Greenhouse gas emissions in the Yukon: 2022

September 2024

Table of Contents

Yukon-wide: 2022 greenhouse gas emissions

2022 total emissions:

735 kilotonnes of CO_2e

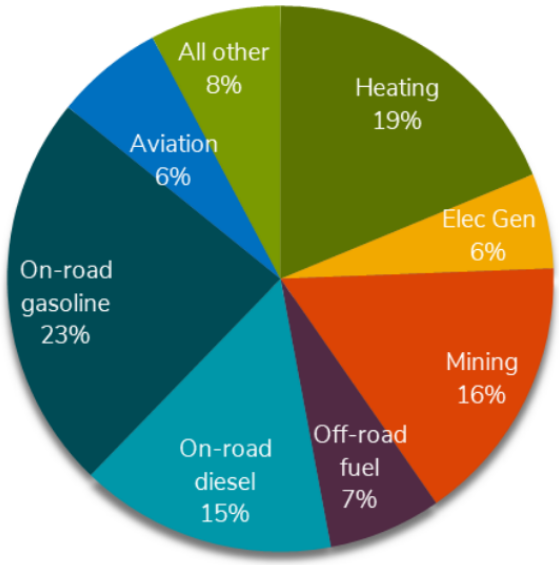
Compared to 2010 (base year):

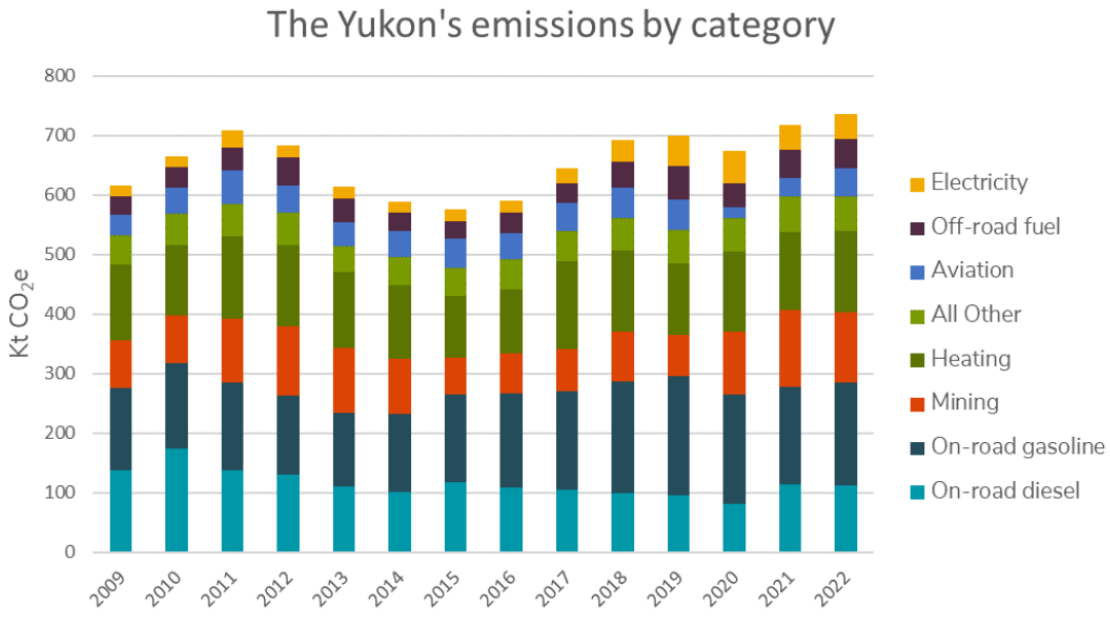
10% increase **overall** ↑

12% decrease **per capita** ↓

Emissions increased somewhat in 2022, mainly due to increases in on-road gasoline and aviation fuel compared to 2021.

Key emission sources:





Connection to Our Clean Future goals:

Our Clean Future Goal 1 is to reduce the Yukon's greenhouse gas emissions, with targets of reducing non-mining emissions to 45 per cent below 2010 levels by 2030, and overall emissions to net-zero by 2050. This report shares information on the Yukon's **total** (mining and non-mining) emissions.

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 2022 emissions are being reported in 2024) due to the length of time required for key data sources to be compiled and analyzed.

This report presents the Yukon's most recent greenhouse gas emissions data, explains how they are calculated, including an overview of recent methodological updates, and analyses 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. Carbon dioxide (CO_2) accounts for the majority of human-caused emissions. Several other greenhouse gases are released due to human activity, and 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. These values are used to calculate carbon dioxide equivalent (CO_2e) values for all non-CO_2 greenhouse gases.

Greenhouse gas	Global warming potential[1]
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 (SF_6)	23,500

Data sources

The Government of Yukon uses two main data sources to measure the Yukon's emissions to source 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 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.

For more information on how emissions are calculated for each fuel type, see Table 4 in Appendix A.

