Yukon

Greenhouse gas emissions in the Yukon: 2020

August 2022

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Yukon-wide: 2020 greenhouse gas emissions

2020 total emissions:

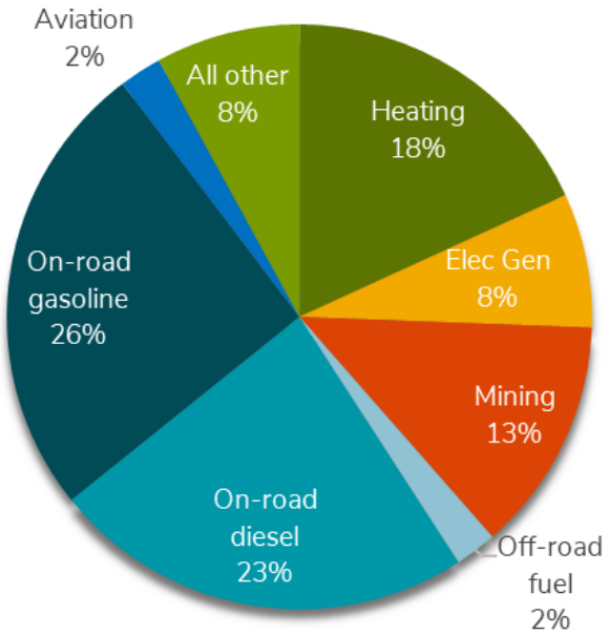
Emissions decreased eight per cent in 2020 due to the COVID-19 pandemic

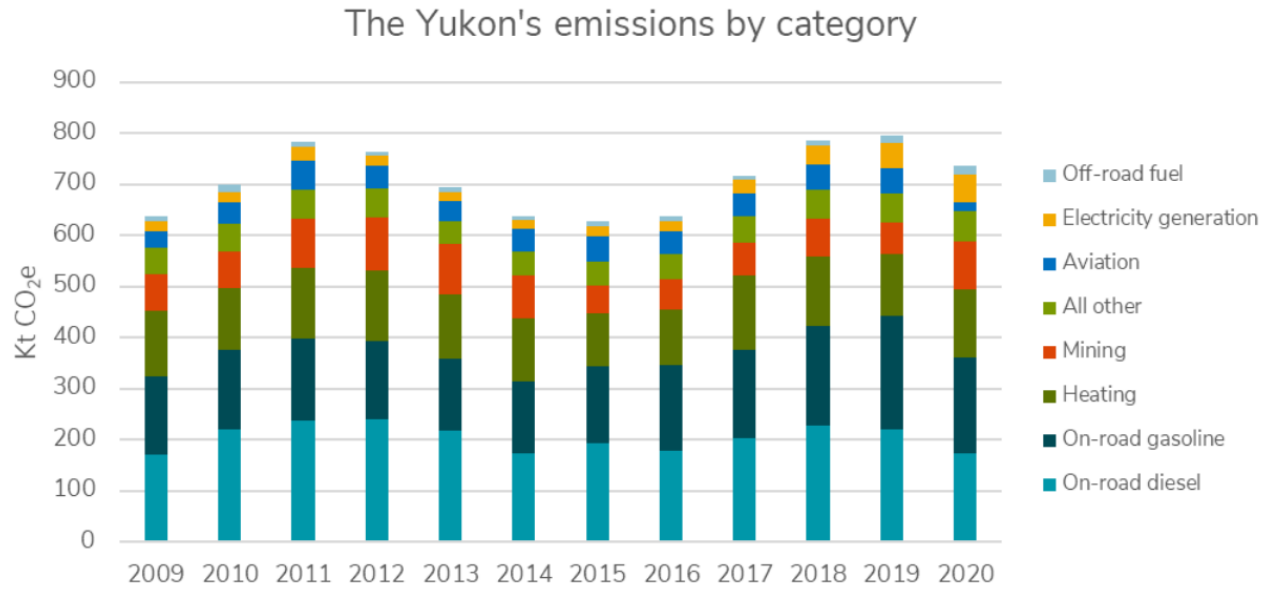
737 kilotonnes of CO_2e

Compared to 2010 levels: ↑ 6% increase

Compared to 2019 levels: ↓ 7% decrease

Key emission sources:





Connection to *Our Clean Future* goals:

Our Clean Future Goal 1 is to reduce the Yukon's greenhouse gas emissions. This report shares information on the Yukon's **total** (mining and non-mining) emissions, which supports our target to be net-zero by 2050.

Introduction

Through *Our Clean Future: a Yukon strategy for climate change, energy and a green economy*, the Government of Yukon is committed to taking ambitious climate action. To measure our progress, accurate and transparent greenhouse gas tracking and reporting is vital. Emissions are reported with a two-year lag (meaning 2020 emissions are being reported in 2022) due to the length of time required for key data sources to be compiled and analyzed.

The first section of this report provides an explanation of how the Yukon's greenhouse gas emissions are calculated including an overview of key data sources and explanation of recent methodological updates. The second section presents annual greenhouse gas emission totals and a look at how they have changed between 2009 and 2020. The third section analyzes the impact of key factors such as the Yukon's population and gross domestic product on emissions.

