Government of Yukon corporate greenhouse gas emissions

Yukon

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Climate Change Secretariat
Department of Environment
Government of Yukon

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Overview

The Government of Yukon is committed to tracking the greenhouse gas emissions (GHGs) from its internal operations. Consistent tracking and reporting of our inventory allows us to remain transparent and accountable for emissions activity and targets. This report communicates what role the Government of Yukon plays in Yukon's overall greenhouse gas emissions, identifies the major sources of the Government of Yukon's emissions and provides an analysis regarding the major factors that influence emission increases and decreases over time.

The release of this report is intended to accompany the release of *Our Clean Future: A Yukon strategy for climate change, energy and a green economy*, under which Government of Yukon has committed to reducing its greenhouse gas emissions from building heating by 30 per cent below 2010 levels by 2030. Included below is the methodology used to calculate the Government of Yukon's corporate GHGs; a summary of Government of Yukon emissions over the past nine years broken down by emission source type, building type and location; analysis of factors relevant to emissions such as Yukon's population and annual temperatures; and the next steps to be taken.

Third party verification

We undertake rigorous emissions work each year to calculate the Government of Yukon's annual corporate emissions. Every five years, these calculations are verified by an independent third party to ensure data accuracy and are also reported publically to fulfill international reporting requirements. This is done through The Climate Registry, a non-profit organization that designs and operates global GHG reporting programs.

This quality assurance step provides a higher level of confidence in the methodology used to put together the Government of Yukon's emissions inventory and allows us to ensure that emission reductions are being tracked against an accurate baseline. Currently, the Government of Yukon greenhouse gas emission reports for the calendar years 2010 and 2015 are available through the Climate Registry Information System. The next verification of Government of Yukon greenhouse gas emissions will take place in 2021 for the 2020 reporting year.

Methodology

All greenhouse gas emission calculations were undertaken in adherence to the principles and standards set by The Climate Registry, including the use of the emission factors set by the Registry. These reporting standards determine the types of emission sources that must be included in reporting and the specific methods that must be used to calculate total greenhouse gas emissions. As part of this, emissions are reported in kilotonnes of carbon dioxide equivalent (CO_2e). This means that greenhouse gasses other than carbon dioxide (such as methane and nitrous oxide) are included and reported in terms of how much more potent than carbon dioxide they are. For example, one tonne of methane is the same as 28 tonnes of carbon dioxide equivalent. Emission factors are the tonnes of carbon dioxide equivalent emitted per fuel source (ex. electricity, oil, propane) and allows us to calculate total greenhouse gas emissions based on quantity of fuel or energies consumed.

There are two main sources of information that make up the Government of Yukon's greenhouse gas inventory. These are the Public Building Energy Tracker (PBET), which is managed by the Property Management Division, and the KEYS database, managed by Fleet Vehicle Agency. The PBET database tracks the amount of heating fuel and electricity used in each Government of Yukon building. Given that more than half of the Government of Yukon's greenhouse gas emissions come from heating its buildings, this database is the most significant source of information for the Government of Yukon's greenhouse gas inventory. The KEYS database tracks the volume of fuel used by Government of Yukon fleet vehicles, which accounts for nearly one-quarter of the government's emissions.

The remaining emission sources that are not captured in these two databases include fuel associated with non-fleet vehicles, waste management (landfilling, waste water treatment, solid waste incinerations) and refrigeration (stationary refrigeration systems and A/C in fleet vehicles). Greenhouse gasses from waste management include the emissions that come directly from landfills, septic pits, sewage lagoons and sites where waste is incinerated. This makes up a relatively small proportion of total emissions, and is estimated based on the population that each site services. As part of The Climate Registry reporting standards, all refrigerants that are regulated under the Kyoto

Protocol must be reported. These include common refrigerants such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) which are used in Government of Yukon building refrigeration systems and fleet vehicle air conditioning units, and contribute to climate warming.

Key findings

The greenhouse gas emissions produced by the Government of Yukon's operations were 32.5 kilotonnes of CO_2e in 2018. This is a 4.9 per cent increase over the emissions in base year 2010. This is the 4th highest emission year during the period from 2010 – 2018.

As per Figure 1, the Government of Yukon's emissions peaked in 2013 and 2014, and have since decreased, though emissions remain marginally higher than those in 2010. Variations in emissions between 2010 and 2018 can be attributed to a growing Yukon population and GDP, as well a greater number of Government of Yukon buildings switching to cleaner heating fuels. These factors will be explored in greater detail throughout this report.

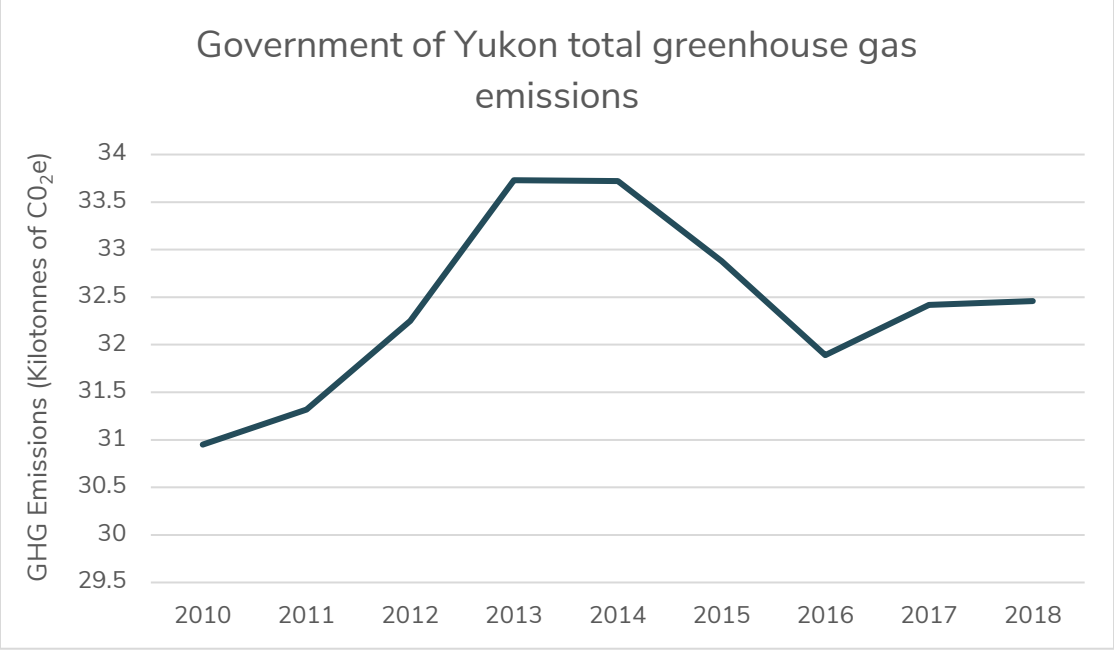

Figure 1: Total greenhouse gas emissions from Government of Yukon operations in kilotonnes of carbon dioxide equivalent.