Methodological updates

The methods used to measure greenhouse gases are being improved on a regular basis. When there is an update to the methods used to calculate emissions, the new

[1] Intergovernmental Panel on Climate Change, Fifth Assessment Report.

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 emissions report and applied to previous years. These updates include:

- **Mining:** Improvements to estimates of per-litre emissions from off-road mining equipment.
- **All other:** Small changes (0.1 – 4.2 kilotonnes (kt) CO_2e) to solid waste disposal emissions due to improved carbon content assumptions.
- **Off-road fuel; on-road diesel; on-road gasoline**: Small changes (>1 kt CO_2e) due to minor revisions to National Inventory Report data.

Table 2. Revisions to the Yukon's historical greenhouse gas emissions (kt CO_2e). Minor changes (<1 kt) are indicated in light yellow and larger (>1 kt) changes are indicated in dark yellow.

		Aviation	Heating	Electricity Generation	Mining	Non-mining off-road fuel	On-road gasoline	On-road diesel	All other	**Total**
2009	Old	33.8	128	17.6	72.5	31.1	138.6	137.6	47.3	606.4
	New	33.8	128	17.6	80.2	31.2	138.1	137.4	49.0	615.3
2010	Old	43.4	118.6	19.7	73.1	33.5	143.8	174.4	50.7	656.8
	New	43.4	118.6	19.7	80.8	33.7	143.0	174.1	52.3	665.6
2011	Old	56.4	137.2	29.1	96.8	38.1	148.8	137.5	54.1	698.1
	New	56.4	137.2	29.1	107.0	38.2	148.4	137.3	55.0	708.6
2012	Old	44.5	136.8	19.2	104.8	47.8	132.1	131.3	55.2	671.7
	New	44.5	136.8	19.2	115.7	48.0	131.8	131.1	55.7	682.7
2013	Old	39.0	126.1	18.7	99.1	41.3	124.8	109.8	44.1	602.9
	New	39.0	126.1	18.7	109.4	41.4	124.5	109.6	44.7	613.5
2014	Old	42.8	123.5	18.1	84.4	31.7	131.9	100.8	46.1	579.5
	New	42.8	123.5	18.1	93.3	31.7	131.7	100.7	47.3	589.1
2015	Old	49.3	103.8	20.1	55.2	27.3	147.1	118.0	46.8	567.7
	New	49.3	104.0	20.1	61.2	27.4	146.9	117.8	48.2	575.0
2016	Old	44.7	108.2	20.3	61.2	33.7	157.4	109.3	48.1	582.9
	New	44.7	108.2	20.3	67.6	33.9	157.1	109.1	49.7	590.7
2017	Old	46.5	146.6	25.7	63.9	33.8	165.9	105.2	50.4	638.0
	New	46.5	146.6	25.7	70.6	33.8	165.7	105.2	51.8	645.8
2018	Old	50.3	135.7	36.7	75.8	44.2	187.5	99.8	54.2	684.2
	New	50.3	135.7	36.7	83.8	44.2	187.3	99.6	55.1	692.7
2019	Old	49.8	120.9	49.5	61.7	57.7	199.9	96.5	55.9	691.9
	New	49.8	120.9	49.5	68.2	57.7	199.6	96.3	56.7	698.8
2020	Old	17.4	134.0	54.7	95.5	39.7	183.1	82.2	56.4	663.0
	New	17.4	134.0	54.7	105.5	39.5	182.8	82.1	57.7	673.8
2021	Old	31.1	132.2	41.4	117.1	48.8	163.2	114.4	57.1	705.3
	New	31.0	132.2	41.3	128.7	48.3	163.1	114.2	58.8	717.5

Results

Our Clean Future and the new *Clean Energy Act* commit to:

A. Reaching a greenhouse gas reduction target of 45 per cent, not including mining sector emissions, below 2010 levels by 2030; and,
B. Reaching net-zero total greenhouse gas emissions by 2050.

The text below describes our progress to each of these targets.

In 2022, the Yukon's non-mining greenhouse gas emissions (target A, above) were 618.1 kt of CO_2e. This is a six per cent increase above the 2010 baseline, and a five per cent increase from 2021 levels.

In 2022, the Yukon's total greenhouse gas emissions (target B, above) for all categories, including mining, were 735.4 kt of CO_2e. This is a ten per cent increase above the 2010 baseline, and a two per cent increase from 2021 levels.

