



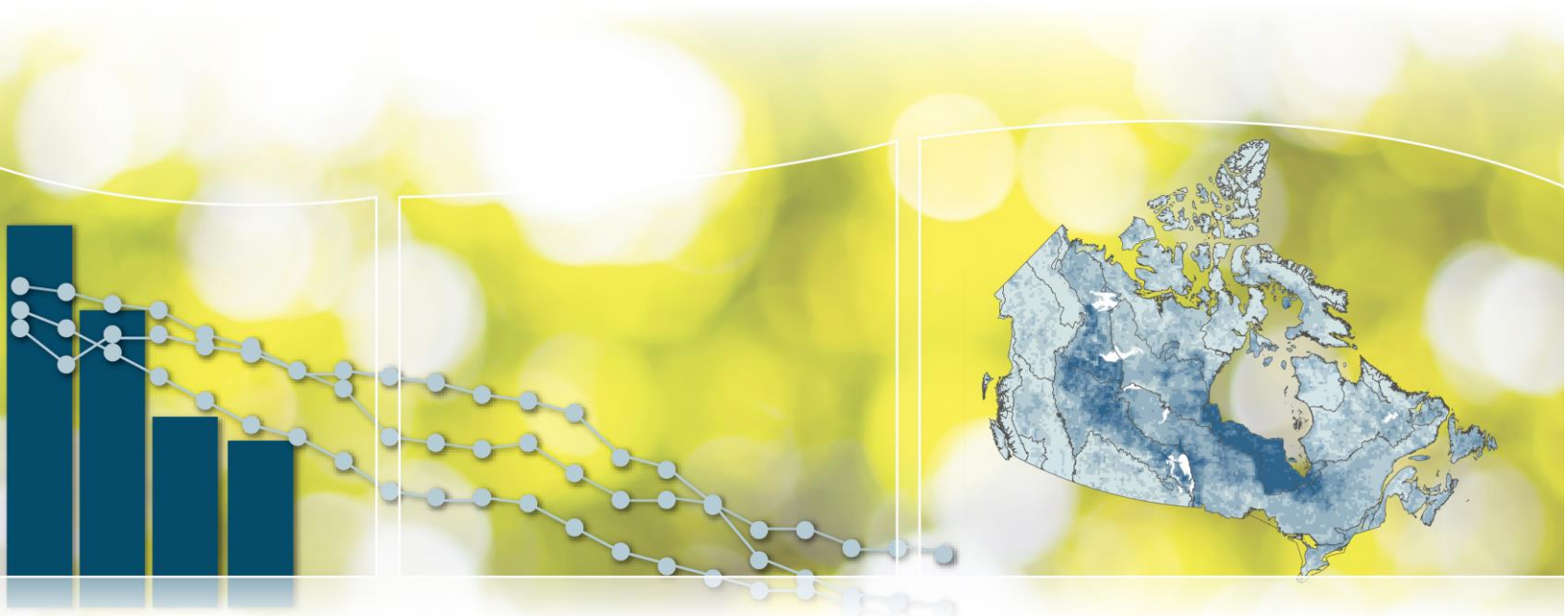
Environment and
Climate Change Canada

Environnement et
Changement climatique Canada



Canadian Environmental Sustainability Indicators

Greenhouse gas emissions



Suggested citation for this document: Environment and Climate Change Canada (2019) Canadian Environmental Sustainability Indicators: Greenhouse gas emissions. Consulted on *Month day, year*. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html.

Cat. No.: En4-144/18-2019E-PDF
ISBN: 978-0-660-30369-7

Unless otherwise specified, you may not reproduce materials in this publication, in whole or in part, for the purposes of commercial redistribution without prior written permission from Environment and Climate Change Canada's copyright administrator. To obtain permission to reproduce Government of Canada materials for commercial purposes, apply for Crown Copyright Clearance by contacting:

Environment and Climate Change Canada
Public Inquiries Centre
12th floor, Fontaine Building
200 Sacré-Coeur boul.
Gatineau, QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860
Fax: 819-938-3318
Email: ec.enviroinfo.ec@canada.ca

Photos: © Thinkstockphotos.ca; © Environment and Climate Change Canada

© Her Majesty the Queen in Right of Canada, represented by the Minister of Environment and Climate Change, 2019

Aussi disponible en français

Canadian Environmental Sustainability Indicators

Greenhouse gas emissions

April 2019

Table of Contents

Greenhouse gas emissions	5
Key results.....	5
Greenhouse gas emissions per person and per unit of gross domestic product.....	6
Key results.....	6
Greenhouse gas emissions by economic sector.....	7
Key results.....	7
Greenhouse gas emissions from the oil and gas sector.....	8
Key results.....	8
Greenhouse gas emissions from the transportation sector.....	9
Key results.....	9
Greenhouse gas emissions from the electricity sector.....	10
Key results.....	10
Greenhouse gas emissions by province and territory.....	11
Key results.....	11
About the indicators.....	12
What the indicators measure.....	12
Why these indicators are important.....	12
Related indicators.....	13
Data sources and methods.....	13
Data sources.....	13

Methods	14
Recent changes.....	15
Caveats and limitations	16
Resources.....	16
References	16
Related information	16
Annex	17
Annex A. Data tables for the figures presented in this document	17

List of Figures

Figure 1. Greenhouse gas emissions, Canada, 1990 to 2017	5
Figure 2. Indexed trend in greenhouse gas emissions per person and per unit of gross domestic product, Canada, 1990 to 2017	6
Figure 3. Greenhouse gas emissions by economic sector, Canada, 1990 to 2017.....	7
Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2017	8
Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2017	9
Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2017	10
Figure 7. Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2017 ...	11

List of Tables

Table A.1. Data for Figure 1. Greenhouse gas emissions, Canada, 1990 to 2017	17
Table A.2. Data for Figure 2. Indexed trend in greenhouse gas emissions per person and per unit of gross domestic product, Canada, 1990 to 2017	18
Table A.3. Data for Figure 3. Greenhouse gas emissions by economic sector, Canada, 1990 to 2017	19
Table A.4. Data for Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2017	20
Table A.5. Data for Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2017	21
Table A.6. Data for Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2017	22
Table A.7. Data for Figure 7. Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2017	23

