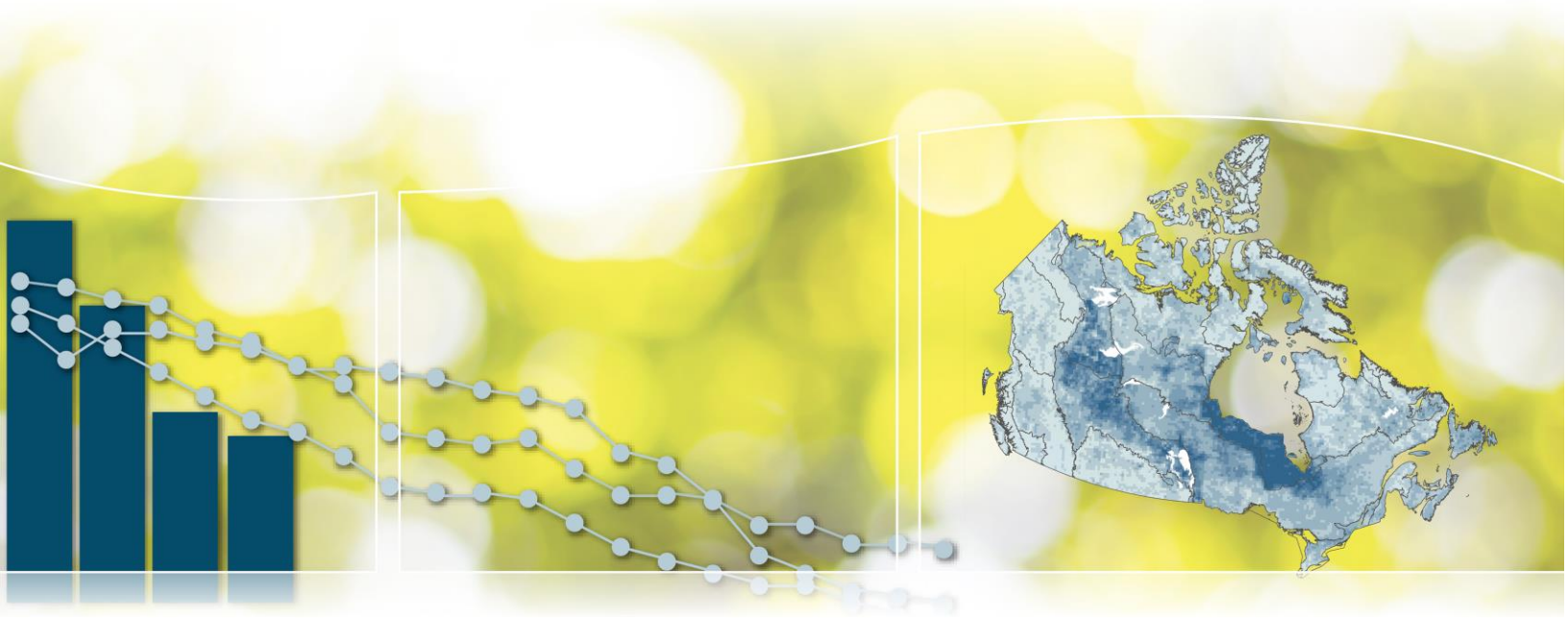
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

Greenhouse Gas Emissions



Canada

Suggested citation for this document: Environment and Climate Change Canada (2017) Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions. Consulted on *Month day, year*.
Available at: www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=FBF8455E-1.

Cat. No.: En4-144/18-2017E-PDF
ISBN: 978-0-660-07941-7

Environment and Climate Change Canada
Public Inquiries Centre
7th floor, Fontaine Building
200 Sacré-Coeur boul.
Gatineau, QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Fax: 819-994-1412
TTY: 819-994-0736
Email: ec.enviroinfo.ec@canada.ca