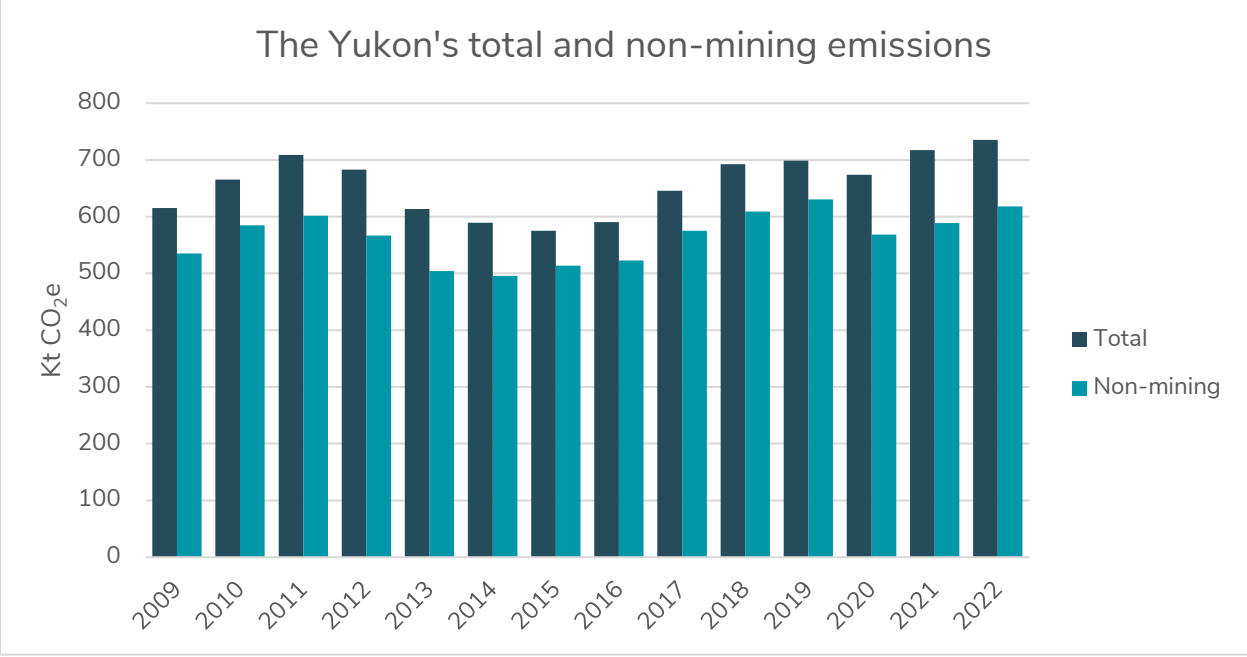


Figure 1. The Yukon's total and non-mining greenhouse gas emissions from 2009 to 2022.

Road transportation continues to be the Yukon's main emission source, making up 47 per cent of 2010 emissions and 38 per cent of 2022 emissions (Figure 2). The lower share of emissions from road transportation reflects a decrease in on-road diesel emissions over time.