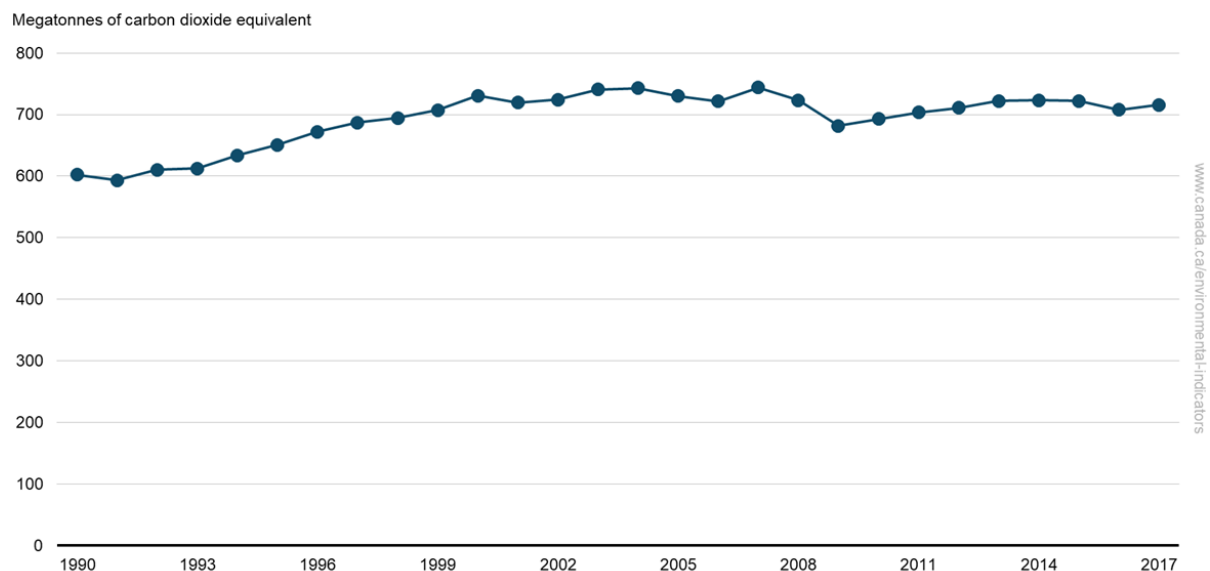
Greenhouse gas emissions

Climate change is one of the most important environmental issues of our time. Climate change is caused by the increase in concentrations of greenhouse gases (GHGs) in the atmosphere. These increases are primarily due to human activities such as the use of fossil fuels or agriculture. The indicators report estimates of Canada's emissions and removals of greenhouse gases.

Key results

- Canada's total GHG emissions in 2017 were 716 megatonnes of carbon dioxide equivalent (Mt CO₂ eq)
- The decrease in emissions since 2005 was primarily driven by reduced emissions from the electricity generation sector

Figure 1. Greenhouse gas emissions, Canada, 1990 to 2017



[Data for Figure 1](#)

Note: The national indicator tracks 7 greenhouse gases released by human activity: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data. Emissions and removals from the land use, land use change and forestry sector (LULUCF) are excluded from national totals. For information on Canada's projected GHG emissions up to 2030, please consult the [Progress towards Canada's greenhouse gas emissions reduction target](#) indicator.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Between 1990 and 2017, emissions increased by 18.9%, or 114 Mt CO₂ eq. Canada's emissions growth over this period was driven primarily by increased emissions from mining and upstream oil and gas production as well as transport.

Since 2005, emissions decreased by 15 Mt CO₂ eq or 2.0%. The decrease was driven primarily by reduced emissions from public electricity and heat production utilities.

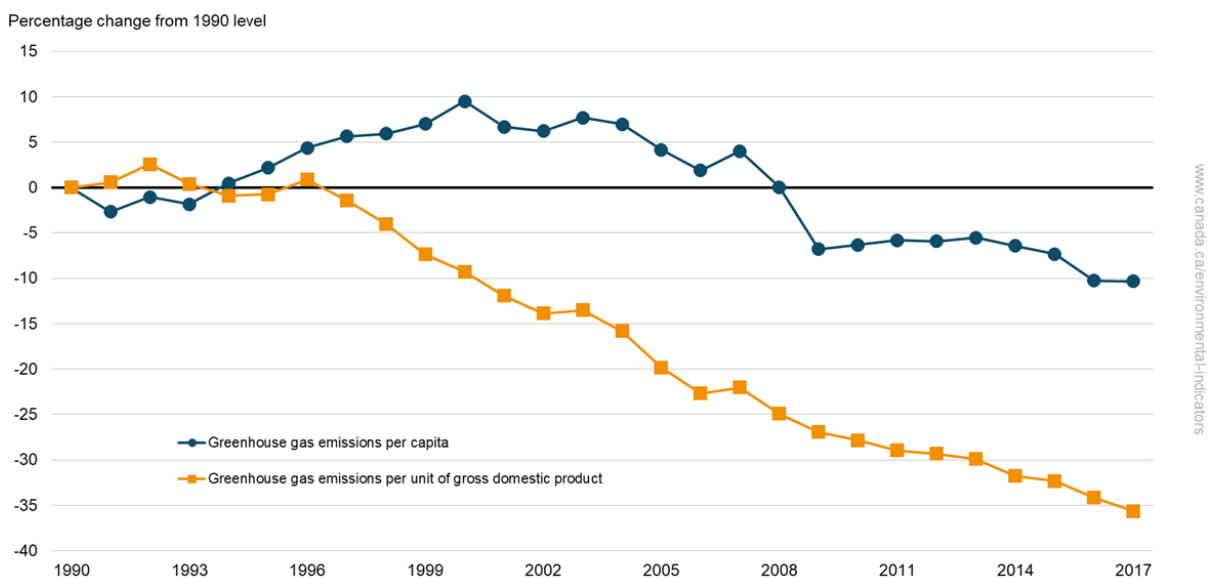
Greenhouse gas emissions per person and per unit of gross domestic product

These indicators show the relationship between the size of Canada's population and the amount of GHGs emitted. They also show how efficiently sectors in the economy are minimizing GHG emissions while producing goods and services for our consumption and export.

Key results

- Between 1990 and 2017, the amount of GHGs emitted per person decreased 10% from 21.7 to 19.5 tonnes of carbon dioxide equivalent (CO₂ eq)
- Over the same period, GHG per unit of gross domestic product decreased 36% from 0.55 to 0.36 megatonnes CO₂ eq per billion dollars gross domestic product

Figure 2. Indexed trend in greenhouse gas emissions per person and per unit of gross domestic product, Canada, 1990 to 2017



[Data for Figure 2](#)

Note: The chart presents the ratio of annual greenhouse gas emissions per person and per unit of gross domestic product relative to those values in 1990 (that is the values are indexed to 1990). Greenhouse gas emissions per unit of gross domestic product is calculated using real inflation-adjusted gross domestic product in 2012 dollars. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#). Statistics Canada [Table 17-10-0005-01](#) - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual. Statistics Canada [Table 36-10-0369-01](#) - Gross domestic product at 2012 constant prices, expenditure-based, annual.

Decreases in emissions per person and per unit of gross domestic product are attributable to a number of factors. More efficient industrial processes, a shift to a more service-based economy and a decrease in the emissions associated with energy generation are all contributing to these decreases.