Methodology

Greenhouse gases

Greenhouse gases absorb heat and trap it in the Earth's atmosphere. Their concentration in the atmosphere has increased significantly over the past several decades, raising the planet's overall temperature. The most well-known greenhouse gas, carbon dioxide (CO_2), accounts for the majority of human-caused emissions. In addition to CO_2, several other greenhouse gases contribute to climate change. Many of these are significantly more potent than CO_2. The Government of Yukon reports the Yukon's emissions in terms of carbon dioxide equivalent (CO_2e). This metric includes the six greenhouse gases that are regulated under the Kyoto Protocol (Table 1), and how they compare to CO_2 in terms of potency. To convert non-CO_2 greenhouse gases into a carbon dioxide equivalent, a conversion factor called the global warming potential (GWP) is used (Table 1).

Table 1: Global warming potential of greenhouse gases emitted in the Yukon.

Greenhouse gas	Global warming potential[1],[2]
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous Oxide (N_20)	265
Hydrofluorocarbon (HFC)	4 – 12,400
Perfluorocarbon (PFC)	7,190 – 11,100
Sulfur Hexafluoride (SF6)	23,500

Data sources

The Government of Yukon uses two main data sources to measure the Yukon's emissions to use the best available data for all sectors. The first source is the National Inventory Report, which is produced annually by the Government of Canada and reports the greenhouse gas emissions of all provinces and territories. The National Inventory Report is released with a two-year lag due to the length of time required to compile and analyze data across the country. For example, the report on 2020 emissions was released in April 2022. As a result, the Government of Yukon's emissions reporting also operates on a two-year lag.

The second data source is the Yukon's fuel tax databases, which track the total volume of fuel purchased in the Yukon based on the amount of tax paid. The Yukon Bureau of Statistics uses this information to calculate greenhouse gas emissions from different types of fuel.

[1] Intergovernmental Panel on Climate Change, Fifth Assessment Report.
[2] Recent updates to Global warming potential values are not reflected in this report due to reporting timeline, but are available in *Chapter 7: The Earth's Energy Budget, Climate Feedback and Climate Sensitivity* of the Intergovernmental Panel on Climate Change Sixth Assessment Report.

Table 2 lists the fuel types included in the Yukon's greenhouse gas inventory and which of the two main data sources we use to calculate emissions from each fuel.

Table 2: Fuel types included in Yukon's greenhouse gas emission inventory.

Fuel type	Description	Data source	Methodology
Aviation fuel	Aviation gas, jet fuel, and any other aviation fuels sold within the Yukon.	Yukon Bureau of Statistics: Fuel tax databases	Emissions calculated based on the total amount of aviation fuel purchased in Yukon.
Heating	Diesel and propane used to heat buildings.	Yukon Bureau of Statistics: Fuel tax databases	Emissions calculated based on the total amount of heating fuel purchased in the Yukon.
Electricity generation	Diesel and liquid natural gas used to generate electricity.	Yukon Bureau of Statistics: Fuel tax databases Yukon Bureau of Statistics: Calculations based on Yukon Energy Corporation and ATCO Electric Yukon annual public reporting	Emissions calculated based on total volume of diesel and liquid natural gas combusted by the Yukon's public utilities as well as total amount of tax exempt fuel purchased by private entities for electricity generation purposes under the Fuel Tax Exempt Program.

Fuel type	Description	Data source	Methodology
Mining	Diesel purchased for use at a mine site.	Yukon Bureau of Statistics: Fuel tax databases	Emissions calculated based on total amount of tax exempt fuel purchased for mining purposes under the Fuel Tax Exempt Program.
Off-road fuel	Diesel and gasoline not intended for use on official roadways. This includes fuel used for snowmobiles and all-terrain vehicles.	National Inventory Report	Emission simulation model calculates off-road fuel consumption based on factors including number and type of off-road vehicles, hours of annual run-time and average cargo weight.
On-road diesel	Diesel used in registered vehicles intended to be used on official roadways only.	National Inventory Report	Emission simulation model calculates road transportation emissions based on factors including number and type of registered vehicles, average annual kilometres driven per vehicle type, and uptake of emission control technology.
On-road gasoline	Includes gasoline used in registered vehicles intended to be	National Inventory Report	

Fuel type	Description	Data source	Methodology
	used on official roadways only.		
All other sources	This captures emission sources not included in the above categories. In Yukon, emissions in this category come from waste management and industrial processes and product use (IPPU).	National Inventory Report	Methane emitted from waste management sites is calculated based on a rate of decay model and the population serviced by each site. IPPU emission methodologies vary significantly based on the specific process/product. 91 per cent of Yukon's IPPU emissions come from the use of hydrofluorocarbons (refrigerants), which are measured based on bulk import data.

Methodological updates

The methods used to measure greenhouse gases are constantly being improved. When there is an update to the methods used to calculate emissions, the new method is also applied retroactively to previous years. This is referred to as "backcasting." This is done so that we can directly compare emissions from one year to the next and accurately track our progress. This means that emissions reported for previous years are revised if an improved methodology is adopted.

Key updates

Several improved methodologies have been adopted in this 2020 emissions report and backcasted to previous years. These updates include:

- **Off-road fuel:** Off-road fuel data from the National Inventory Report was used instead of fuel tax data for this category. This is to capture fuel purchased for off-road purposes but taxed as on-road fuel. For example, fuel for a snowmobile or all-terrain vehicle at a gas station would be reflected in the fuel tax databases as on-road fuel.
- **All Other:** Minor changes (>1 kt CO_2e) made to waste sector emissions.
- **Electricity generation**: Small changes (0.1-1.9 kt CO_2e) due to minor revisions to Yukon's fuel tax databases and updated information from utilities.

