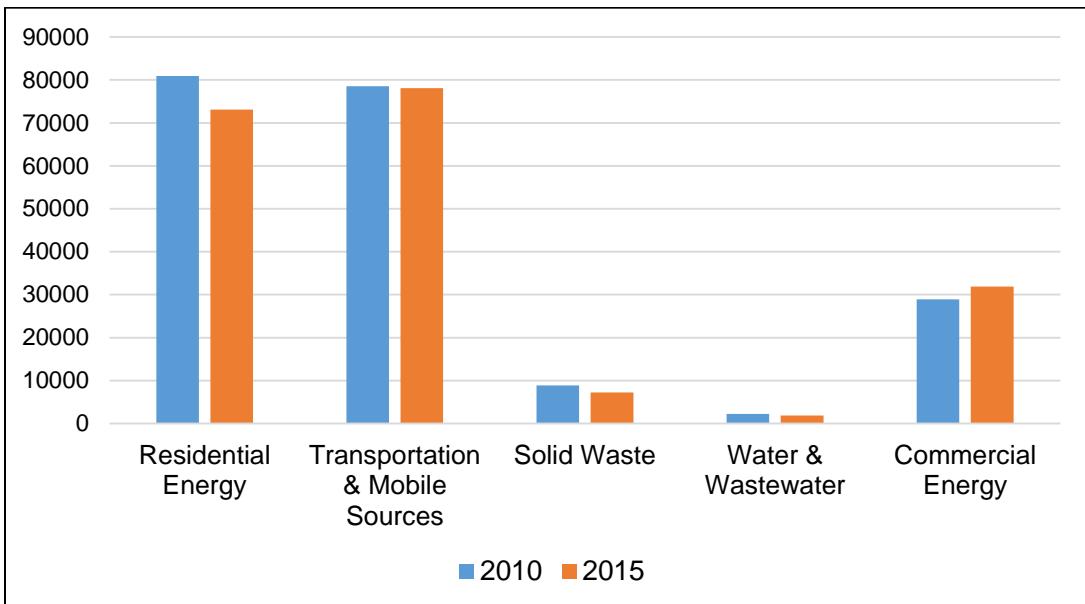


Figure 5: Community CO₂e (MT) Emissions by Sector 2010 - 2015

Year	Buildings & Facilities	Street Lights & Traffic Signals	Vehicle Fleet	Employee Commute	Water & Wastewater Treatment Facilities	Process & Fugitive Emissions
2010	2373	1209	704	235	1991	85
2015	2092	1126	797	235	1587	32