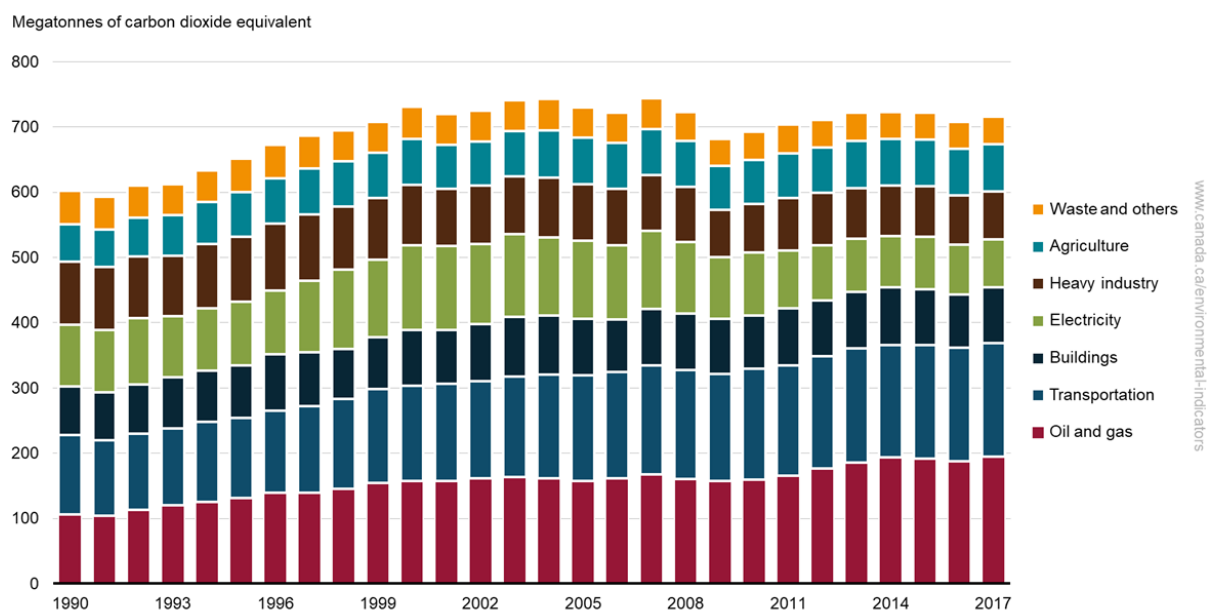
Greenhouse gas emissions by economic sector

These indicators show the GHG emissions reported by economic sector in which they are generated. They show how efficiently sectors in the economy are minimizing GHG emissions while producing goods and services for our consumption and export.

Key results

- In 2017, the oil and gas sector and transportation sector were the largest GHG emitters in Canada. Together, they accounted for 52% of total emissions.
- The other Canadian economic sectors each accounted for between 6% and 12% of total GHG emissions in Canada

Figure 3. Greenhouse gas emissions by economic sector, Canada, 1990 to 2017



[Data for Figure 3](#)

Note: The Waste and others sector consists of emissions from light manufacturing, construction, forest resources, waste and coal production. The Heavy industry sector consists of emissions from mining, smelting and refining, pulp and paper, iron and steel, cement, lime and gypsum, and chemicals and fertilizers.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

In 2017, the oil and gas sector accounted for 195 megatonnes of carbon dioxide equivalent (Mt CO₂ eq) (27% of total emissions), followed closely by the transportation sector, which emitted 174 Mt CO₂ eq (24%).

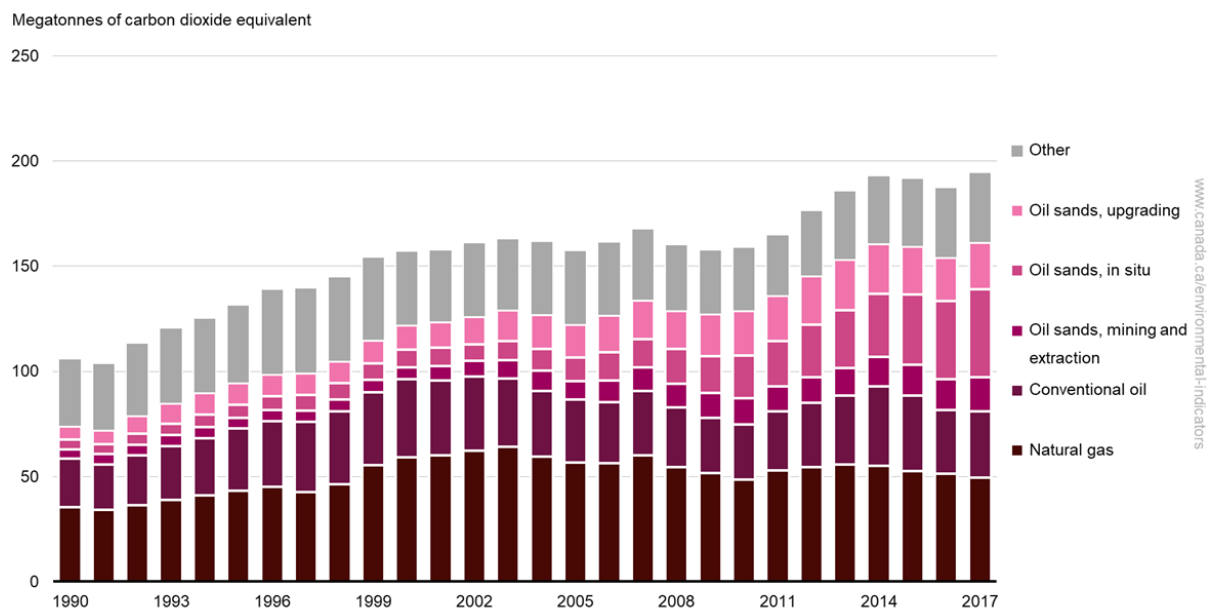
The increase in total GHG emissions between 1990 and 2017 was mostly due to a 84% (89 Mt CO₂ eq) increase in emissions in the oil and gas sector and a 43% (53 Mt CO₂ eq) increase in the transportation sector. These increases were partially offset by a 20 Mt CO₂ eq decrease in emissions in the electricity sector and a 24 Mt CO₂ eq decrease in emissions from heavy industry.

Greenhouse gas emissions from the oil and gas sector

Key results

- In 2017, the oil and gas sector was the largest source of GHG emissions, accounting for 27% of total national emissions
- Emissions of GHGs from the oil and gas sector have increased 84% from 106 megatonnes of carbon dioxide equivalent (Mt CO₂ eq) in 1990 to 195 Mt CO₂ eq in 2017. This increase is mostly attributable to the increased production of crude oil and the expansion of the oil sands industry.

Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2017



[Data for Figure 4](#)

Note: Conventional oil includes production from frontier, light and heavy oil fields. The Other category includes downstream oil and gas emissions (combustion and fugitive emissions from the production of refined petroleum products and the distribution of natural gas to end consumers) and oil and gas transmission emissions (combustion and fugitive emissions from transmission, storage and delivery activities).

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Between 1990 and 2017, GHG emissions from conventional oil production have increased by 36%, while emissions from oil sands production have increased by 423%. More than half of the increase in emissions from oil sands production over this period came from the growth of in situ production. A temporary decrease in GHG emissions from the oil and gas sector was observed between 2007 and 2009 and is mostly attributable to the world economic downturn that resulted in a lower global demand for petroleum products.

Between 1990 and 2017, crude oil production more than doubled in Canada. This was mostly driven by a rapid increase in production from the oil sands, which are more GHG-intensive than conventional sources (that is, more GHGs are emitted per unit cubic meters of oil produced). This change thus had a major impact on total GHG emissions from the sector.