Implications of methodological updates

Given that Yukon's 2030 greenhouse gas reduction target is based on 2010 emissions, revisions to 2010 emissions due to methodological updates affect the baseline from which we are aiming to reduce emissions. As a result of these updates, emissions from all years were revised upwards by one to two per cent.[3] Updated historical emission data will be incorporated into our third-party greenhouse gas projection model on an ongoing basis to ensure our projected emissions scenarios up to 2030 are as accurate as possible.

[3] The range of percentages is because each year's emissions inventory was revised upwards by a slightly different amount.

Table 3. Revisions to Yukon's historical greenhouse gas emissions due to methodological updates. Revisions highlighted in yellow.

		Aviation	Heating	Electricity Generation	Mining	Non-mining off-road fuel	On-road gasoline	On-road diesel	All other	**Total**
2009	Old	33.9	128	16.6	76.4	4	153.6	169.6	41.3	633.3
	New	33.9	128	17.6	72.5	11.9	153.6	169.6	51.5	638.6
2010	Old	43.5	118.6	19.2	73.1	0.3	157.8	219.3	52.7	684.4
	New	43.5	118.6	19.7	73.1	13.1	157.8	219.2	53.1	698.1
2011	Old	56.5	137.2	26.9	96.9	0.2	160.2	238.3	55.3	771.5
	New	56.5	137.2	29.1	96.9	10.3	160.2	238.3	55.9	784.4
2012	Old	44.5	136.8	18.9	104.8	0.3	154.2	239.3	55.7	754.6
	New	44.5	136.8	19.2	104.8	9.3	154.2	239.3	56.3	764.5
2013	Old	39.1	126.1	18.8	99.1	0.2	139.9	217.4	44.9	685.5
	New	39.1	126.1	18.7	99.1	8.6	139.9	217.4	45.4	694.3
2014	Old	42.8	123.5	18	84.5	0.3	141.8	172.5	46.2	629.6
	New	42.8	123.5	18.1	84.5	8.7	141.8	172.5	46.8	638.7
2015	Old	49.4	103.8	20.6	55.2	0.3	150.1	193.2	46	618.7
	New	49.4	103.8	20.1	55.2	9.6	150.1	193.2	46.6	628.0
2016	Old	44.8	108.2	20.6	60.9	0.9	169.1	177	48.1	629.6
	New	44.8	108.2	20.3	60.9	9	169.1	177	48.6	637.9
2017	Old	46.5	146.6	25.2	64	1.5	171.5	203.3	51.5	710.1
	New	46.5	146.6	25.7	64	8.2	171.5	203.3	51.1	716.9
2018	Old	50.4	135.7	34.8	75.9	0.4	195	227.2	55.2	774.6
	New	50.4	135.7	36.7	75.9	10.4	195	227.2	55	786.3
2019	Old	49.8	120.9	50	61.7	1	221.7	220.8	57.3	783.2
	New	49.8	120.9	49.5	61.8	12.7	221.7	220.8	57.4	794.7

Results

In 2020, Yukon's total greenhouse gas emissions for all categories were 737 kilotonnes (kt) of CO_2e. This is a six per cent increase above the 2010 baseline, but a seven per cent decrease from 2019 levels.

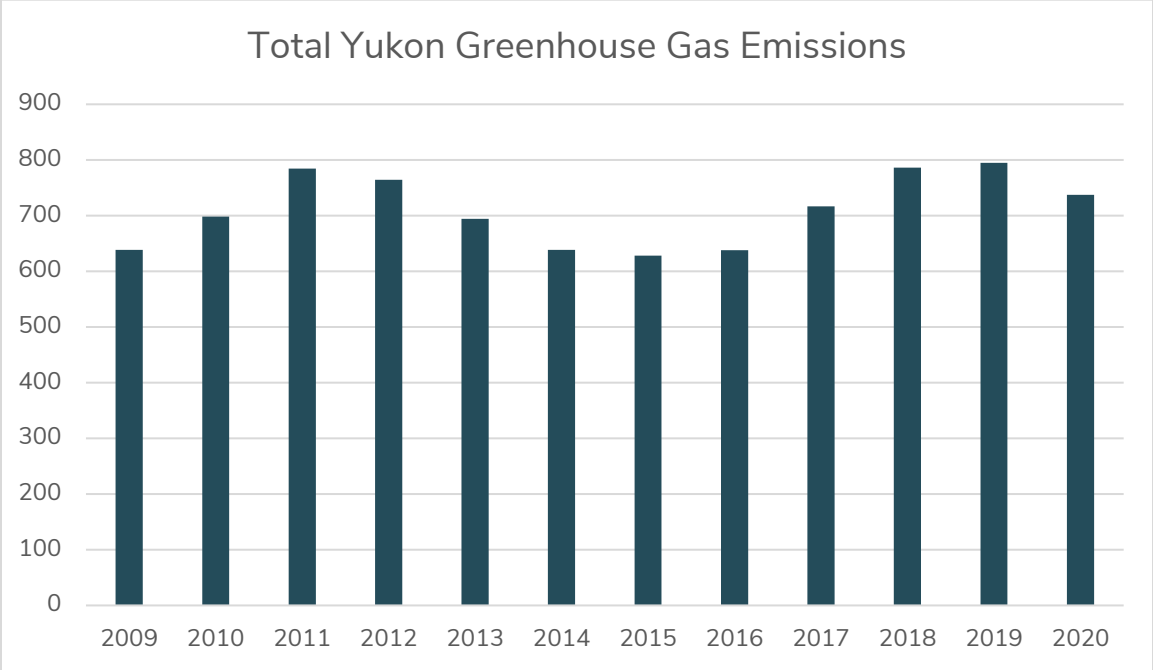


Figure 1. The Yukon's total greenhouse gas emissions from 2009 to 2020.