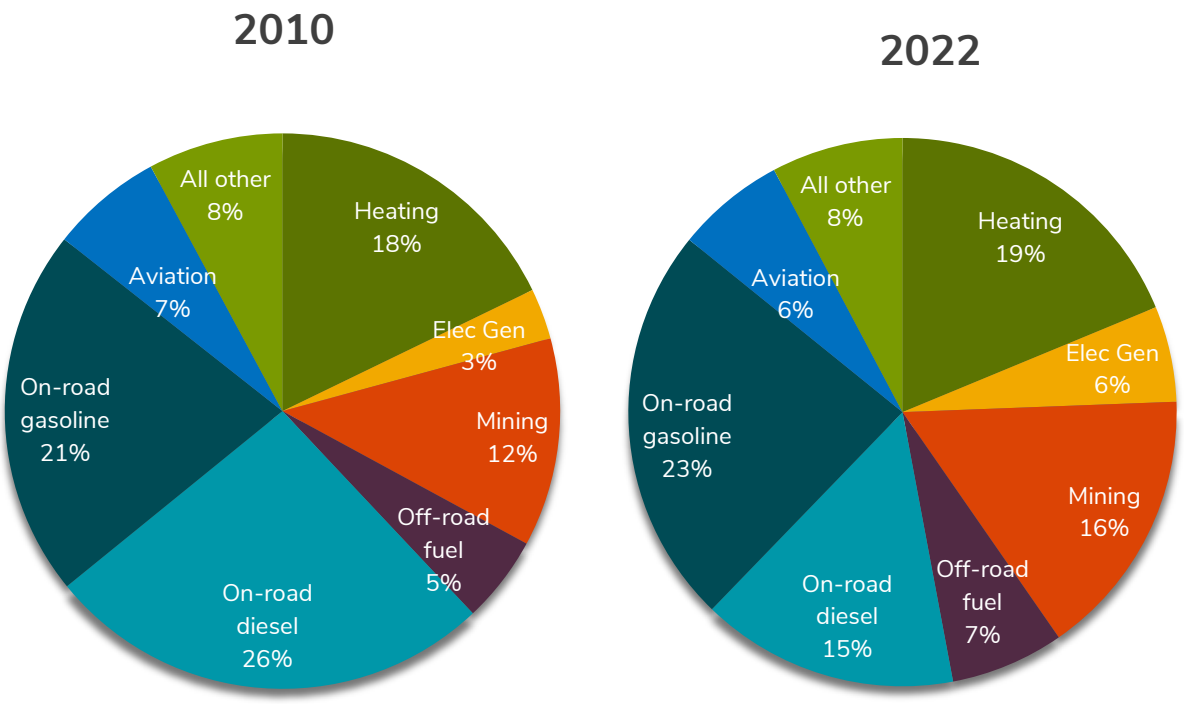


Figure 2. The Yukon's emissions by fuel type in 2010 and 2022. Transportation sector emissions (which include on-road gasoline, on-road diesel and aviation fuel) are indicated in blue and made up 54 and 42 per cent of Yukon's emissions in 2010 and 2021, respectively.

The most notable change between 2021 and 2022 emissions was aviation emissions which increased by 52%, in addition to on-road gasoline which increased by six per cent (Figure 3).

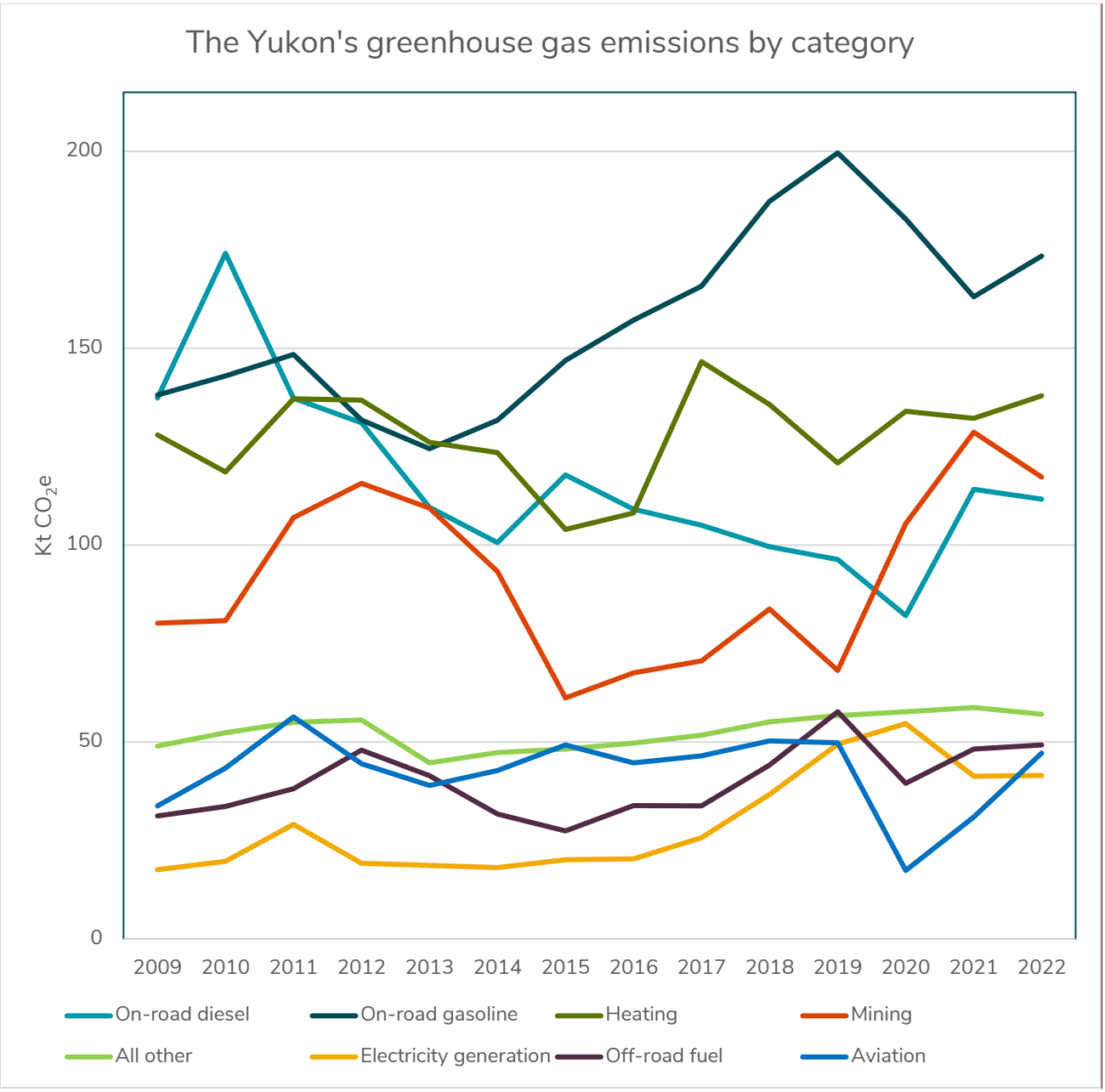


Figure 3. The Yukon's emissions by category from 2009 to 2022.