Together, heating and transportation make up 92 per cent of the Government of Yukon's emissions as of 2018. There was significant variation between 2010 and 2018 in terms of the proportion of emissions which come from each source type. Figure 2 shows how the percentage of emissions from each source type has changed over time.

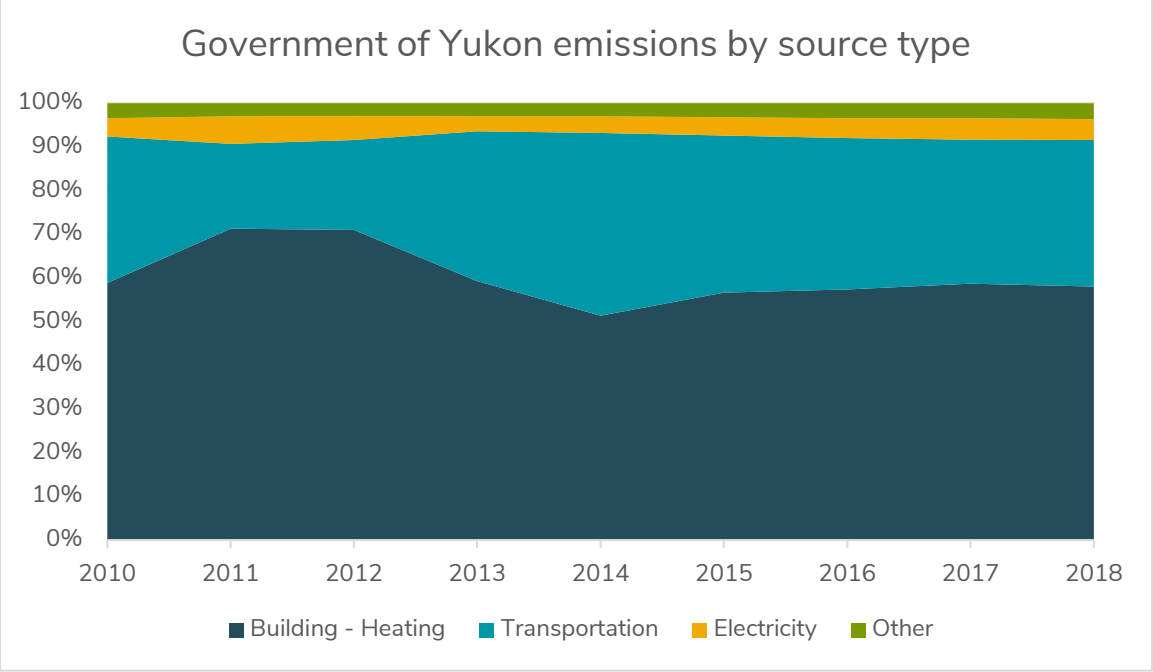

Figure 2: Proportion of Government of Yukon greenhouse gas emissions from each source type from 2010 – 2018.

Between 2010 and 2018, all greenhouse gas emission source categories increased, with the exception of emissions from refrigerants which decreased 21 per cent.

Most of the Government of Yukon's emissions are from heating government buildings. These emissions have decreased since 2012 as a result of ongoing efforts to reduce energy use and greenhouse gas emissions. Our success has allowed 2018's greenhouse gas emissions to be only 3 per cent higher than its 2010 levels (Table 1) despite Yukon's growth over the last nine years.

Similarly, emissions from transportation peaked in 2014, but as of 2018, are 5 per cent higher than 2010 levels. Emissions from electricity consumption, and other sources

(waste processing and refrigeration) total to less than 10 per cent of the Government of Yukon's 2018 total emissions, though this can vary year-to-year.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Per cent change 2010 - 2018
Buildings – Heating	18.22	22.34	22.90	19.99	17.32	18.62	18.29	19.02	18.84	3.39 per cent
Transportation	10.38	6.08	6.64	11.58	14.11	11.84	11.05	10.69	10.89	4.88 per cent
Electricity	1.30	1.98	1.76	1.15	1.28	1.37	1.46	1.59	1.56	20.04 per cent
Waste	0.84	0.86	0.88	0.89	0.9	0.99	1.00	0.99	1.01	20.11 per cent
Refrigerants	0.21	0.07	0.08	0.12	0.1	0.06	0.10	0.12	0.17	- 20.76 per cent

Table 1: Total Government of Yukon greenhouse gas emissions (kT CO_2e) by source type 2010 – 2018.

Approximately half of the Government of Yukon's emissions come from its operations in Whitehorse. Remote highway maintenance camps and structures located outside of communities represent the next largest emission source by location. These camps have higher emissions due to lack of connectivity to electrical grids and need to generate power using on-site diesel generators. These camps consists of grader stations, living complexes and other related facilities along Yukon's highways. Operations in Dawson City, Watson Lake, Ross River, Mayo and Haines Junction are also notable contributors to the Government of Yukon's GHG emissions, as shown Figure 3. These communities are notable contributors for two main reasons. Firstly, these communities are home to some of the highest populations in Yukon outside of Whitehorse, and secondly, Watson Lake is not connected to the electrical grid and therefore relies on diesel for electricity generation.