The dominant sources of emissions in the Yukon have remained relatively consistent between 2010 and 2020 (Figure 2). Road transportation continues to make up roughly half of all emissions, accounting for 54 per cent in 2010 and 50 per cent in 2020. It is notable, however, that within this category, the proportion of diesel has decreased while the proportion of gasoline has increased. On-road diesel and on-road gasoline continue to be the two largest emission sources in 2020 despite being 22 per cent and 15 per cent lower than in 2019.

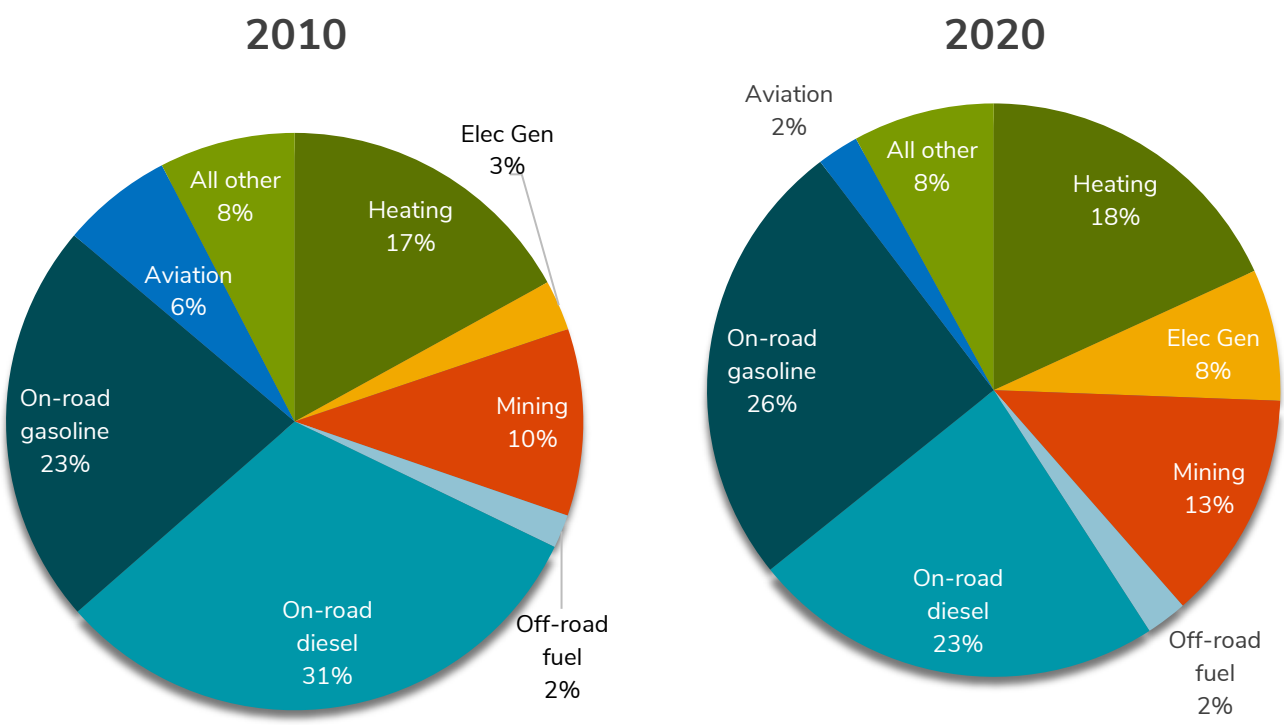


Figure 2. The Yukon's emissions by fuel type in 2010 and 2020. Transportation sector emissions are indicated in blue and make up 62 and 54 per cent of Yukon's emissions in 2010 and 2020, respectively.

Emissions from electricity generation have steadily increased over this period. They made up seven per cent of overall emissions in 2020 as compared to three per cent in 2010. The proportion of emissions from off-road fuel, heating and all other sources remained relatively consistent over this period.

Emissions from aviation and on-road diesel made up a much smaller proportion of the Yukon's emissions in 2020 than 2010.

The percentage of emissions from mining increased somewhat from 10 to 13 per cent.

Emissions for all categories in the interim years remained relatively consistent over time (Figure 3 and Table 4). However, in years where the Yukon's emissions were particularly high, such as 2011 and 2018, emissions from mining, aviation and/or on-road diesel are visibly higher as compared to other years. This points to these three fuel types as potential drivers of inter-annual variation.