Emissions Category	2009	2010 (base year)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	% Change[2] 2010-2022
Heating diesel/propane	128	119	137	137	126	124	104	109	147	136	121	134	132	138	+16
LNG/diesel for electricity generation	18	20	29	19	19	18	20	20	26	37	50	55	41	42	+111
Mining off-road fuel	80	81	107	116	109	93	61	68	71	84	68	106	129	117	+45
On-road diesel	137	174	137	131	110	101	118	109	105	100	96	82	114	112	-36
On-road gasoline	138	143	148	132	125	132	147	157	166	187	200	183	163	174	+21
Aviation gas/jet fuel	34	45	56	45	39	43	49	45	47	50	50	17	31	47	+9
Off-road fuel	31	34	38	48	41	32	27	34	34	44	58	40	48	49	+46
All other	49	52	55	56	45	47	48	50	52	55	57	58	59	57	+9
Non-mining total	535	585	602	567	504	496	514	523	575	609	631	568	589	618	+6
Total	615	666	709	683	614	589	575	591	646	693	699	674	718	735	+10

Table 3. The Yukon's total greenhouse gas emissions by fuel type from 2009 to 2022 (kt CO_2e).

Analysis

Gross Domestic Product

Territory-wide demographic and economic factors such as population change, and gross domestic product (GDP) impact the Yukon's emissions. A growing economy appears to be correlated to the increase in greenhouse gas emissions.

Since 2010, the Yukon's greenhouse gas emissions have increased ten per cent, while its GDP has increased by 33 per cent (Figure 4).

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

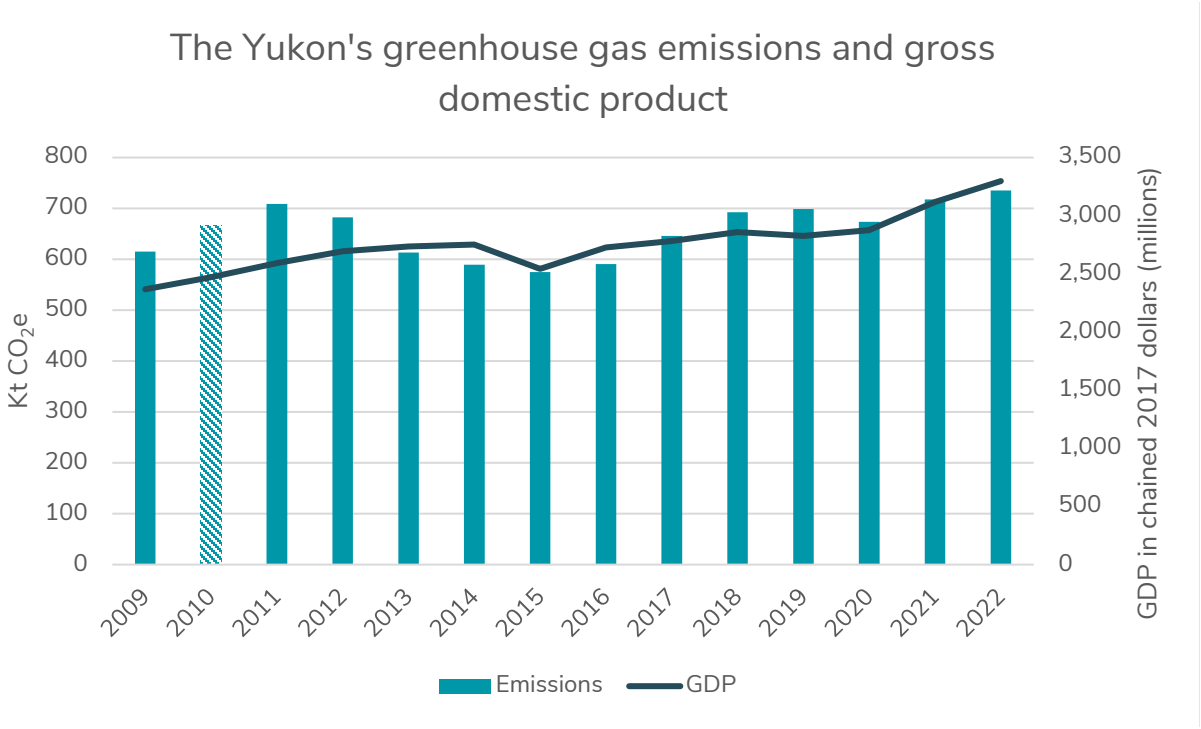


Figure 4. The Yukon's greenhouse gas emissions and gross domestic product[3] from 2009 to 2022. 2010 (represented by the patterned bar) is used as a baseline for all comparisons to align with Our Clean Future targets.