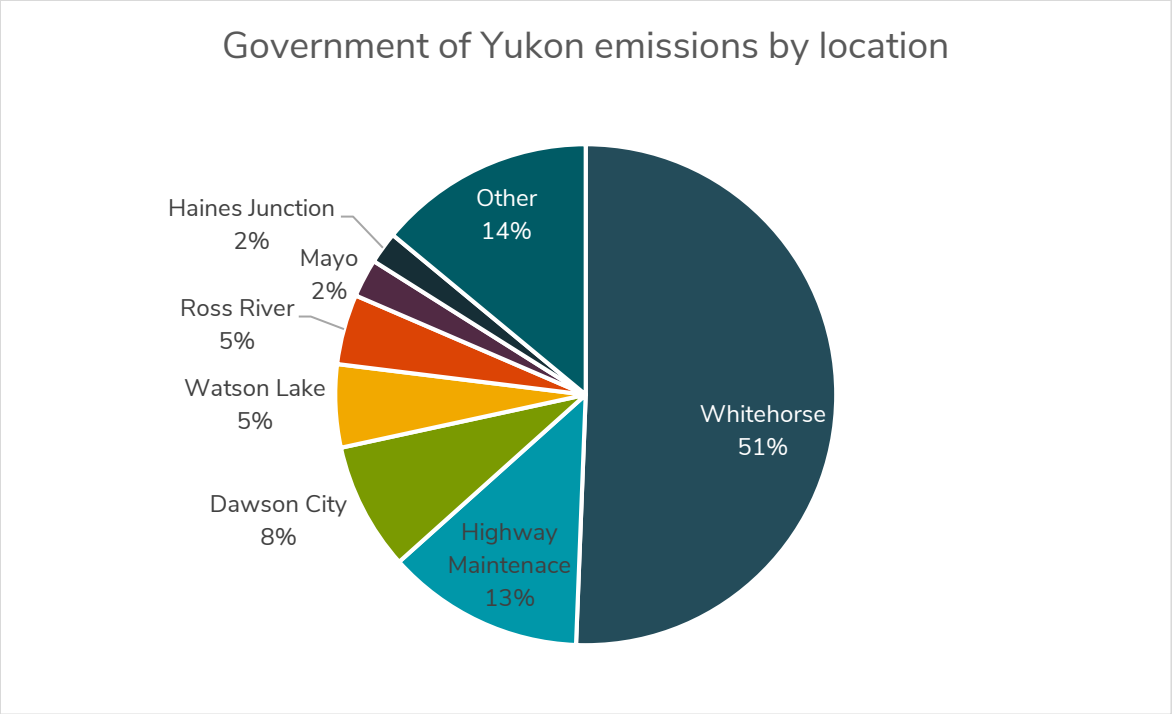

Figure 3: Breakdown of Government of Yukon greenhouse gas emissions from stationary sources by location.

Emissions by source type

Building heating emissions

Overall, building heating consistently makes up the largest proportion of Government of Yukon emissions, making up 56 per cent of 2018 emissions.

Heat for government buildings such as schools, healthcare facilities and office buildings, continue to be the largest emission category for the Government of Yukon. However, the annual emissions from government buildings only increased 3 per cent from 2010 to 2018 despite the growth in population and governmental services over the last 8 years (Figure 4). Building heating emissions were highest in 2011 and 2012, then decreased to levels comparable to the 2010 baseline due to the success of energy conservation and GHG emissions reduction measures (Figure 4).

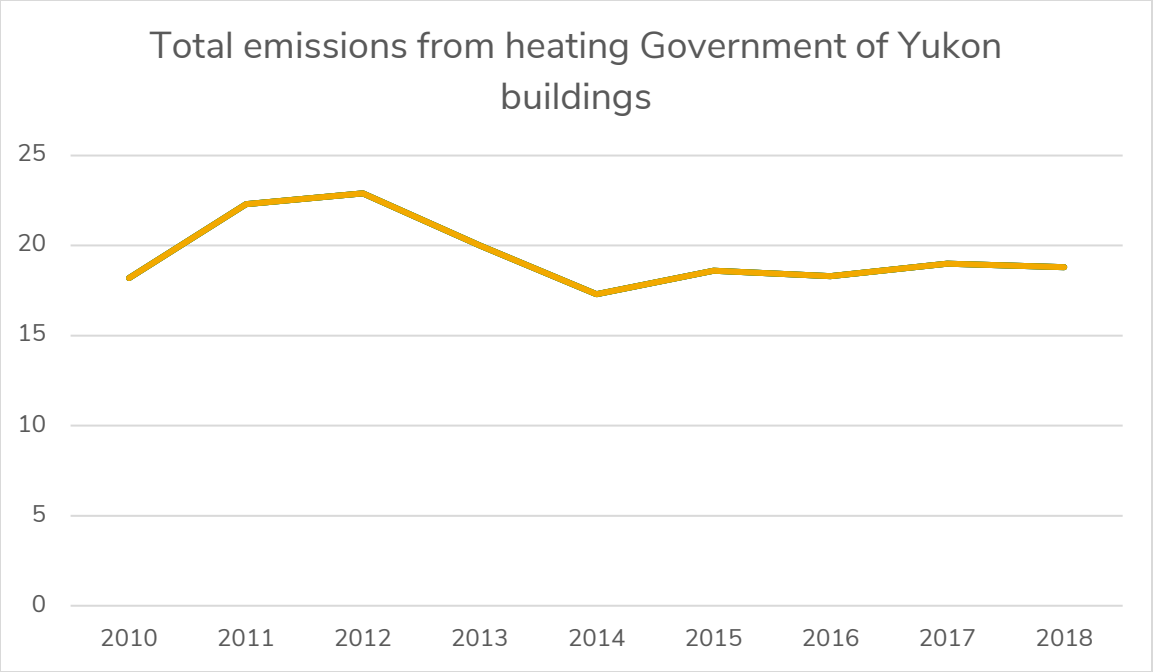

Figure 4: Greenhouse gas emissions from heating Government of Yukon buildings (kT $C0_2e$).

The Government of Yukon manages many different types of buildings which have a wide range of energy requirements. The number and size of buildings within each building type, as well as the intensity of its operations determine the proportion of the Government of Yukon's overall emissions that it makes up. The largest category is schools, which account for 28 per cent of building emissions (Figure 5). Secondly, grader stations (buildings which support road maintenance work) make up 14 per cent of building emissions. Since many grader stations are not connected to electrical grids, they are required to generate power using on-site diesel generators, leading to higher greenhouse gas emissions. Office buildings account for 12 per cent of building emissions. The next highest emissions are attributed to residential buildings, airports, continuing care, water and sewage treatment, workshops, garages and storage sheds.