Aussi disponible en français

Canadian Environmental Sustainability Indicators

Greenhouse Gas Emissions

April 2017

Table of Contents

List of Figures

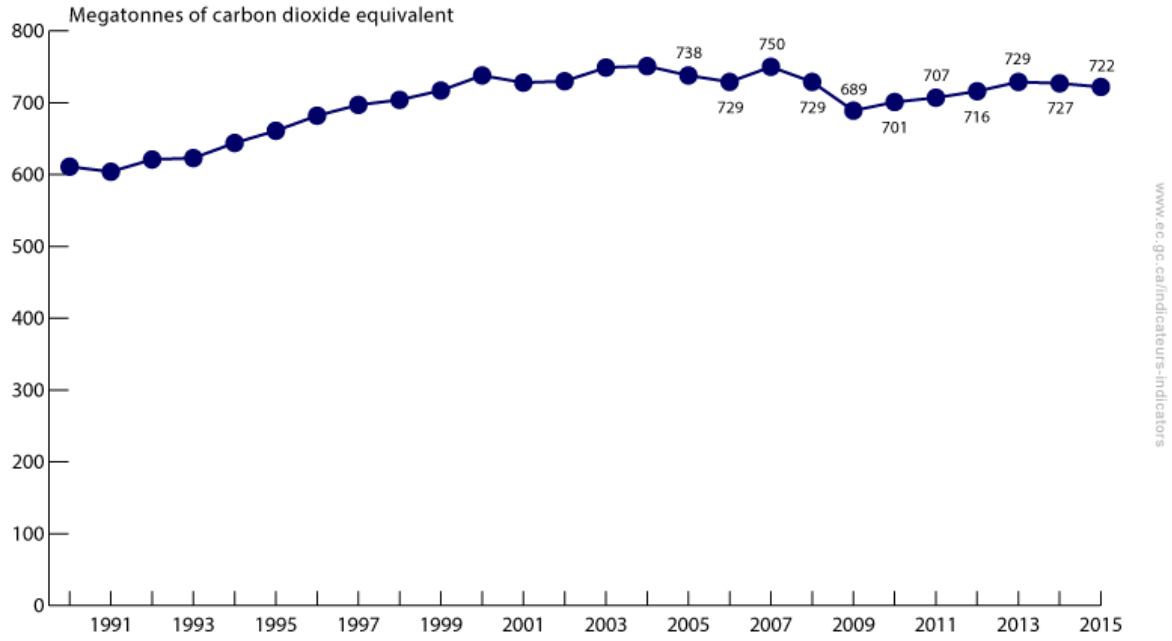
List of Tables

Part 1. Greenhouse Gas Emissions Indicators

Canada's total greenhouse gas (GHG) emissions in 2015 were 722 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq), or 18% (111 Mt CO_2 eq) above the 1990 emissions of 611 Mt CO_2 eq. Annual emissions steadily increased during the first 10 years of this period, fluctuated between 2000 and 2008, dropped in 2009, and gradually increased thereafter.

Canada's emissions growth between 1990 and 2015 was driven primarily by increased emissions from mining and upstream oil and gas production as well as transport. Emission reductions from 2005 to 2015 were driven primarily by reduced emissions from public electricity and heat production utilities.

Figure 1. Greenhouse gas emissions, Canada, 1990 to 2015



Data for Figure 1

Note: The national indicator tracks seven 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.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

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.

Greenhouse gas emissions per person and per unit gross domestic product

Two ways to analyze how greenhouse gas (GHG) emissions relate to socio-economic developments in Canada are:

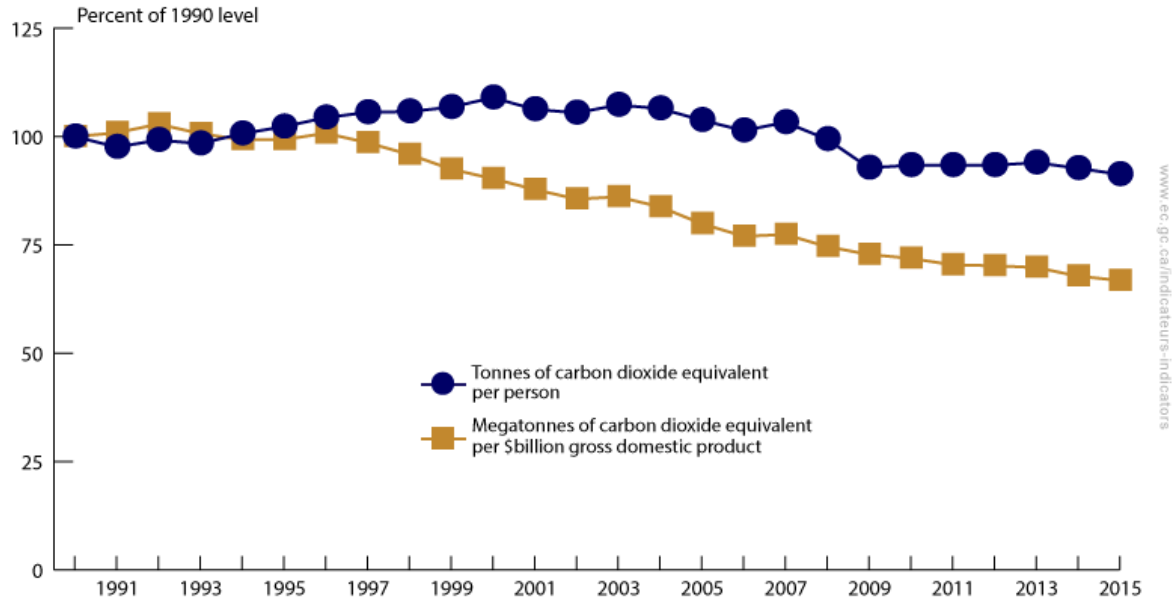
1. the amount of GHGs emitted per person (GHGs per capita), and
2. the amount of GHGs per unit of gross domestic product (GHG intensity of the economy).

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

The level of emissions per unit of gross domestic product was 33% lower in 2015 than in 1990. Over that period, GHG per unit of gross domestic product decreased from 0.62 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq) per $billion gross domestic product[1] in 1990 to 0.41 Mt CO_2 eq per $billion gross domestic product in 2015. The amount of GHGs emitted per person in Canada decreased to 20.1 tonnes CO_2 eq in 2015, compared with 22.1 tonnes CO_2 eq in 1990.