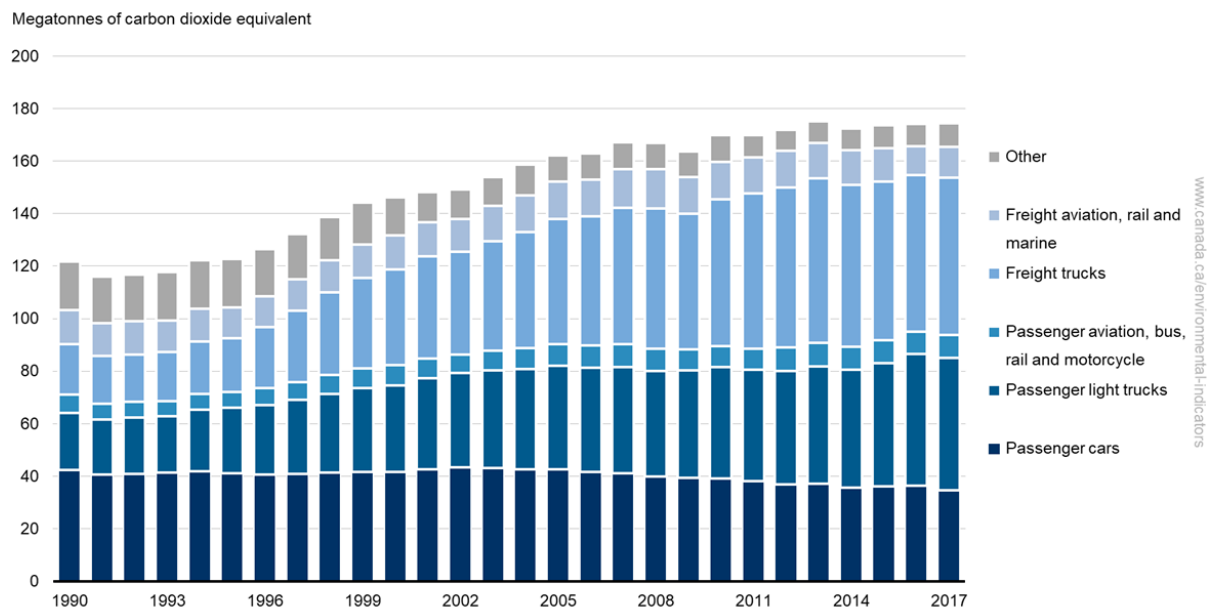
During the same period, production of natural gas from unconventional sources, such as those requiring the use of multi-stage fracturing techniques, also increased significantly.

Greenhouse gas emissions from the transportation sector

Key results

- In 2017, the transportation sector was the second largest source of GHG emissions, accounting for 24% (174 megatonnes of carbon dioxide equivalent) of total national emissions
- Between 1990 and 2017, GHG emissions from the transportation sector grew by 43%. The growth in emissions was mostly driven by increases from freight trucks and passenger light trucks

Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2017



[Data for Figure 5](#)

Note: The Other category includes other recreational, commercial and residential uses.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Between 1990 and 2017, part of the GHG emissions increase was due to a higher number of vehicles on the road and to changes in vehicle type used. Although total passenger emissions grew by 32%, emissions from cars declined by 18%, while emissions from light trucks (including trucks, vans and sport utility vehicles) more than doubled. Freight travel emissions grew by 122% between 1990 and 2017. Specifically emissions from freight trucks tripled and emissions from other modes of freight transportation decreased by 9%.

Passenger and freight travel emissions are influenced by a variety of factors, including population and economic growth, vehicle type, fuel efficiency and fuel type. Changes in the mix of vehicle type used, such as the increasing preference of passenger vehicle owners for light trucks rather than more fuel-efficient passenger cars, played an important role in shaping the evolution of GHG emissions.

Since 1990, the number of light trucks increased much faster than the increase of other passenger on-road vehicles. At the same time, there have been continual improvements in the fuel efficiency of

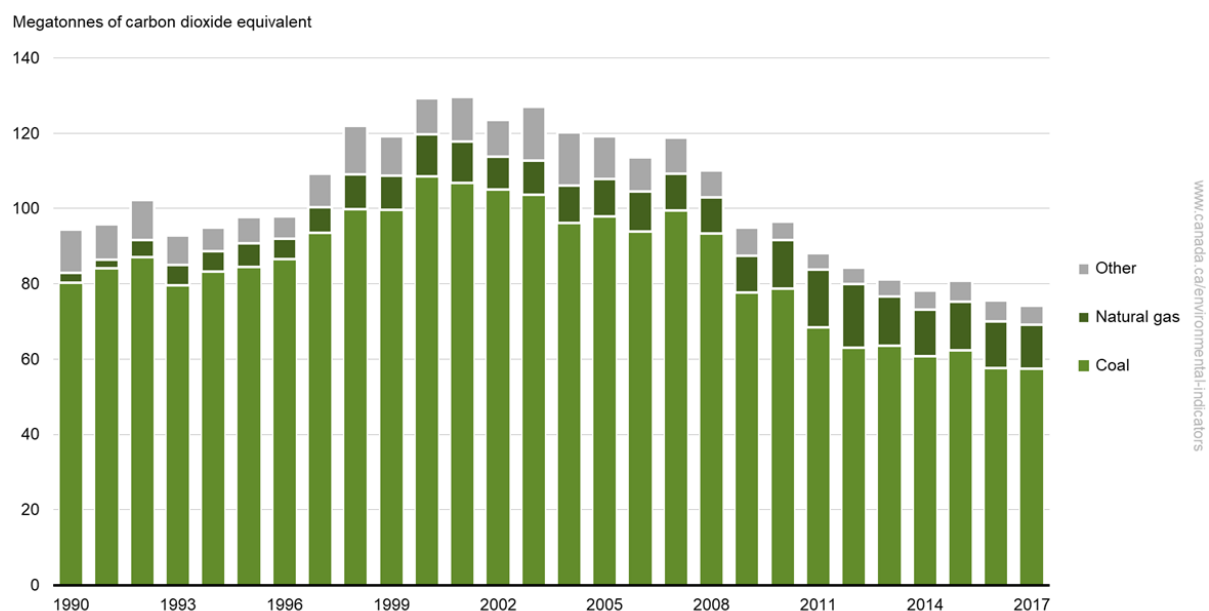
both passenger cars and light trucks over the last few decades.¹ However, these improvements were not sufficient to offset the increases in emissions due to the change in composition of the vehicle fleet.

Greenhouse gas emissions from the electricity sector

Key results

- In 2017, the electricity sector was the fourth largest source of GHG emissions, accounting for 10% of total national emissions
- Between 1990 and 2017, greenhouse gas emissions from combustion-based electricity generation have decreased by 21%

Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2017



[Data for Figure 6](#)

Note: The Other category includes diesel fuel oil, heavy fuel oil, light fuel oil, motor gasoline, petroleum coke, own use of primary electricity, solid wood waste and still gas.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Greenhouse gas emissions from combustion-based electricity generation have decreased from 94 megatonnes of carbon dioxide equivalent (Mt CO₂ eq) in 1990 to 74 Mt CO₂ eq in 2017. The growing share of electricity generated from non-GHG-emitting sources (such as hydro, nuclear and other renewables) and from fuels less GHG-intensive than coal contributed to the decline in GHG emissions from electricity.