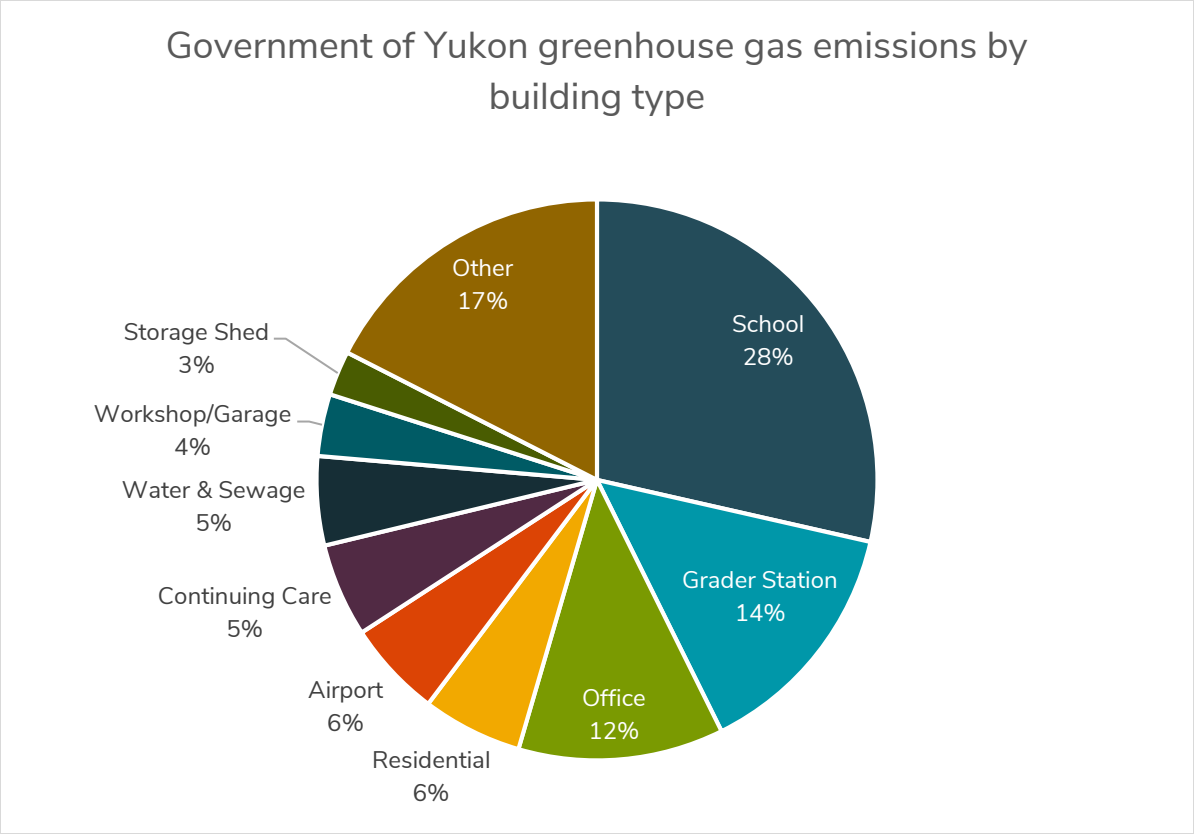

Figure 5: Government of Yukon greenhouse gas emissions by building type.

Annual greenhouse gas emissions from government buildings vary year to year due to multiple factors including weather, occupancy, program changes and operating hours.

Additionally, ongoing efforts such as building system upgrades and fuel switching to a less carbon-intensive fuel have also achieved reductions in greenhouse gas emissions. In particular, the Government of Yukon is gradually replacing oil-based heating systems with propane systems as part of its commitment to reduce Yukon's reliance on diesel. As such, the proportion of heating by propane relative to heating by fuel oil increased over 2010 – 2018 (Figure 6). Emissions from heating oil reduced from 84 per cent in 2010 to 76 per cent in 2018. Comparatively, propane increased from 16 per cent in 2010 to 24 per cent in 2018. Due to the lower carbon intensity of propane, this shift contributed to the reduction in emissions from building heating that was seen between 2012 and 2018.

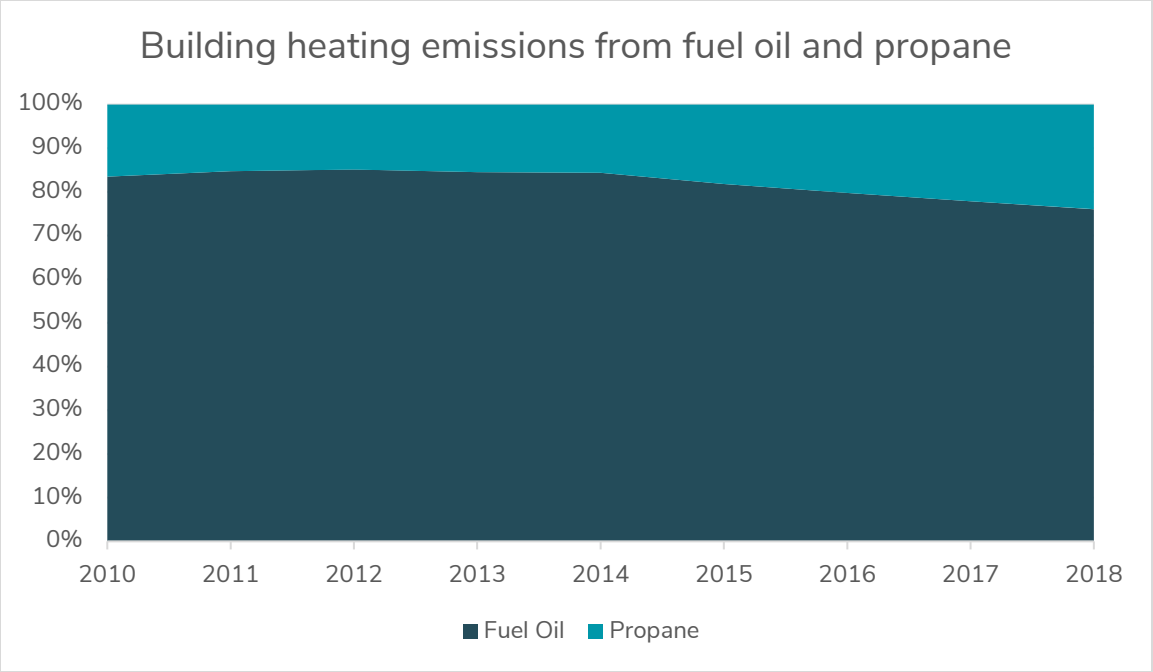

Figure 6: Proportion of greenhouse gas emissions from fuel oil and propane as building heating fuels.

In addition to this, annual temperatures are an important predictor of how much heating fuel will be used in a given year. In a particularly cold winter, more fuel is needed in order to keep buildings warm.

A common way of summarizing a year's temperatures is by using Heating Degree Days (HDDs). This is the average temperature difference between a cold day and the ideal indoor temperature (18 degrees Celsius, in this case). Heating degree days are measured in degrees Celsius as a representation of the amount of heat required to temper a space for comfortable occupancy for the day. Heating degree days are added together to quantify the total amount of heat required over a period of time.

Figures 7 and 8 show the annual heating degree days in Whitehorse, Dawson City, Ross River, Watson Lake and Haines Junction compared to the emissions from building heating in each community.