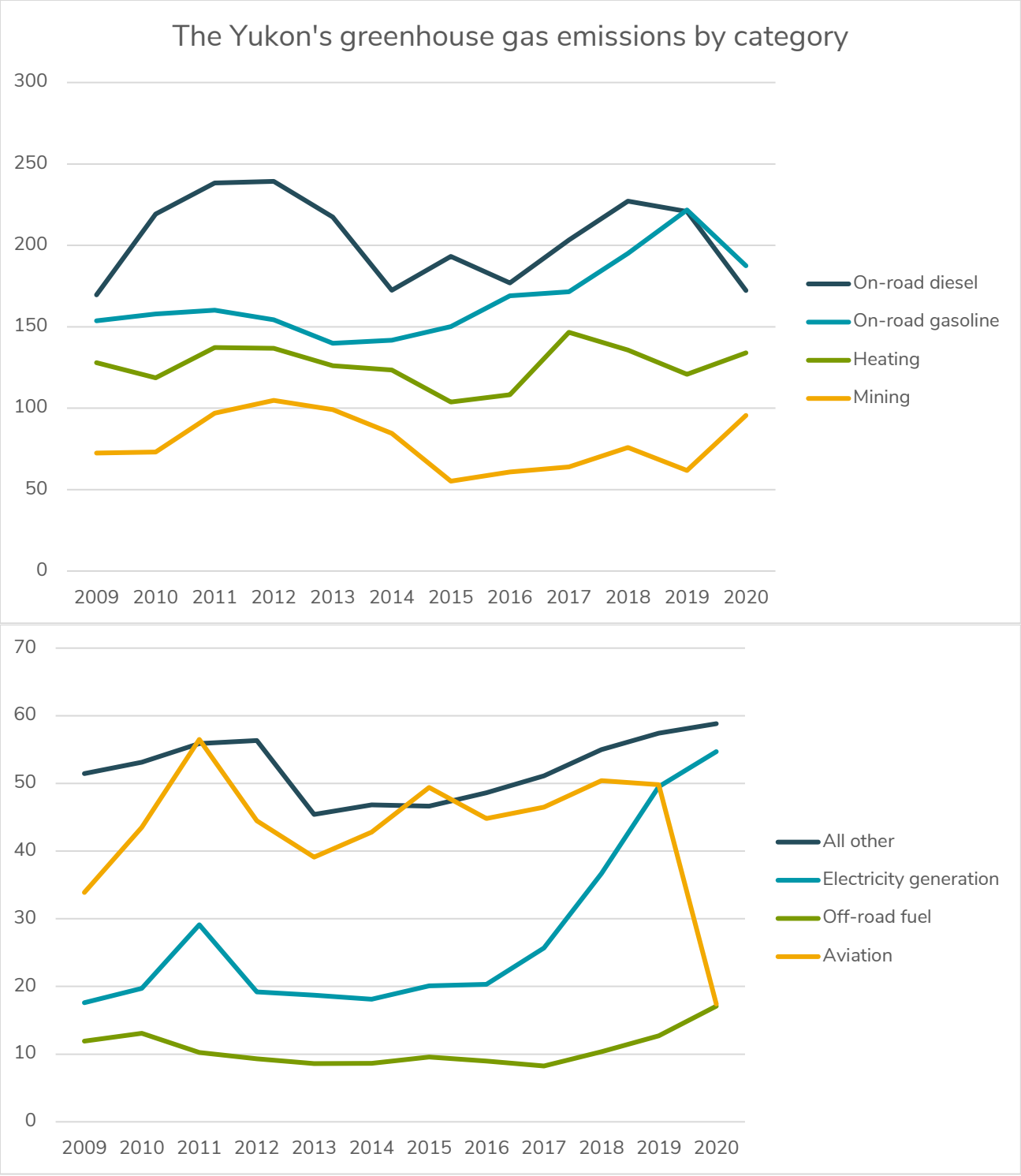


Figure 3. The Yukon's emissions by category from 2009 to 2020. Data is separated into two graphs for readability.

Emissions Category	2009	2010 (base year)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Change[4] 2010 - 2020
Heating diesel/propane	128	119	137	137	126	124	104	109	147	136	121	134	+13
LNG/diesel for electrical generation	18	20	29	19	19	18	20	20	26	37	50	55	+178
Mining off-road fuel	76	73	97	105	99	85	55	61	64	76	62	96	+31
On-road diesel	170	219	238	239	217	173	193	177	203	227	221	172	-21
On-road gasoline	154	158	160	154	140	142	150	169	172	195	222	188	+19
Aviation gas/jet fuel	34	44	57	45	39	43	49	45	47	50	50	17	-60
Off-road diesel	12	13	10	9	9	9	10	9	8	10	13	17	+31
All other	52	53	56	56	45	47	47	49	51	55	57	59	+11
Total	638	697	783	764	693	638	627	637	716	785	794	733	+6

Table 4. The Yukon's total greenhouse gas emissions by fuel type from 2010 to 2020.

Analysis

COVID-19

The Yukon's emissions overall decreased by eight per cent in 2020 relative to 2019. A large part of this appears to be due to the impact of the COVID-19 pandemic on Yukoners' transportation choices. However, it is worth noting that the Yukon's 2019-2020 emission drop is greater than the global average of six per cent[5].

[4] Percentage change is compared against a 2010 base year, as this is the base year for the Yukon's emission reduction targets.