Electricity generation technologies have various levels of GHG emission intensity (which is defined as the quantity of GHGs emitted per unit of electricity produced). Hydroelectricity and nuclear power emit no GHGs when generating electricity, while coal-burning power plants have a higher GHG intensity than natural gas-burning power plants. The general decline in the GHG intensity of electricity

¹ Natural Resources Canada (2016) [Energy Efficiency Trends Analysis Tables - Transportation Sector - Energy Use Analysis](#).

generation of public electric utilities from 1990 to 2017 can be attributed partly to a reduction in the use of coal and increases in other power plant types.

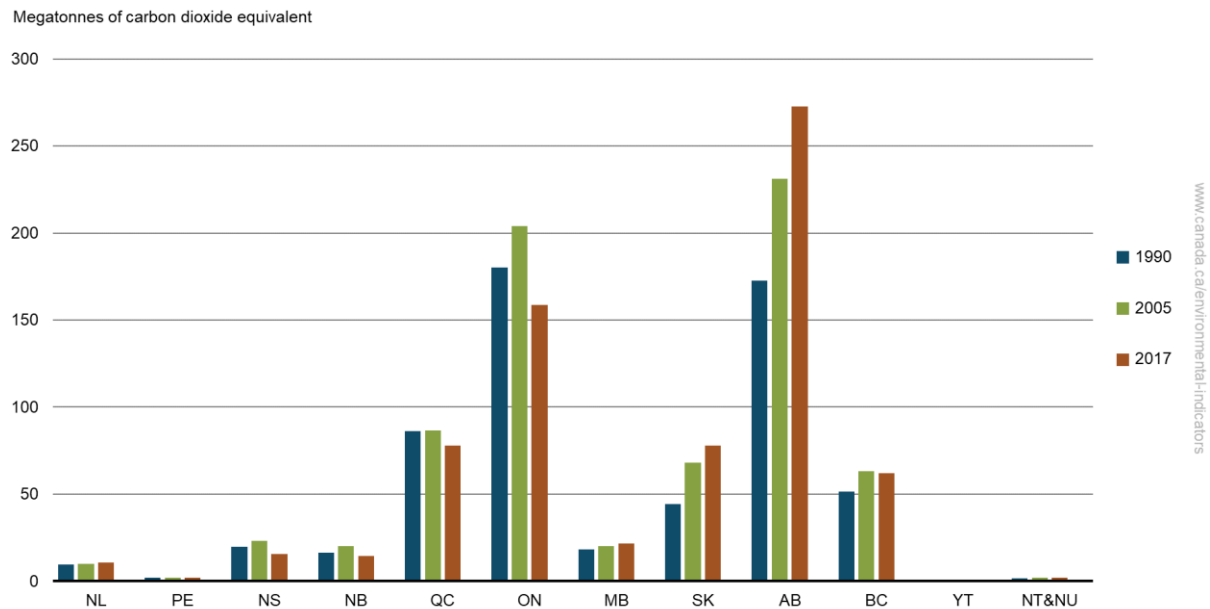
Greenhouse gas emissions by province and territory

Emissions vary significantly by province. The level of emissions depends on factors such as population, energy sources and economic base. Provinces and territories that are the most populated, have economies based on resource extraction or are relying on fossil fuels to generate electricity will tend to have higher emission levels.

Key results

- In 2017, the top 5 emitters (Alberta, Ontario, Quebec, Saskatchewan and British Columbia) together released 91% of Canada's national total GHG emissions
- Of the top 5 emitters, greenhouse gas emissions were lower in 2017 than in 1990 for Ontario and Quebec
 - For Quebec, emissions were lower by 8.0 megatonnes of carbon dioxide equivalent (Mt CO₂ eq)
 - For Ontario, emissions were lower by 21.3 Mt CO₂ eq

Figure 7. Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2017



[Data for Figure 7](#)

Note: Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

In 2017, the combined emissions from Alberta and Ontario, the largest emitters, represented 60% (38% and 22%, respectively) of the national total.

In 1990, Ontario's GHG emissions were higher than those from the other provinces because of its large manufacturing industry. Alberta's emissions subsequently surpassed Ontario's, with an increase of 58% since 1990, primarily due to the increase in the oil and gas industry. Ontario's emissions

decreased between 1990 and 2017 primarily because of the closure of coal-fired electricity generation plants.

The provinces of Quebec and British Columbia, which rely on abundant hydroelectric resources for their electricity production, show more stable emission patterns over time and a decreasing pattern since 2005. Quebec had a 10% (8.4 Mt CO₂ eq) decrease from its 2005 emissions level; mainly attributable to decreasing emissions from the residential, aluminium production and petroleum refining industries. Over the same period, emissions from British Columbia had a decline of 2% (1.0 Mt CO₂ eq); essentially due to decreasing emissions from the manufacturing industries and fugitive sources. In contrast to these decreases, emissions in Saskatchewan increased by 14% (9.8 Mt CO₂ eq) between 2005 and 2017, primarily due to increases in activity from sectors such as transportation, oil and gas, and mining.

About the indicators

What the indicators measure

The indicators show trends in anthropogenic (human-made) greenhouse gas (GHG) emissions. It includes emissions for 7 greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride). Emissions are presented:

- at the national level (total emissions, emissions per person and emissions per unit of gross domestic product)
- by economic sector
- at the provincial/territorial level

The indicators do not capture:

- emissions from natural processes (for example, material decay, plant and animal respiration, volcanic and thermal venting)
- removal of emissions from the atmosphere by natural sinks (for example, forests, oceans)

Why these indicators are important

Greenhouse gases trap heat in the Earth's atmosphere, just as the glass of a greenhouse keeps warm air inside. Human activity increases the amount of GHGs in the atmosphere, contributing to a warming of the Earth's surface. This is called the enhanced greenhouse effect.

Over the past 200 years in particular, humans have released GHGs into the atmosphere primarily from burning fossil fuels. As a result, more heat is being trapped and the temperature of the planet is increasing. Sea levels are rising as Arctic ice melts, and there are changes to the climate, such as more severe storms and heat waves. All of this [impacts](#) the environment, the economy and human health.

The Greenhouse gas emissions indicators are used to track the progress of Canada's efforts to lower emissions and reach environmental performance objectives. They also support decision making on sustainable development.

As an Annex I Party to the [United Nations Framework Convention on Climate Change](#), Canada is required to prepare and submit a national inventory of anthropogenic sources and sinks of GHGs on an annual basis.



Effective action on climate change

These indicators support the measurement of progress towards the following [2016–2019 Federal Sustainable Development Strategy](#) long-term goal: A low-carbon economy contributes to limiting global average temperature rise to well below 2 degrees Celsius and supports efforts to limit the increase to 1.5 degrees Celsius. They are used to assess progress towards the target: By 2030, reduce Canada's GHG emission by 30%, relative to 2005 emission levels.