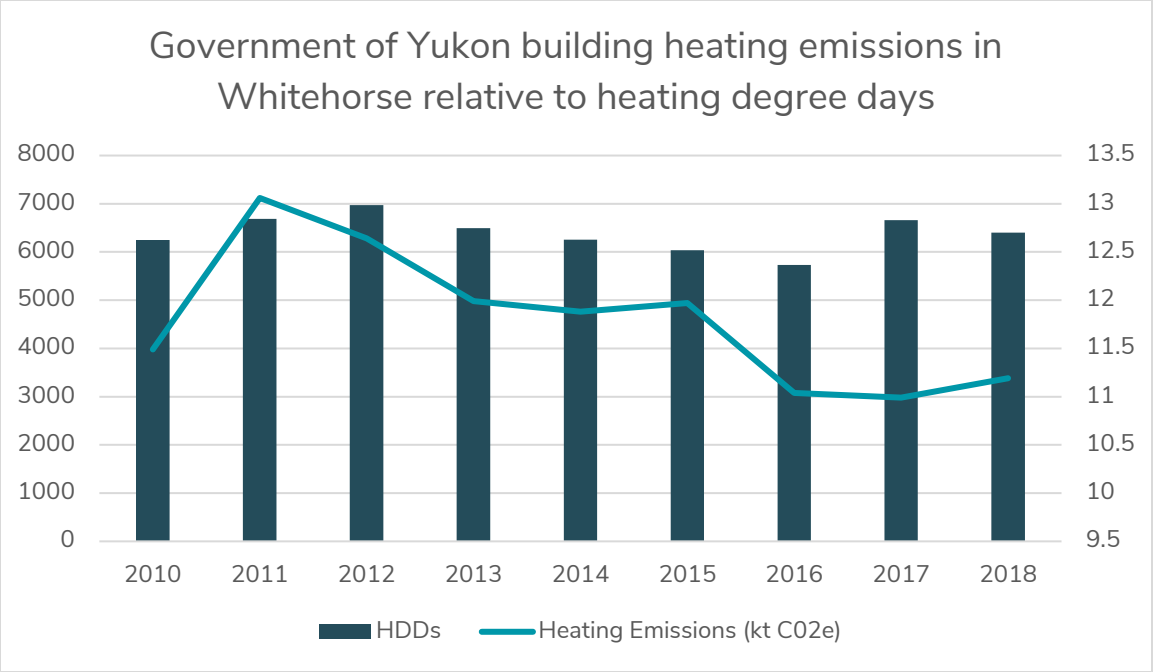

Figure 7: Whitehorse building heating emissions relative to annual Heating Degree Days.[1]

Building heating emissions do not appear to be directly correlated to Heating Degree Days in Whitehorse (Figure 7). 2011 and 2012 had the coldest temperatures during this period as well as the highest emissions related to building heating. This indicates that the reason for the higher building emissions in these two years may be the colder winters requiring more heating fuel to be used. The decrease in emissions from building heating in Whitehorse between 2013 and 2018 does not appear to be due to warmer temperatures as the annual HDDs do not decrease over this period. Rather, this decrease in emissions appears to be due to the fuel switching from fuel oil to propane as seen in Figure 6.

[1] Source: Environment Canada, Whitehorse A and Whitehorse Auto weather stations.

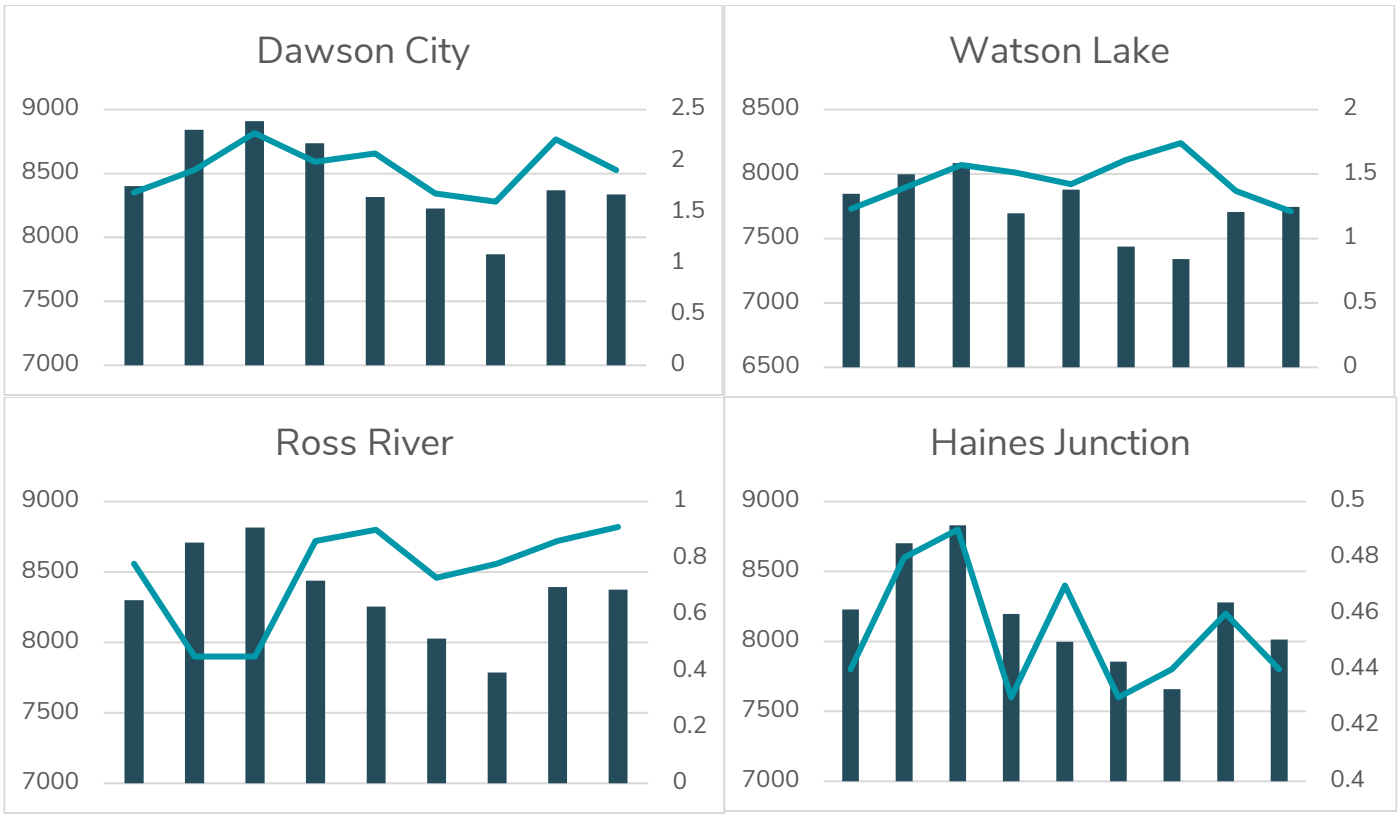

Figure 8: Building heating emissions relative to annual Heating Degree Days in Dawson City, Watson Lake, Ross River and Haines Junction [2]