Table 2: Government operations CO₂e (MT) Emissions by Sector 2010 – 2015

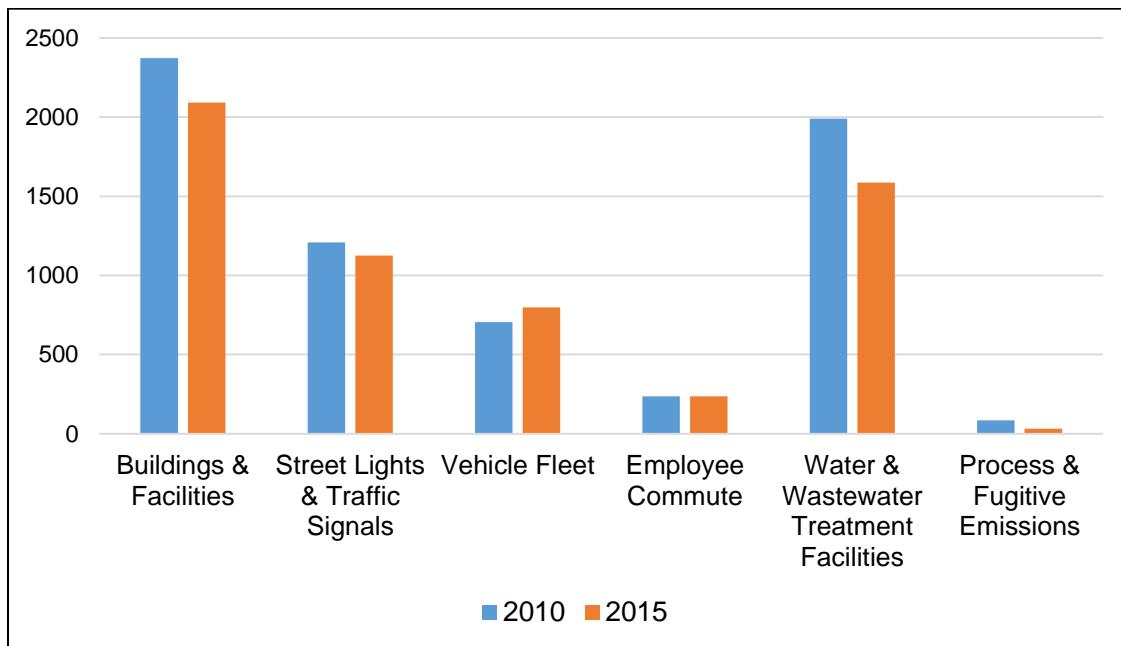


Figure 6: Government operations CO₂e (MT) Emissions by Sector 2010 - 2015

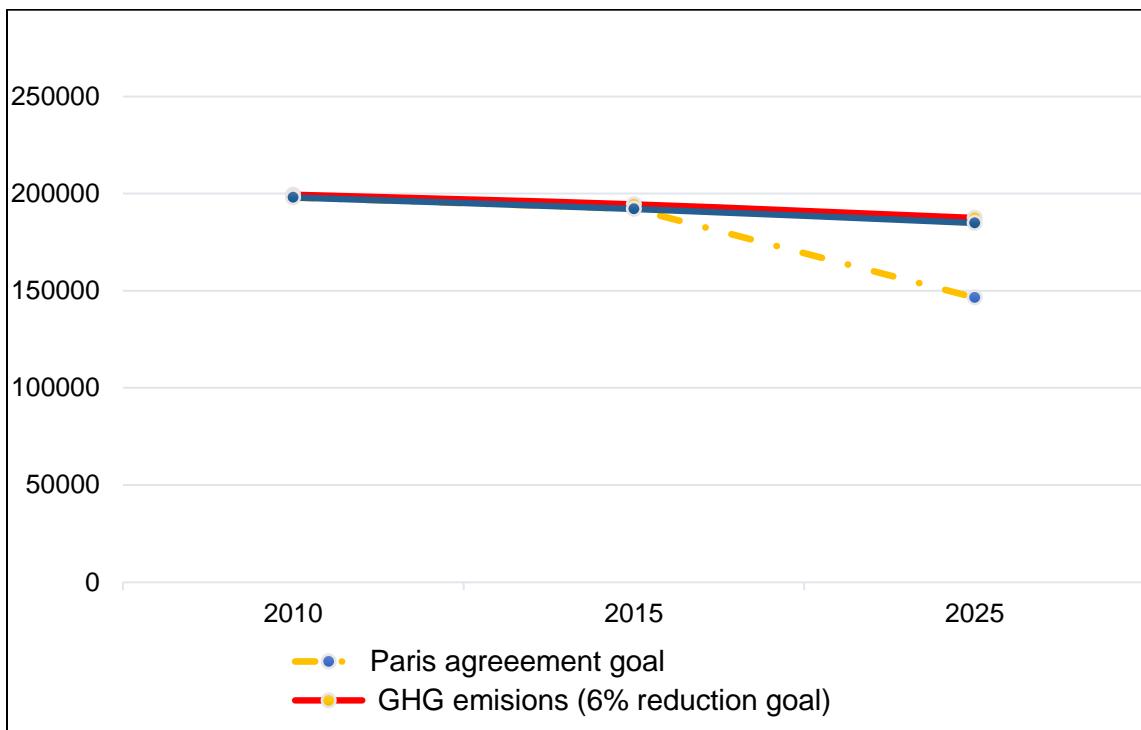


Figure 7: Community GHG Emissions Trends

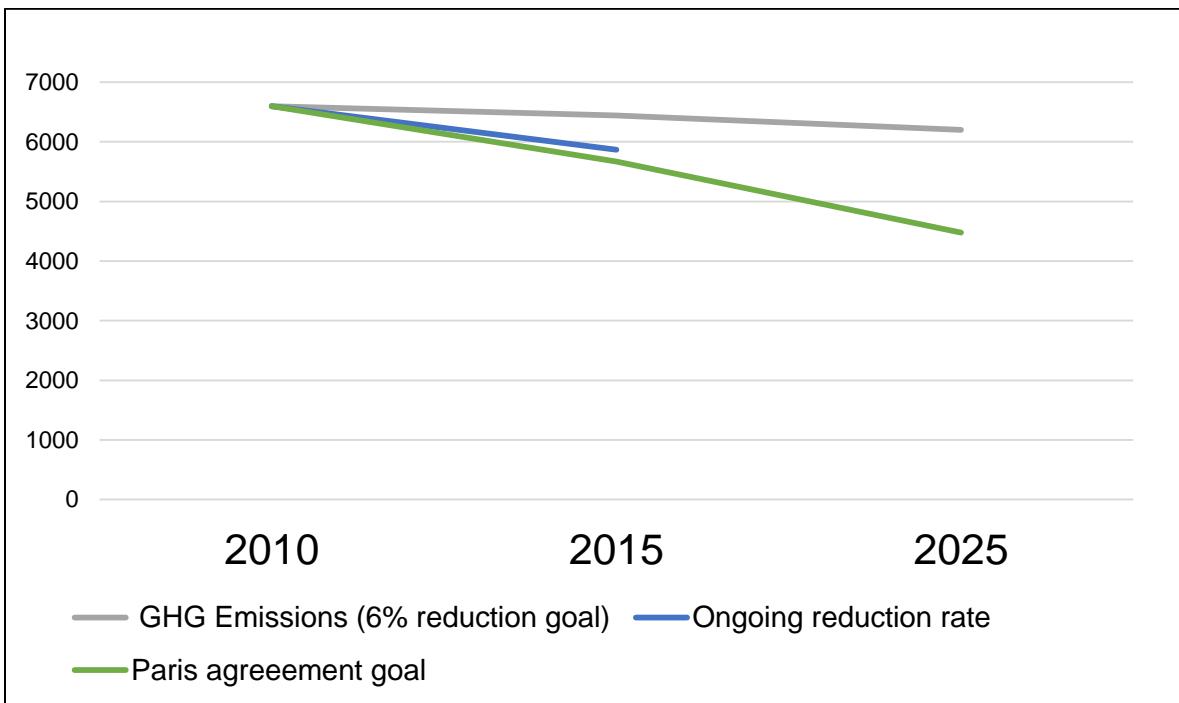


Figure 8: Government operations GHG Emissions Trends.