[5] Nature **589,** 343 (2021). DOI: 10.1038/d41586-021-00090-3

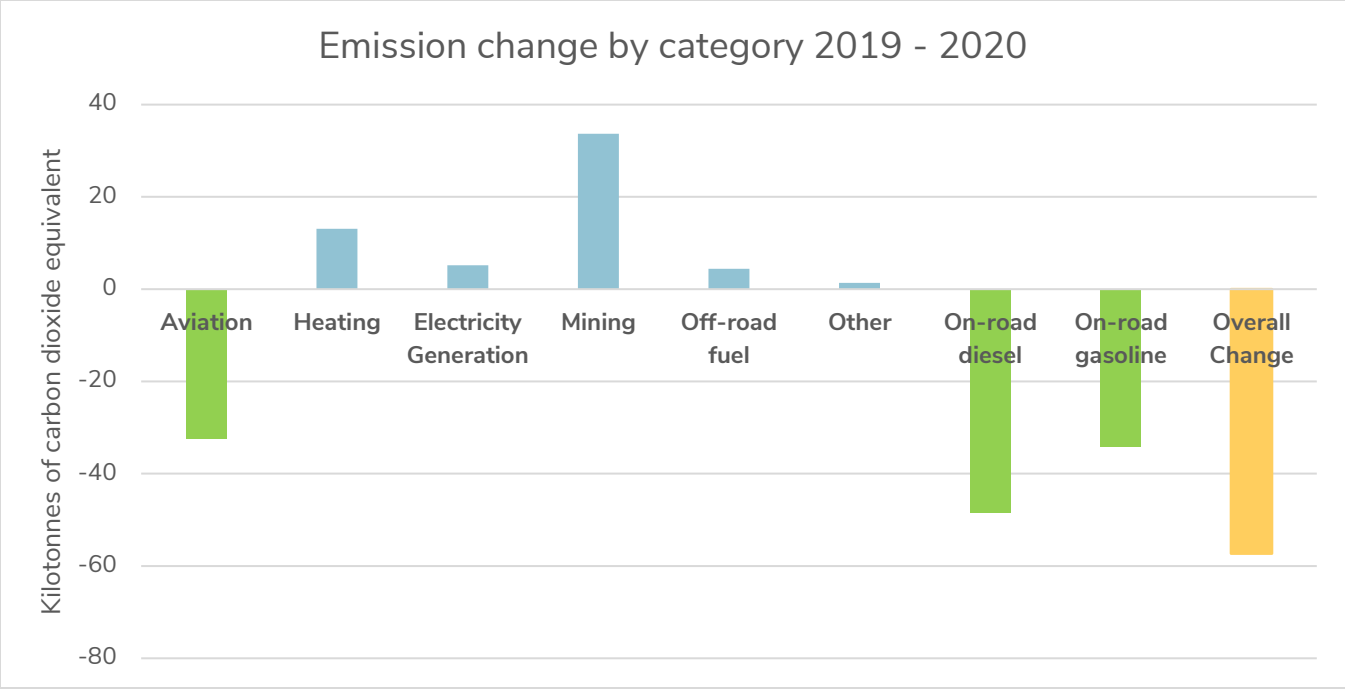


Figure 4. Change in greenhouse gas emissions by category between 2019 and 2020.

As per Figure 4, all emission categories which decreased between 2019 and 2020 are transportation-related. In particular, emissions from aviation decreased by 65 per cent, reaching a level unseen since before 1990 when the Government of Canada began tracking national emissions.

Gross Domestic Product

Territory-wide demographic and economic factors such as population change and gross domestic product (GDP) impact the Yukon's emissions significantly. Overall, a growing population and growing economy appear to be tied to the observed increase in greenhouse gas emissions. In 2020, both emissions per capita and emissions per unit of GDP decreased notably relative to 2019. This is in part due to the emission reduction seen in 2020 as a result of COVID-19 lockdown measures.

Between 2010 and 2020, the Yukon's GDP increased by 19 per cent, while greenhouse gas emissions increased five per cent over the same period (Figure 5).

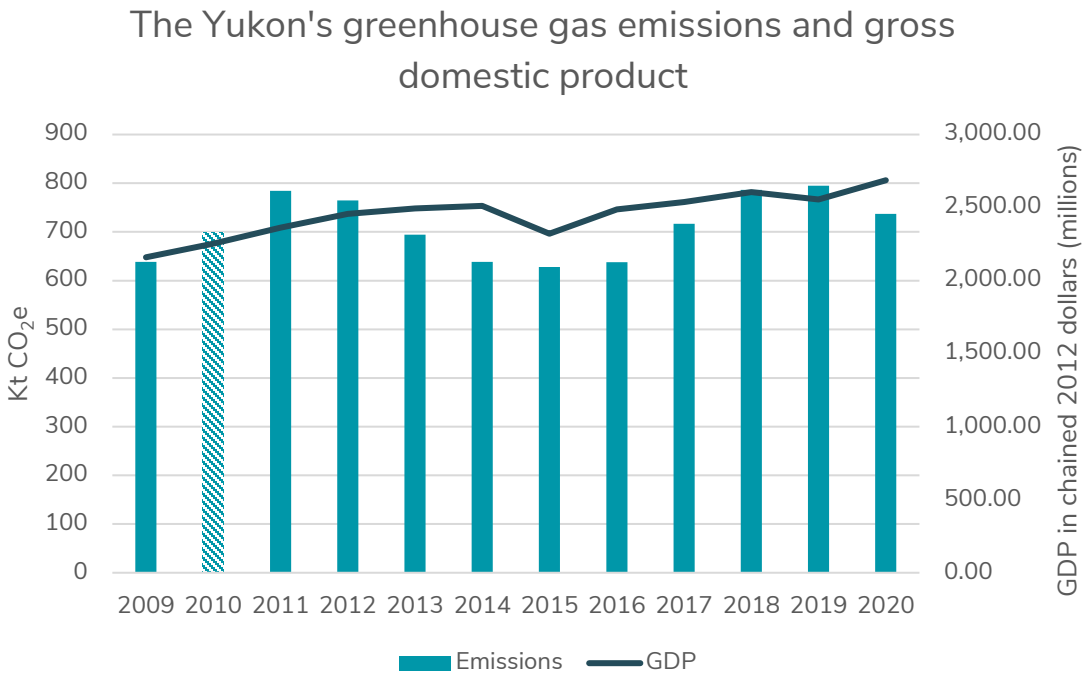


Figure 5. The Yukon's greenhouse gas emissions and gross domestic product[6] from 2009 to 2020. 2010 (represented by the patterned bar) is used as a baseline for all comparisons in order to align with *Our Clean Future* targets.