In addition, the indicators contribute to the [Sustainable Development Goals of the 2030 Agenda for Sustainable Development](#). They are linked to the 2030 Agenda's Goal 9: "Industry, Innovation and Infrastructure" and Goal 13: "Climate Action"; more specifically to Target 9.4: "By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities" and Target 13.2: "Integrate climate change measures into national policies, strategies and planning."

Related indicators

The [Greenhouse gas emissions from large facilities](#) indicator reports GHG emissions from the largest GHG emitters in Canada (industrial and other types of facilities).

The [Global greenhouse gas emissions](#) indicator provides a global perspective on Canada's share of global GHG emissions.

The [Carbon dioxide emissions from a consumption perspective](#) indicator shows the impact of Canada's consumption of goods and services, regardless of where they are produced, on the levels of carbon dioxide released into the atmosphere.

The [Progress towards Canada's greenhouse gas emissions reduction target](#) indicator provides an overview of Canada's projected GHG emissions up to 2030.

Data sources and methods

Data sources

The Greenhouse gas emissions indicators are based on greenhouse gas (GHG) emissions data taken from Environment and Climate Change Canada's [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

More information

Data used to develop the emission and removal estimates presented in the National Inventory Report are drawn from published and unpublished sources from various government departments, industry sources and scientific papers.

Greenhouse gas emission estimates are provided at the national level, by economic sectors and at provincial/territorial level. The greenhouse gas emission estimates are compiled annually and reported for the period from 1990 to 2017. Complete details of the temporal coverage for each data source used for the indicators can be found in chapters 3 through 7 of the National Inventory Report.

Preparation of the GHG emissions inventory takes almost 16 months from the end of the reporting year because of the time needed to collect, validate, calculate and interpret the data. Between November and January, emission estimates are prepared by Environment and Climate Change Canada's Pollutant Inventories and Reporting Division with input from numerous experts and scientists across Canada. From January through March, the National Inventory Report text and accompanying emissions data tables are developed. This material is reviewed by external experts and Environment and Climate Change Canada officials, and finally submitted electronically to the United Nations Framework Convention on Climate Change, typically by mid-April.

Methods

The National Inventory Report is prepared using a "top-down" approach, providing estimates at a sectoral and provincial/territorial level without attribution to individual emitters. The emissions estimates are developed using guidelines produced by the Intergovernmental Panel on Climate Change. Annex 3 of the National Inventory Report describes the methods used to estimate Canada's GHG emissions.

More information

Since direct measurement of emissions from all sources is not possible, the United Nations Framework Convention on Climate Change requires that countries develop, update, publish and maintain national inventories using internationally approved and comparable emissions and removals estimation methods for 7 GHGs (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride). Canada's inventory is developed in accordance with the recently revised [United Nations Framework Convention on Climate Change Annex I Inventory Reporting Guidelines](#) (PDF; 1.67 MB) which require the use of the [2006 methodological guidance](#) developed by the Intergovernmental Panel on Climate Change. The Intergovernmental Panel on Climate Change guidelines are based on the best available science and developed through an international process that involves testing of methods through ongoing inventory development, country studies, technical and regional workshops, and national and international experts consultations.

Emissions calculation

In general, GHG emissions are estimated by multiplying activity data by emission factors.

$$\text{Emissions} = \text{activity data} \times \text{emission factor}$$

Activity data refer to the quantitative amount of human activity resulting in emissions during a given time period. The annual activity data for fuel combustion sources, for example, are the total amounts of fuel burned over a year.

Emission factors are based on samples of measurement data, and are representative rates of emissions for a given activity level under a given set of operating conditions. It is the estimated average emission rate of a given pollutant for a given source, relative to units of activity.

Guidelines produced by the Intergovernmental Panel on Climate Change for countries reporting to the United Nations Framework Convention on Climate Change provide various methods for calculating GHG emissions from a given human activity. The methods for estimating emissions are divided into "tiers," each encompassing different levels of activity and technological detail. The same general structure is used for all tiers, while the level of detail at which the calculations are carried out can vary. Annex 3 of the National Inventory Report describes the methods used to estimate Canada's GHG emissions and illustrates that the selection of Intergovernmental Panel on Climate Change method type is highly dependent on the importance of each category and the availability of data.

Carbon dioxide equivalents

Greenhouse gas emissions are reported in carbon dioxide equivalents (CO₂ eq), determined by multiplying the amount of emissions of a particular greenhouse gas by the global warming potential of that gas. Greenhouse gases differ in their ability to absorb heat in the atmosphere due to their differing chemical properties and atmospheric lifetimes. For example, over a period of 100 years, methane's potential to trap heat in the atmosphere is 25 times greater than carbon dioxide's potential. Therefore, methane is considered to have a global warming potential of 25. The Intergovernmental Panel on Climate Change publishes the global warming potentials and atmospheric lifetimes for each GHG; these can be found in Table 1-1 of the National Inventory Report.

Greenhouse gas emissions by economic sector

The Greenhouse gas emissions by economic sector indicator represents a different classification than the activity sector emissions prescribed by the Intergovernmental Panel on Climate Change's methodological guidance and United Nations Framework Convention on Climate Change's reporting guidelines. Instead of reporting on Canada's emissions by activity, GHG emissions have been allocated to the economic sector in which they are generated (for example, transportation emissions directly supporting an industrial activity, like off-road trucks in mining activities, have been allocated to the economic sector in which they are generated rather than to the transportation "activity" sector). A comprehensive detailing of the emissions reported by economic sector can be found in chapter 2 and Annex 10 of the National Inventory Report.

Quality assurance, quality control and uncertainty

Quality assurance and quality control procedures are an essential requirement of the GHG inventory development and submission process. Quality assurance and quality control procedures ensure and improve transparency, consistency, comparability, completeness and confidence in the national emissions for the purpose of meeting Canada's reporting commitments under the United Nations Framework Convention on Climate Change. Chapter 1 (section 1.3) of the National Inventory Report provides a complete description of the quality assurance and quality control procedures.

Uncertainty analysis helps to prioritize improvements and to guide decisions on methodological choices. Annex 2 of the National Inventory Report presents the uncertainty assessment for Canada's GHG emissions. Further details on uncertainty related to specific sectors can be found in the uncertainty sections of chapters 3 through 7 of the National Inventory Report.

Recent changes

Recalculations are performed annually on Canada's previously reported greenhouse gas emissions estimates to reflect updates to source data and estimation methodology. Chapter 8 of the National Inventory Report provides a summary of the recalculations that occurred due to methodological changes and/or refinements since the previous submission. The summary includes:

- brief description, justification and summary of individual impacts on previously reported emission estimates
- details on specific inventory improvements implemented in 2018 as well as planned improvements

Caveats and limitations

The Greenhouse gas emissions indicators are comprehensive but some emission sources have not been included in the indicators because they are not reported in the National Inventory Report. Owing to their relatively small contributions to the total emissions, these excluded sources do not significantly affect the overall completeness of the inventory. A detailed explanation of the excluded emission sources can be found in Annex 5 of the National Inventory Report.