In Dawson City, the annual temperatures correspond closely to the emissions from building heating (Figure 8). The highest heating emissions and coldest temperatures were both seen during the period from 2011 – 2013, and the lowest heating emissions and mildest temperatures were seen from 2014 – 2015. This indicates that the variation in emissions from building heating in Dawson is likely due to temperature variation. A similar pattern is seen in Haines Junction where the coldest years (2011 and 2012) have the highest emissions from building heating, and the warmest years (2015 and 2016) have the lowest building heating emissions.

In Watson Lake and Ross River, the annual HDDs have a weaker correlation to emissions from building heating, indicating that the reason for annual variation may not be due to temperature. In Ross River, a significant portion of building emissions come from its grader station which is used to support transportation maintenance work. The

[2] NASA Near Real-time Global Radiation and Meteorology Database.

2010 – 2018 emissions trend in Ross River closely matches the transportation maintenance emission trend seen in Figure 9. This indicates that grader station emission variability, caused by overall transportation maintenance emission variability, is likely largely responsible for the greenhouse gas emission trend seen in Ross River. In Watson Lake, greenhouse gas emissions were fairly stable between 2010 and 2016. There was a 25 per cent decrease in emissions between 2016 and 2018 due in part to the Watson Lake Grader Station being switched from fuel oil heating to propane heating.

Transportation emissions

The second-largest source of the Government of Yukon's emissions is transportation, which made up 34 per cent of 2018 emissions.

This includes fleet vehicles (on- and off-road) a well as heavy-duty vehicles used to maintain Yukon's road network. Transportation emissions were lowest in 2011-2012, then peaked in 2014, before returning to a level only slightly above the 2010 baseline in 2018. Transportation emissions increased 5 per cent between 2010 and 2018.

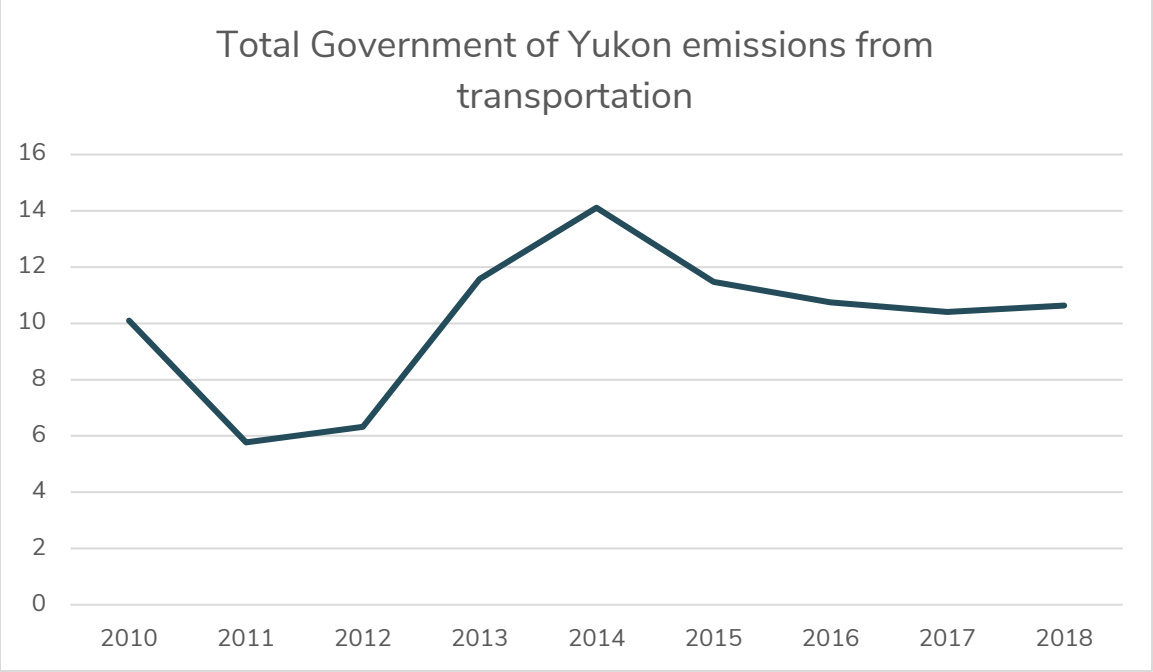

Figure 9: Government of Yukon greenhouse gas emissions from transportation (kT $C0_2e$).

On-road and off-road vehicle emissions were fairly consistent between 2010 and 2018, whereas emissions related to transportation maintenance are more varied year to year according to the amount of maintenance required in a given year (Figure 10). This explains some of the variance seen in the overall transportation category over the last decade.