Consequently, the Yukon's emissions per unit of GDP (measured in tonnes of CO_2e per million chained 2012 dollars[7]) have gradually declined somewhat over time (Figure 6).

The emissions intensity of the economy peaked in 2011 at 331 tonnes of CO_2e per million chained 2012 dollars, then decreased to the lowest levels from 2014 to 2016 and increased again from 2017 to 2019. Between 2019 and 2020, the emissions intensity of the economy decreased by 12 per cent, likely due to the particularly low greenhouse gas emissions in 2020.

[6] Source: Statistics Canada table 36-10-0402-01.

[7] Chained 2012 dollars is a measure used to correct for inflation over time to allow for the comparison of values from different years with 2012 as a base year.

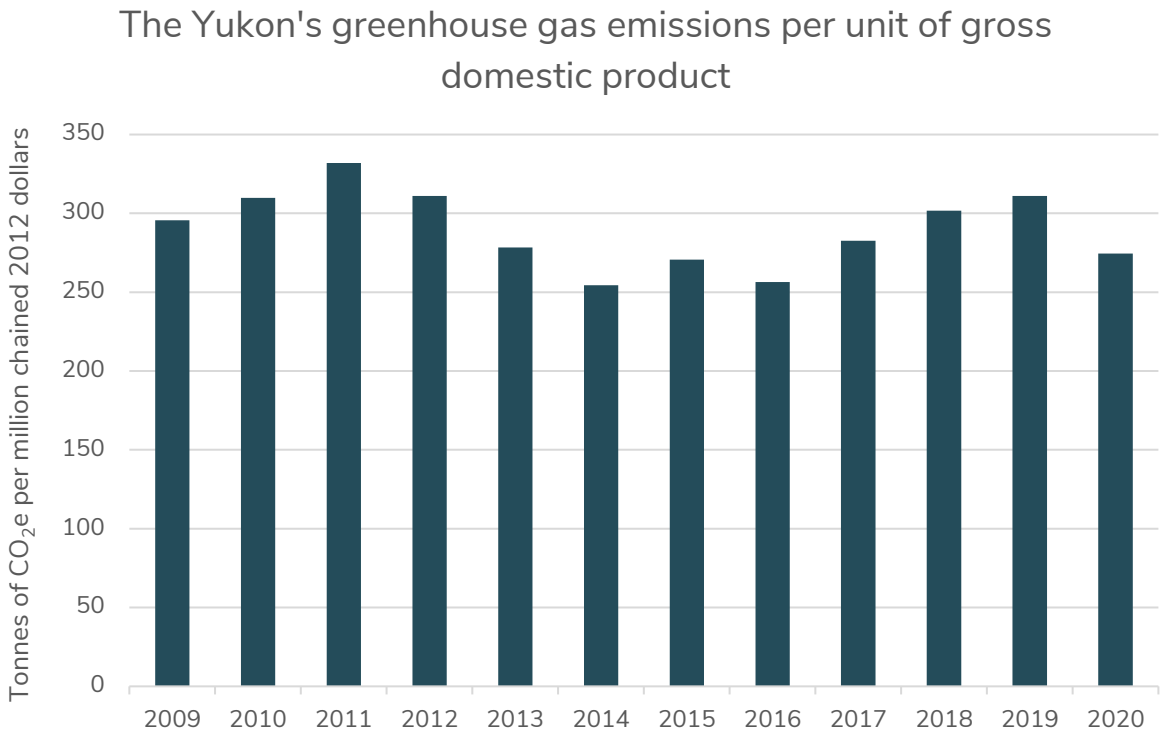


Figure 6. The Yukon's greenhouse gas emissions per unit of gross domestic product from 2009 to 2020.

Population

Similar to GDP, the Yukon's population increased 24 per cent between 2009 and 2019 (Figure 7). This increase has been consistent from year to year, growing from approximately 34,000 people in 2009 to 42,000 people in 2020. While the Yukon's greenhouse gas emissions also increased during this period, emissions and population appear to be less correlated than emissions and GDP. For example, population steadily rose from 2013 to 2016 while emissions dipped during this period.