Although reported in the National Inventory Report, emissions and removals from the land use, land use change and forestry sector are excluded from national totals and subsequently not reported as part of the Greenhouse gas emissions indicators.

Resources

References

Environment and Climate Change Canada (2018) [Canada's greenhouse gas and air pollutant emissions projections](#). Retrieved on February 4, 2019.

Environment and Climate Change Canada (2019) [Greenhouse gas sources and sinks: executive summary 2019](#). Retrieved on April 15, 2019.

Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#). Retrieved on April 15, 2019.

Statistics Canada (2019) [Table 25-10-0014-01 Crude oil and equivalent, monthly supply and disposition \(x 1,000\)](#). Retrieved on February 4, 2019.

Statistics Canada (2019) [Table 25-10-0063-01 Supply and disposition of crude oil and equivalent](#). Retrieved on February 4, 2019.

Related information

Environment and Climate Change Canada (2019) [Greenhouse gas emissions: drivers and impacts](#). Retrieved on January 18, 2019.

Environment and Climate Change Canada (2019) [Canada's action on climate change](#). Retrieved on January 18, 2019.

Environment and Climate Change Canada (2019) [Climate change](#). Retrieved on January 18, 2019.

Intergovernmental Panel on Climate Change (2006) [Guidelines for National Greenhouse Gas Inventories](#). Retrieved on January 18, 2019.

Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Greenhouse gas emissions, Canada, 1990 to 2017

Year	Total greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
1990	602
1991	593
1992	610
1993	612
1994	634
1995	651
1996	672
1997	687
1998	695
1999	707
2000	731
2001	720
2002	724
2003	741
2004	743
2005	730
2006	721
2007	744
2008	723
2009	682
2010	693
2011	703
2012	711
2013	722
2014	723
2015	722
2016	708
2017	716

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. The national indicator tracks 7 greenhouse gases released by human activity: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data. Emissions and removals from the land use, land use change and forestry sector (LULUCF) are excluded from national totals.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Table A.2. Data for Figure 2. Indexed trend in greenhouse gas emissions per person and per unit of gross domestic product, Canada, 1990 to 2017

Year	Greenhouse gas emissions per capita (tonnes of carbon dioxide equivalent per person)	Indexed greenhouse gas emissions per capita (percentage change from 1990 level)	Greenhouse gas emissions per unit of gross domestic product (megatonnes of carbon dioxide equivalent per billion dollars gross domestic product)	Indexed greenhouse gas emissions per unit of gross domestic product (percentage change from 1990 level)
1990	21.7	0.0	0.55	0.0
1991	21.2	-2.7	0.56	0.6
1992	21.5	-1.1	0.57	2.6
1993	21.3	-1.8	0.55	0.4
1994	21.9	0.5	0.55	-0.9
1995	22.2	2.2	0.55	-0.8
1996	22.7	4.4	0.56	0.8
1997	23.0	5.6	0.54	-1.4
1998	23.0	5.9	0.53	-4.0
1999	23.3	7.0	0.51	-7.4
2000	23.8	9.5	0.50	-9.3
2001	23.2	6.7	0.49	-11.9
2002	23.1	6.2	0.48	-13.9
2003	23.4	7.7	0.48	-13.5
2004	23.3	7.0	0.46	-15.8
2005	22.7	4.2	0.44	-19.8
2006	22.2	1.9	0.43	-22.7
2007	22.6	4	0.43	-22.0
2008	21.8	0.0	0.41	-24.9
2009	20.3	-6.8	0.40	-26.9
2010	20.4	-6.3	0.40	-27.9
2011	20.5	-5.8	0.39	-29.0
2012	20.5	-5.9	0.39	-29.3
2013	20.5	-5.5	0.39	-29.9
2014	20.3	-6.4	0.38	-31.8
2015	20.1	-7.3	0.37	-32.3
2016	19.5	-10.3	0.36	-34.2
2017	19.5	-10.3	0.36	-35.7

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. Greenhouse gas per unit of gross domestic product is calculated using real inflation-adjusted gross domestic product in 2012 dollars. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#). Statistics Canada [Table 17-10-0005-01](#) - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual. Statistics Canada [Table 36-10-0369-01](#) - Gross domestic product at 2012 constant prices, expenditure-based, annual.

Table A.3. Data for Figure 3. Greenhouse gas emissions by economic sector, Canada, 1990 to 2017

Year	Oil and gas (megatonnes of carbon dioxide equivalent)	Transportation (megatonnes of carbon dioxide equivalent)	Buildings (megatonnes of carbon dioxide equivalent)	Electricity (megatonnes of carbon dioxide equivalent)	Heavy industry (megatonnes of carbon dioxide equivalent)	Agriculture (megatonnes of carbon dioxide equivalent)	Waste and others (megatonnes of carbon dioxide equivalent)
1990	106	122	74	94	97	57	52
1991	104	116	73	96	97	58	50
1992	113	117	75	102	94	60	49
1993	121	118	79	93	93	62	47
1994	125	122	79	95	99	65	49
1995	132	123	80	98	100	68	51
1996	139	127	86	98	102	69	51
1997	140	132	83	109	102	70	51
1998	145	139	76	122	96	70	47
1999	154	144	79	119	94	69	47
2000	157	146	86	129	93	70	49
2001	158	148	82	130	87	68	47
2002	161	149	87	123	89	67	47
2003	163	154	92	127	88	70	47
2004	162	159	90	120	92	72	49
2005	158	162	86	119	87	72	47
2006	161	163	81	114	86	70	46
2007	168	167	87	119	86	71	47
2008	160	167	86	110	84	70	45
2009	158	164	85	95	72	68	41
2010	159	170	82	97	74	68	43
2011	165	170	87	88	81	68	44
2012	176	172	86	84	80	70	42
2013	186	175	86	81	78	72	43
2014	193	173	88	78	78	71	42
2015	192	174	86	81	77	71	42
2016	187	174	82	76	76	72	41
2017	195	174	85	74	73	72	42

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. The Waste and others sector consists of emissions from light manufacturing, construction, forest resources, waste and coal production. The Heavy industry sector consists of emissions from mining, smelting and refining, pulp and paper, iron and steel, cement, lime and gypsum, and chemicals and fertilizers.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Table A.4. Data for Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2017