The Yukon's GDP increased six per cent between 2021 and 2022, mainly due to increases in the construction sector and the accommodation and food services sector. This growth outpaced the slight increase in greenhouse gas emissions over the same period, resulting in a three per cent decrease to emissions per unit of GDP relative to 2021.

The emissions intensity of the Yukon's economy (measured in tonnes of CO_2e per million chained 2017 dollars[4]) has gradually declined over time, and is currently 17 per cent lower than in 2010 (Figure 5).

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

[4] Chained 2017 dollars is a measure used to correct for inflation over time to allow for the comparison of values from different years with 2017 as a base year.

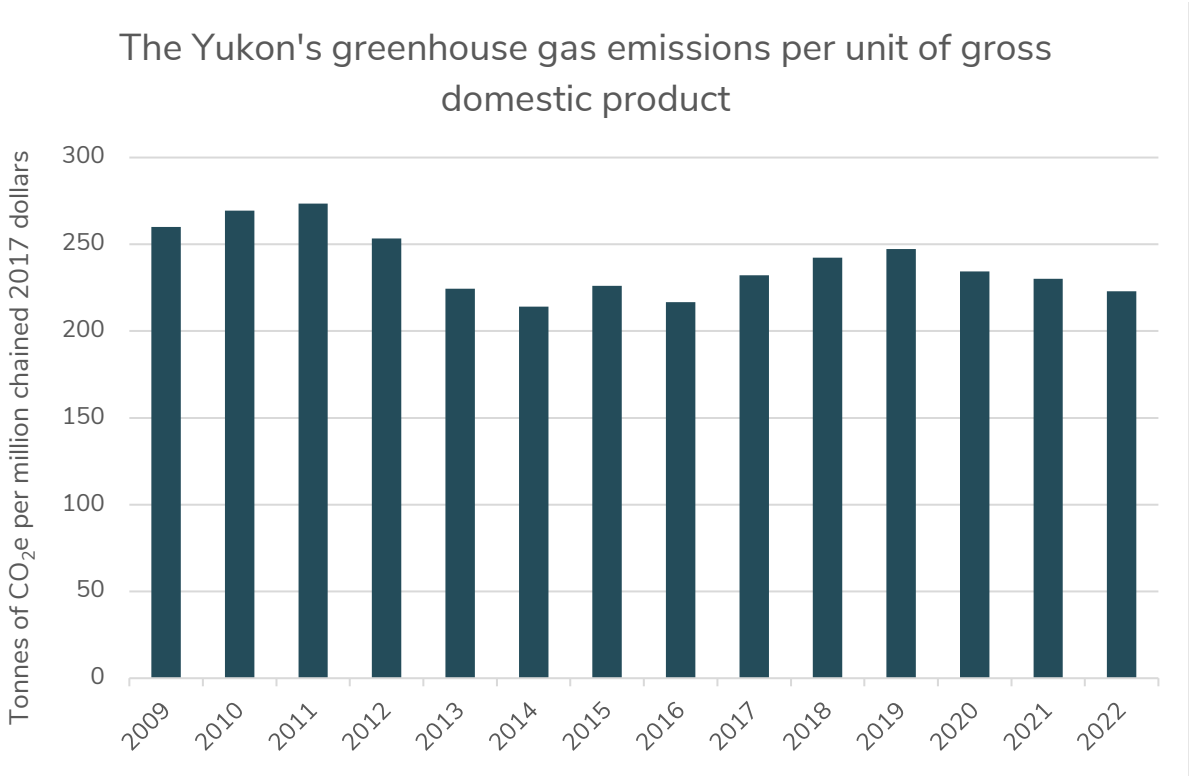


Figure 5. The Yukon's greenhouse gas emissions per unit of gross domestic product from 2009 to 2022.

Population

Similar to GDP, the Yukon's population increased 26 per cent between 2010 and 2022 (Figure 6). This increase has been consistent from year to year, growing from approximately 35,000 people in 2010 to 44,000 people in 2022. 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.