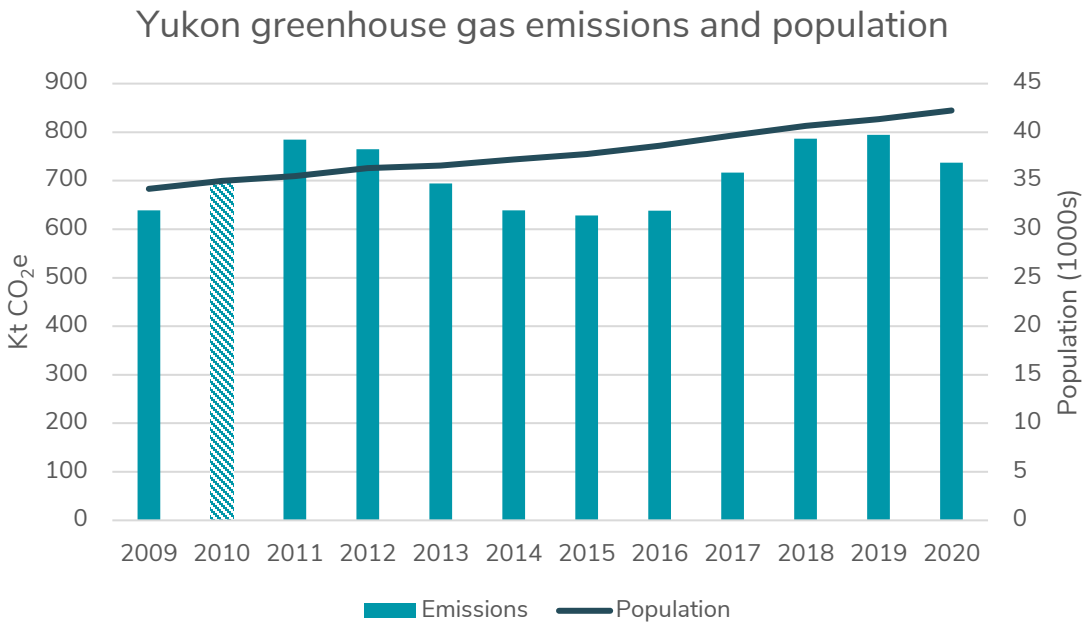


Figure 7. The Yukon greenhouse gas emissions and population[8] from 2009 to 2020. 2010 (represented by the patterned bar) is used as a baseline for all comparisons in order to align with *Our Clean Future* targets.

The Yukon's per capita emissions in 2020 were 17.5 tonnes per person, which is a 13 per cent decrease from 2010 levels of 20.0 tonnes per person (Figure 8). The Yukon has the 6th highest per capita emissions of Canada's 13 provinces and territories. Similar to the emissions intensity of the economy, the Yukon's per capita emissions are somewhat cyclic, peaking in 2011 and 2018 and reaching a low point in 2015 and 2016.

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

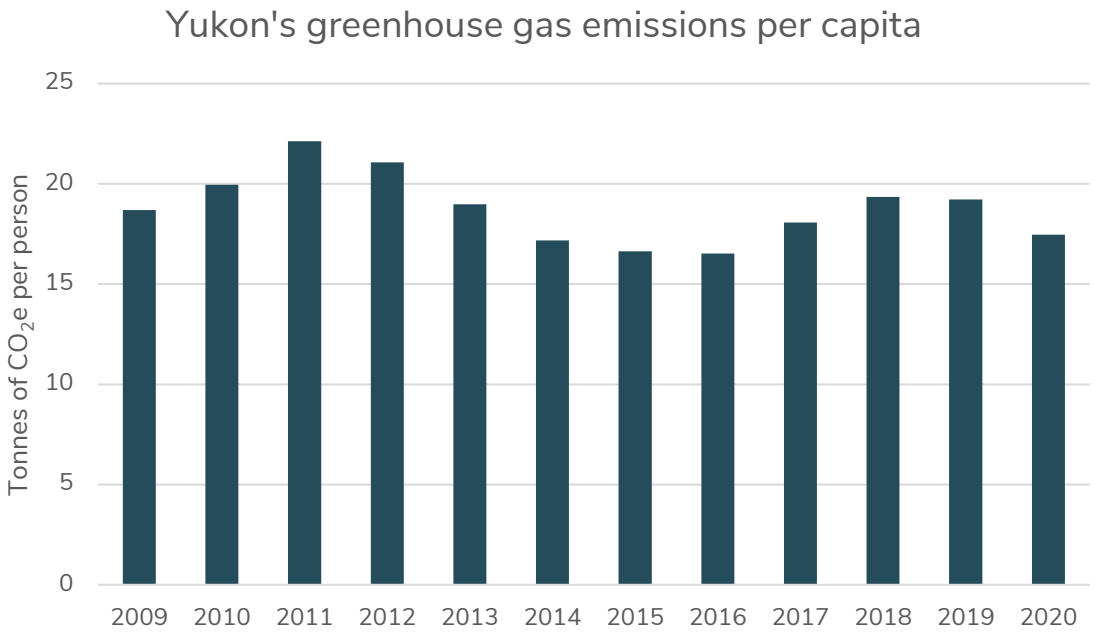


Figure 8. The Yukon's greenhouse gas emissions per capita from 2009 to 2020.

While economic growth, and to a lesser degree population growth, appear to be strong drivers of the Yukon's greenhouse gas emissions historically, we plan to decouple[9] the Yukon's emissions from these factors through the actions in *Our Clean Future: a Yukon strategy for climate change, energy and a green economy.*

Conclusions

The Yukon's total emissions in 2020 were six per cent higher than those in 2010. The increase over the past decade appears to be linked to larger trends, such as the Yukon's economic and population growth. The decrease between 2019 and 2020 emissions in key categories such as aviation and road transportation appear to be related to the COVID-19 pandemic.

Given that *Our Clean Future: A Yukon strategy for climate change, energy and a green economy* was launched in September 2020, its impact on 2020 emissions is likely limited. Third-party modelling indicates that we will begin to see the impacts of *Our*

[9] Decoupling refers to having continued economic growth without a corresponding increase in greenhouse gas emissions.

Clean Future reflected in the Yukon's 2021 emissions inventory. Updates on the progress that Government of Yukon has made towards the targets established in *Our Clean Future* can be found in the 2021 *Our Clean Future* Annual Report.

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