Year	Natural gas (megatonnes of carbon dioxide equivalent)	Conventional oil (megatonnes of carbon dioxide equivalent)	Oil sands, mining and extraction (megatonnes of carbon dioxide equivalent)	Oil sands, in situ (megatonnes of carbon dioxide equivalent)	Oil sands, upgrading (megatonnes of carbon dioxide equivalent)	Other (megatonnes of carbon dioxide equivalent)
1990	35.3	23.1	4.5	4.8	6.2	32.1
1991	34.2	21.7	4.9	4.8	6.5	31.7
1992	36.4	23.8	5.1	5.1	8.6	34.5
1993	38.8	25.7	5.1	5.3	9.7	35.9
1994	41.1	27.2	5.3	5.7	10.4	35.5
1995	43.1	29.8	4.9	6.1	10.5	37.1
1996	45.1	31.2	5.4	6.5	10.3	40.6
1997	42.6	33.4	5.2	7.7	10.1	40.7
1998	46.3	34.7	5.5	7.9	10.4	40.1
1999	55.2	34.9	5.8	7.8	10.9	39.5
2000	59.2	36.9	5.8	8.4	11.4	35.4
2001	60.1	35.6	7.0	8.5	12.4	34.3
2002	62.4	35.2	7.4	8.0	13.0	35.0
2003	64.0	32.5	8.7	9.1	14.6	34.3
2004	59.4	31.4	9.5	10.4	16.2	35.0
2005	56.7	29.8	8.7	11.3	15.5	35.5
2006	56.3	29.0	10.3	13.3	17.7	34.7
2007	60.2	30.4	11.2	13.5	18.6	33.8
2008	54.3	28.6	11.2	16.6	17.9	31.6
2009	51.6	26.3	11.7	17.7	19.8	30.6
2010	48.6	26.3	12.5	20.1	21.3	30.4
2011	52.8	28.3	11.8	21.5	21.7	29.1
2012	54.3	30.7	12.1	25.0	23.2	31.1
2013	55.8	32.7	13.0	27.5	24.2	32.7
2014	55.2	37.7	13.9	30.0	23.9	32.4
2015	52.4	36.2	14.5	33.4	22.9	32.5
2016	51.2	30.4	14.5	37.4	20.6	33.3
2017	49.5	31.3	16.4	41.7	22.4	33.2

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. Conventional oil includes production from frontier, light and heavy oil fields. The Other category includes downstream oil and gas emissions (combustion and fugitive emissions from the production of refined petroleum products and the distribution of natural gas to end consumers) and oil and gas transmission emissions (combustion and fugitive emissions from transmission, storage and delivery activities).

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Table A.5. Data for Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2017

Year	Passenger cars (megatonnes of carbon dioxide equivalent)	Passenger light trucks (megatonnes of carbon dioxide equivalent)	Passenger aviation, bus, rail and motorcycle (megatonnes of carbon dioxide equivalent)	Freight trucks (megatonnes of carbon dioxide equivalent)	Freight aviation, rail and marine (megatonnes of carbon dioxide equivalent)	Other (megatonnes of carbon dioxide equivalent)
1990	42.5	21.6	7.0	19.4	13.0	18.5
1991	40.7	20.9	6.1	18.0	12.6	17.7
1992	40.9	21.2	6.2	18.0	12.6	17.8
1993	41.4	21.4	5.8	18.7	12.0	18.3
1994	41.8	23.5	6.0	20.0	12.5	18.5
1995	41.0	24.9	6.2	20.4	11.7	18.7
1996	40.7	26.3	6.7	23.2	11.7	18.0
1997	40.9	28.1	6.8	27.3	11.8	17.3
1998	41.3	30.1	7.2	31.3	12.3	16.4
1999	41.5	31.9	7.6	34.5	12.5	16.0
2000	41.6	32.9	7.7	36.6	12.8	14.5
2001	42.7	34.6	7.3	39.1	13.0	11.5
2002	43.2	36.0	7.1	39.1	12.6	11.2
2003	43.1	37.3	7.4	41.8	13.4	11.0
2004	42.5	38.3	7.9	44.2	14.0	11.6
2005	42.6	39.3	8.3	47.8	14.2	10.0
2006	41.6	39.7	8.4	49.3	13.9	9.9
2007	41.1	40.4	8.7	51.9	14.9	10.1
2008	39.8	40.1	8.6	53.5	14.9	9.9
2009	39.4	41.0	7.8	51.9	13.9	9.7
2010	39.2	42.5	7.8	56.1	14.2	10.1
2011	38.0	42.7	8.0	59.0	13.8	8.4
2012	36.9	43.2	8.8	60.9	14.1	8.0
2013	37.2	44.6	9.0	62.7	13.5	8.1
2014	35.7	44.9	8.6	61.6	13.2	8.5
2015	36.1	47.0	8.6	60.4	12.7	8.7
2016	36.3	50.1	8.6	59.7	11.0	8.6
2017	34.6	50.5	8.6	59.9	11.9	8.9

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. The Other category includes other recreational, commercial and residential uses.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Table A.6. Data for Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2017

Year	Coal (megatonnes of carbon dioxide equivalent)	Natural gas (megatonnes of carbon dioxide equivalent)	Other (megatonnes of carbon dioxide equivalent)
1990	80.2	2.7	11.5
1991	84.2	2.2	9.4
1992	87.2	4.4	10.7
1993	79.7	5.4	7.9
1994	83.3	5.3	6.3
1995	84.5	6.2	7.0
1996	86.5	5.5	6.0
1997	93.5	6.9	8.8
1998	99.8	9.3	12.9
1999	99.6	9.1	10.4
2000	108.5	11.1	9.6
2001	106.8	11.0	11.8
2002	105.1	8.7	9.7
2003	103.6	9.2	14.2
2004	96.2	9.9	14.1
2005	97.9	9.9	11.5
2006	93.8	10.7	9.0
2007	99.4	9.7	9.7
2008	93.3	9.6	7.2
2009	77.7	9.7	7.5
2010	78.7	12.9	4.9
2011	68.4	15.4	4.2
2012	63.1	16.9	4.2
2013	63.6	13.1	4.6
2014	60.7	12.5	5.1
2015	62.3	12.9	5.6
2016	57.6	12.4	5.6
2017	57.4	11.8	5.1

Note: Data are presented as rounded figures. However, all calculations have been performed using unrounded data. The Other category includes diesel fuel oil, heavy fuel oil, light fuel oil, motor gasoline, petroleum coke, own use of primary electricity, solid wood waste and still gas.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Table A.7. Data for Figure 7. Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2017

Province or territory	1990 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2005 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2017 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
Newfoundland and Labrador (NL)	9.4	9.9	10.5
Prince Edward Island (PE)	1.9	2.0	1.8
Nova Scotia (NS)	19.6	23.2	15.6
New Brunswick (NB)	16.1	20.0	14.3
Quebec (QC)	86.1	86.5	78.0
Ontario (ON)	180.0	203.9	158.7
Manitoba (MB)	18.3	20.1	21.7
Saskatchewan (SK)	44.4	68.0	77.9
Alberta (AB)	172.6	231.1	272.8
British Columbia (BC)	51.6	63.1	62.1
Yukon (YT)	0.5	0.5	0.5
Northwest Territories (NT)	1.6 ^[A]	1.6	1.3
Nunavut (NU)	n/a	0.4	0.6

Note: ^[A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. Data are presented as rounded figures. However, all calculations have been performed using unrounded data. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.

Source: Environment and Climate Change Canada (2019) [National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada](#).

Additional information can be obtained at:

Environment and Climate Change Canada

Public Inquiries Centre

12th Floor, Fontaine Building

200 Sacré-Coeur boul.

Gatineau, QC K1A 0H3

Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860

Fax: 819-938-3318

Email: ec.enviroinfo.ec@canada.ca