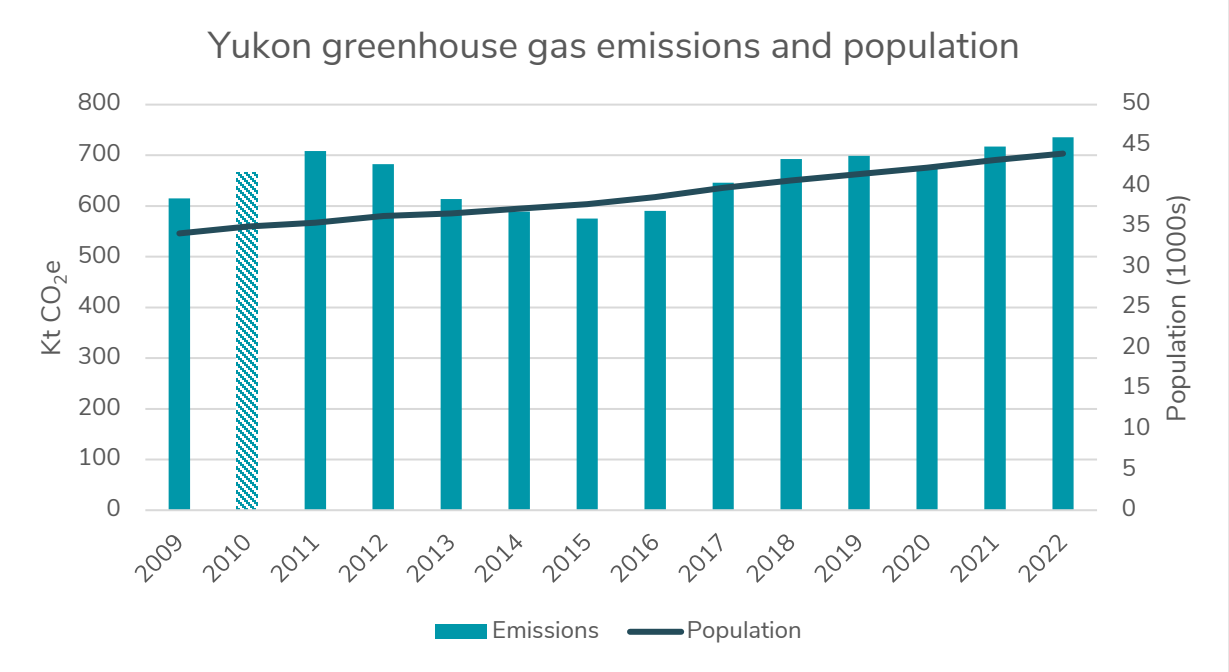


Figure 6. The Yukon greenhouse gas emissions and population[5] from 2009 to 2022. 2010 (represented by the patterned bar) is used as a baseline for all comparisons in order to align with Our Clean Future targets.

The Yukon's per capita emissions in 2022 were 16.7 tonnes per person, which is a 12 per cent decrease from 2010 levels of 19 tonnes per person (Figure 7). The Yukon has the 6th highest per capita emissions of Canada's 13 provinces and territories.

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

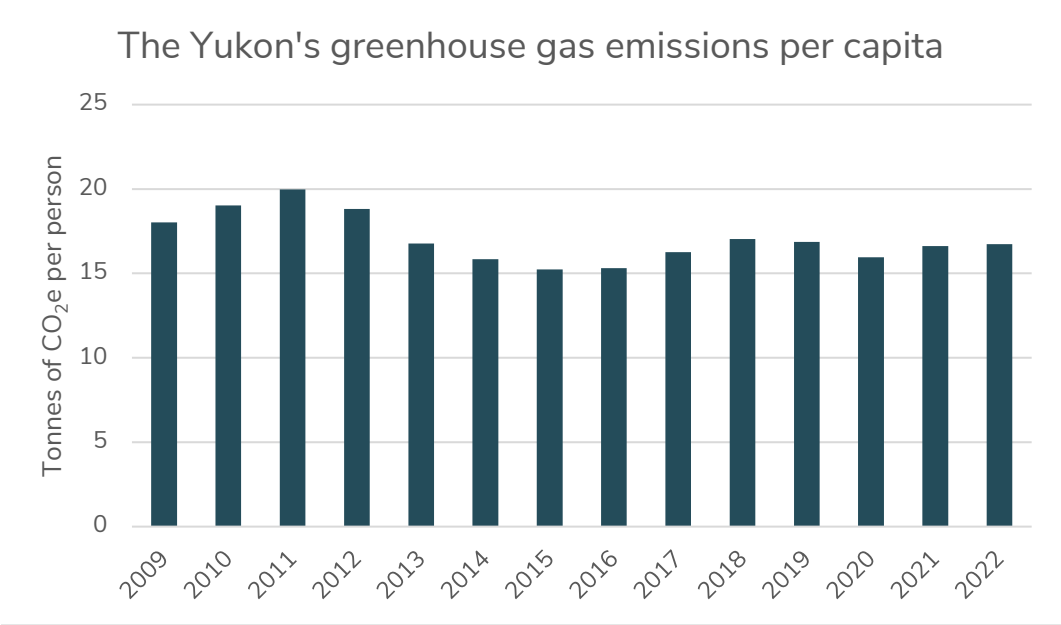


Figure 7. The Yukon's greenhouse gas emissions per capita from 2009 to 2022.

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 continue decoupling[6] 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.

COVID-19

Changes to the Yukon's emissions between 2021 and 2022 appear to reflect changes to Yukoners' transportation patterns as the COVID-19 public health measures continued to lift (Figure 4). Specifically:

- Aviation emissions increased by 52 per cent in 2022 and are comparable to pre-COVID levels.

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

- On-road gasoline emissions increased six per cent but remain below 2020 levels.