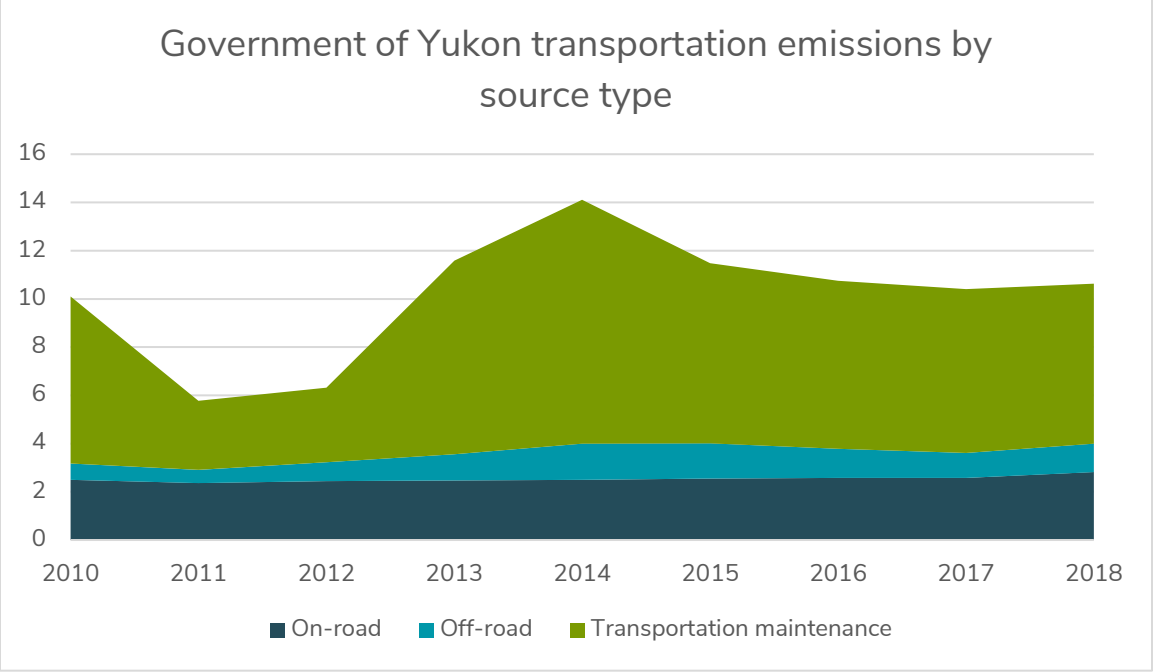

Figure 10: Government of Yukon greenhouse gas emissions from the transportation sector by source type (kT $C0_2e$).

Below we have used annual budget as a proxy to draw comparisons between the annual variation in transportation maintenance emissions and the amount of maintenance completed each year.

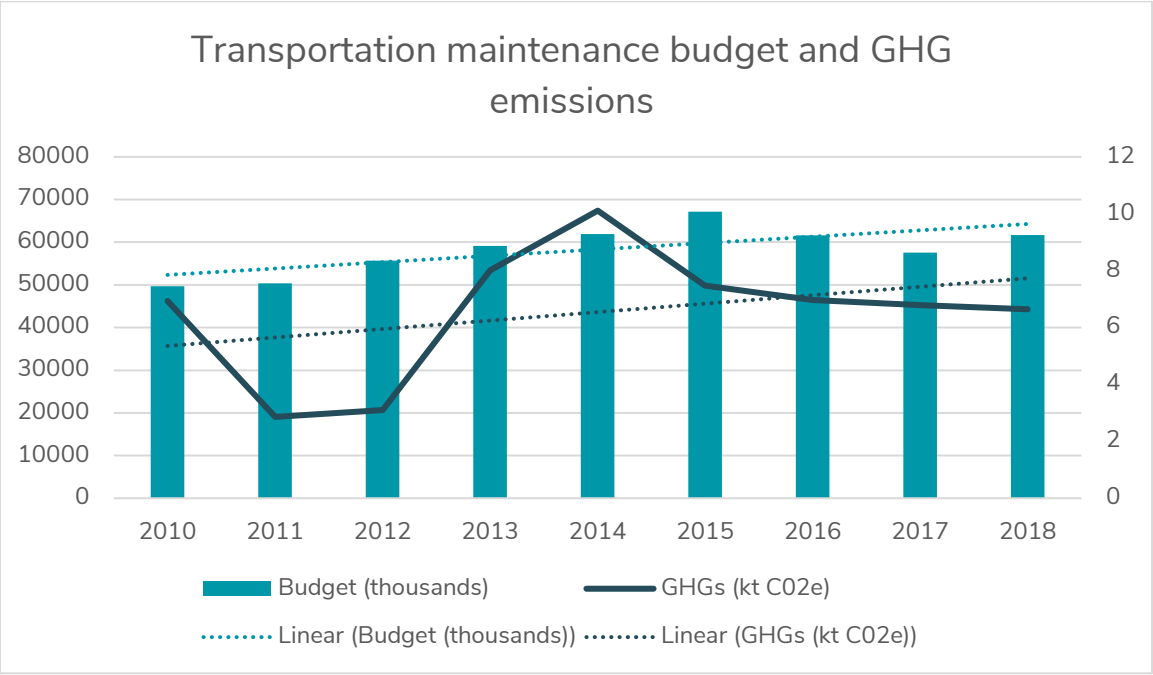

Figure 11: Greenhouse gas emissions from transportation maintenance compared against the budget for transportation maintenance activities.[3]

As can be seen in Figure 10, the emissions related to transportation maintenance do not correspond directly to the variation in budget over this same time period. However, the rate of increase of both (as indicated by the dotted lines in Figure 11) over this time period is approximately the same. This indicates that the increase in transportation emissions seen between 2010 and 2018 may be due in part to an increasing scope and frequency of road infrastructure maintenance work. Other potential reasons for this increase are weather volatility and an aging fleet of transportation maintenance vehicles.

[3] RAERF Revenues and TMB Infrastructure Financial Expenditures by Year 2010 – 2018.

Other indicators

As part of this analysis, it is also important to explore other major demographic and economic trends in Yukon between 2010 – 2018 to examine what effect they may have had on the Government of Yukon's emissions. Specifically, the factors that will be examined are Yukon's gross domestic product and Yukon's population.

Yukon's GDP consistently increased between 2010 and 2018 by 15 per cent, with the exception of a dip in 2015 (Figure 12). Given that the Public Administration sector made up 23.9 per cent of Yukon' GDP in 2018[4], a growing GDP is an important indicator of growth in Yukon overall and within the public sector. This growth is therefore linked to a greater scope of government operations, and by extension, to increased greenhouse gas emissions.

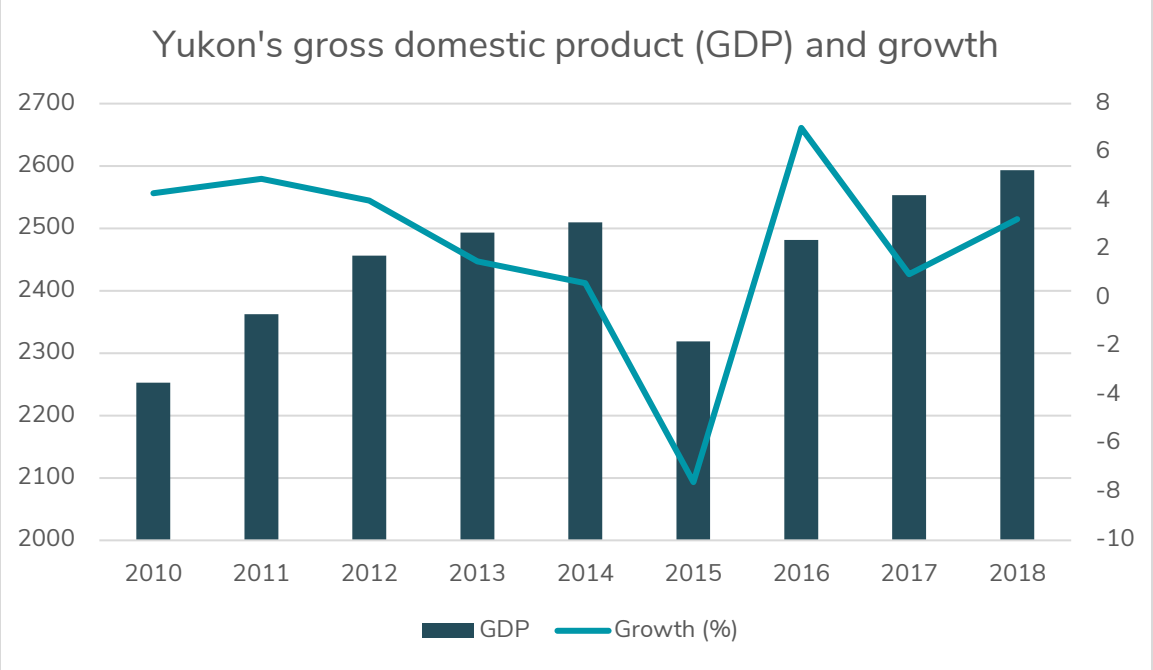

Figure 12: Gross domestic product (in millions of chained 2012 dollars) for all industries in Yukon.[5]

[4] Source: Yukon Bureau of Statistics, Gross Domestic Product (GDP) by Industry at Basic Prices, 2018.
[5] Source: Statistics Canada table 36-10-0402-01.

Yukon's population increased 16 per cent between 2010 and 2018 (Figure 13). A growing Yukon population is linked to a greater scope of government operations due to an increased occupancy in schools and healthcare facilities, growth of government programs, and a greater need for permits, licences and other government services. This is a likely reason for the slight overall rise in greenhouse gas emissions over the 2010 – 2018 period. However, over this same period, the Government of Yukon's greenhouse gas emissions per capita (relative to Yukon's total population) decreased by 10 per cent. This is due in part to greenhouse gas reduction initiatives such as switching to less carbon intensive fuels.

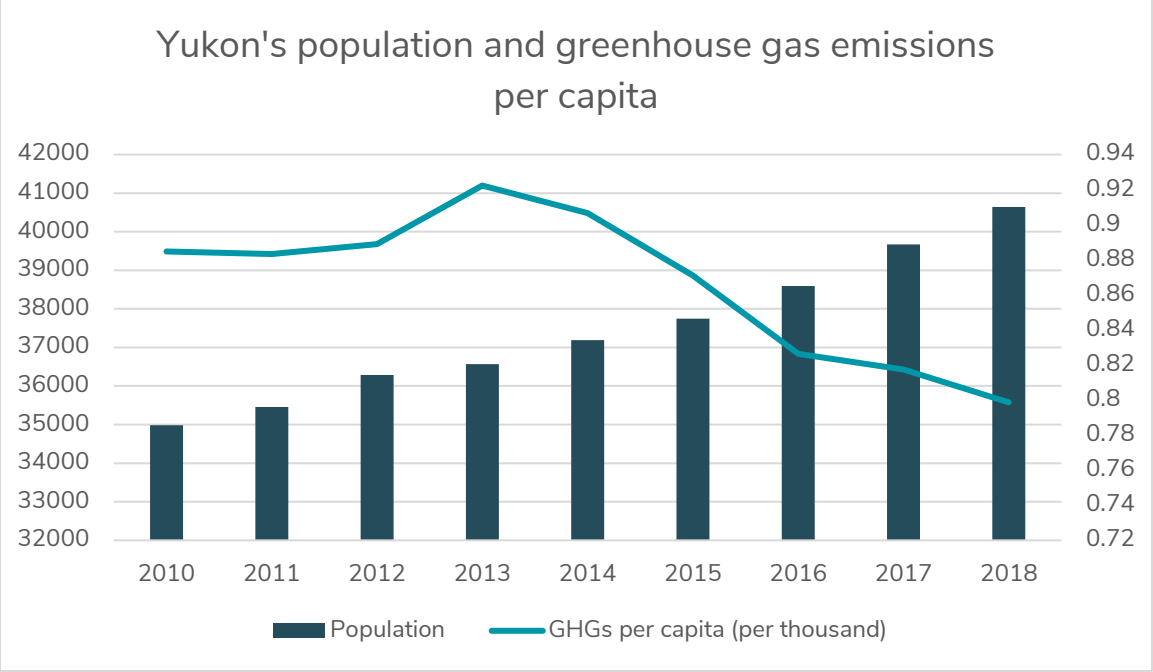

Figure 13: Yukon population growth 2010 – 2018, and Government of Yukon greenhouse gas emissions in kT $C0_2e$ per 1000 Yukon residents.[6]

[6] Source: Yukon Bureau of Statistics, Population as of June 31 of each year.

Conclusions and next steps

Overall, emissions from Government of Yukon operations increased 5 per cent between 2010 and 2018, due largely to significant GDP and population growth over this period. However, relative to Yukon's population, the actions that the Government of Yukon has taken (including switching to cleaner fuels and implementing energy retrofits) has helped Government of Yukon emissions

As of 2018, the Government of Yukon's emissions contribute to approximately 5 per cent of Yukon's total emissions. Therefore, the Government of Yukon is committed to reducing its emissions in order to contribute and show leadership in the efforts to meet Yukon's territory-wide emission reduction target. This commitment, captured in *Our Clean Future: a Yukon strategy for climate change, energy and a green economy*, is to reduce Yukon's emissions by 30 per cent below 2010 levels by 2030.

The Green Infrastructure Program has recently been created to increase the Government of Yukon's efforts in managing and reducing greenhouse gas emissions from government buildings. Since the majority of the Government of Yukon's emissions are from the need to heat government buildings, there is an increased emphasis on supplementing fossil fuel consumption with renewable heating energies such as biomass. The government's goal is to decrease government building's greenhouse gas emissions by 30 per cent in 2030, compared to 2010's baseline.

Going forward, the Government of Yukon will continue to track emissions from its operations in a consistent fashion in order to accurately evaluate progress on reducing its emissions. This report includes emissions from the Government of Yukon's departments only. Beginning for the 2019 reporting year, greenhouse gas emissions from Yukon's crown corporations will be tracked and reported on as well. This includes the Yukon Energy Corporation, Yukon Hospital Corporation, Yukon Housing Corporation and Yukon Liquor Corporation.