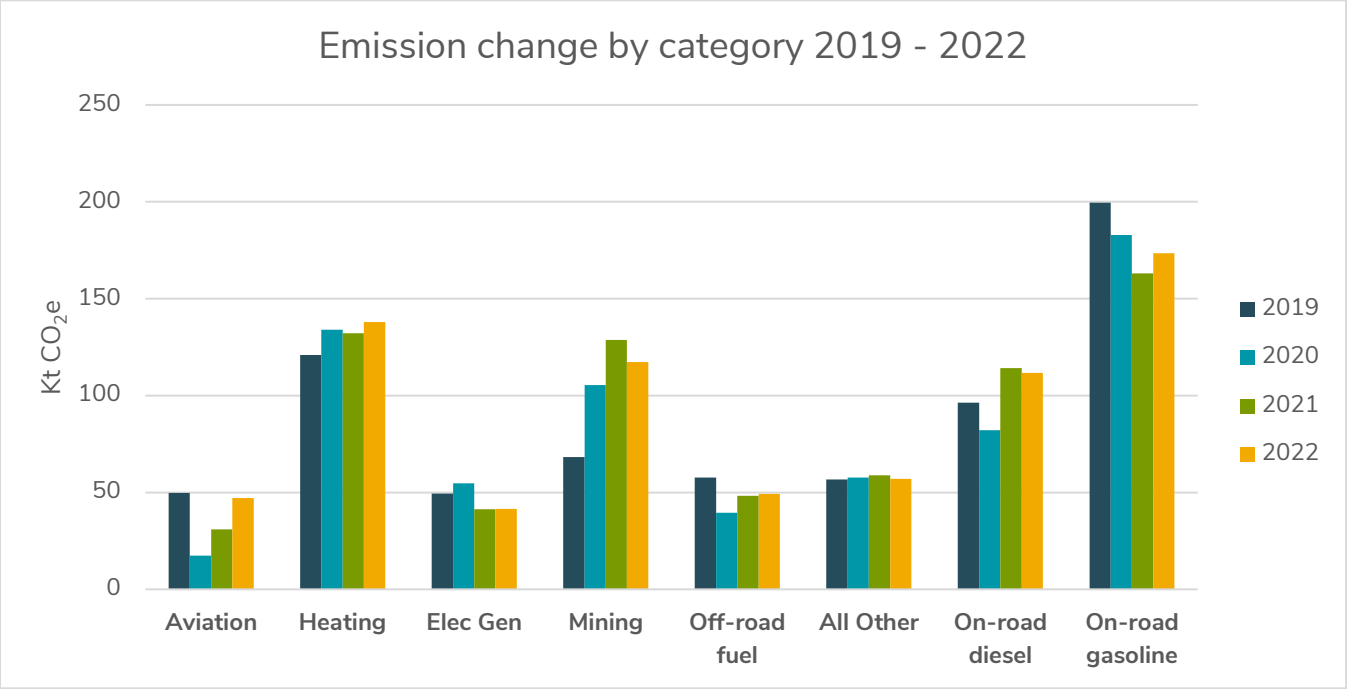


Figure 8. Emissions by sector between 2019 and 2022. Transportation emissions (aviation, on-road diesel, on-road gasoline) decreased notably in 2020 relative to 2019 levels, likely due to the COVID-19 pandemic. While aviation and on-road diesel emissions appear to have returned to pre-pandemic levels, on-road gasoline emissions remain well below 2019 levels.

Conclusions

The Yukon's total emissions in 2022 were ten per cent higher than those in 2010. However, it is promising to see that emissions per capita and per unit of GDP have continued to decline substantially over this period. Emissions per capita have decreased twelve per cent since 2010 and emissions per unit of GDP have decreased 17 per cent.

The Yukon is on a long journey towards further decoupling as well as broader decarbonization, guided by the Our Clean Future strategy. Progress is difficult to measure in early years due to the wide range of factors that impact greenhouse gas

emissions, but greenhouse gas emissions reductions are expected to become more and more pronounced as we move towards 2030. Updates on the progress that Government of Yukon has made towards the targets established in Our Clean Future can be found at: “our-clean-future.yukon.ca/what-you-can-do/reports."

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Appendix A – Detailed Methodology

Table 4: 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 liquefied 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.
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	National Inventory Report	Emissions calculated based on outputs of simulation model which estimates off-road fuel consumption using factors including number and type of off-

Fuel type	Description	Data source	Methodology
	used for snowmobiles and all-terrain vehicles.		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	Emissions calculated based on outputs of simulation model which estimates on-road fuel consumption using factors including number and type of registered vehicles, average annual kilometres driven per vehicle type, and uptake of emission control technology.
On-road gasoline	Gasoline used in registered vehicles intended to be used on official roadways only.	National Inventory Report	
All other sources	Emission sources not included in the above categories. This mainly includes direct emissions 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.