These improvements are attributable to a number of factors such as more efficient industrial processes, a shift to a more service-based economy and a decrease in the emissions associated with energy generation (such as those realized through fuel switching).

Figure 2. Indexed trend in greenhouse gas emissions per person and per unit of gross domestic product, Canada, 1990 to 2015



Data for Figure 2

Note: The graph presents the ratio of annual GHG emissions per person and per unit of gross domestic product relative to those values in 1990 (i.e., the values are indexed to 1990). Greenhouse gas per unit of gross domestic product is calculated using real inflation-adjusted gross domestic product in 2007 dollars. Emission levels for some years have been revised in light of improvements to estimation methods and

[1] Greenhouse gas intensity per unit of gross domestic product is calculated using the real inflation-adjusted gross domestic product in 2007 dollars.

availability of new data.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada. Statistics Canada. Table 051-0001 – Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual. Statistics Canada. Table 380-0106 – Gross domestic product at 2007 constant prices, expenditure-based, annual.

Effective action on climate change

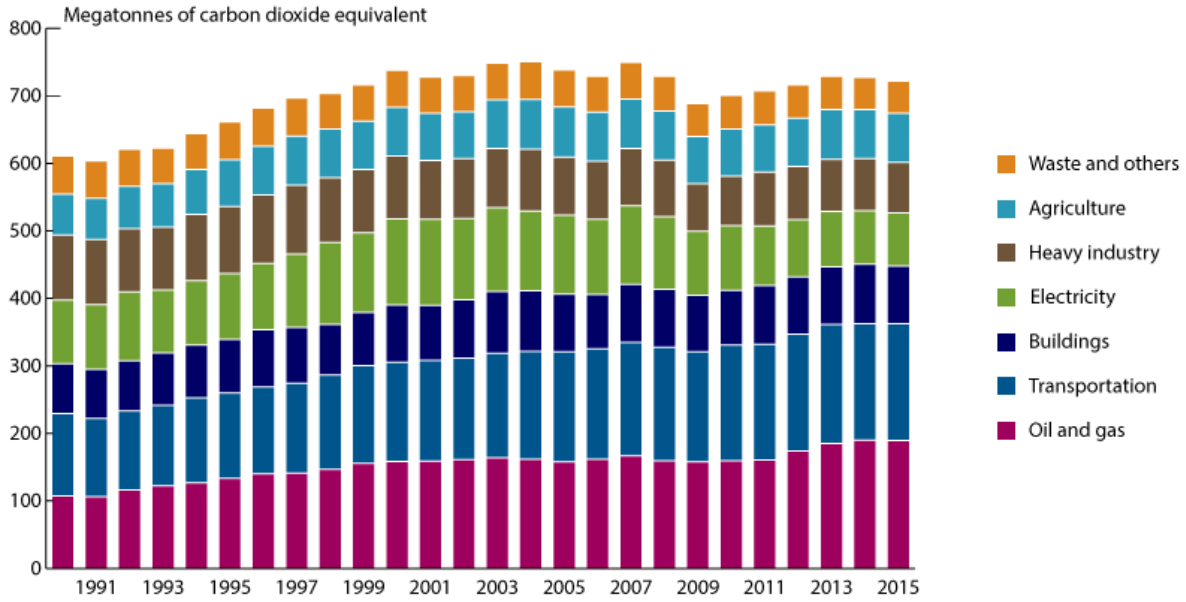
These indicators support the measurement of progress towards the long-term goal of the 2016–2019 Federal Sustainable Development Strategy: A low-carbon economy contributes to limiting global average temperature rise to well below two degrees Celsius and supports efforts to limit the increase to 1.5 degrees Celsius.

Greenhouse gas emissions by Canadian economic sector

In 2015, Canada's total greenhouse gas (GHG) emissions were 722 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq). The oil and gas sector was the largest GHG emitter in Canada, accounting for 189 Mt CO_2 eq (26% of total emissions), followed closely by the transportation sector, which emitted 173 Mt CO_2 eq (24%). The other Canadian economic sectors (i.e., buildings, electricity, heavy industry,[2] agriculture, and waste and others), each accounted for between 7% and 12% of total GHG emissions in Canada.

The increase in GHG emissions between 1990 and 2015 was mostly due to a 76% (82 Mt CO_2 eq) increase in emissions in the oil and gas sector and a 42% (51 Mt CO_2 eq) increase in the transportation sector. These increases were offset by a 16 Mt CO_2 eq decrease in emissions in the electricity sector and a 22 Mt CO_2 eq decrease in emissions from heavy industry.

Figure 3. Greenhouse gas emissions by Canadian economic sector, Canada, 1990 to 2015



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 (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Greenhouse gas emissions from the oil and gas sector

In 2015, the oil and gas sector was the largest source of GHG emissions, accounting for 26% of total national emissions.

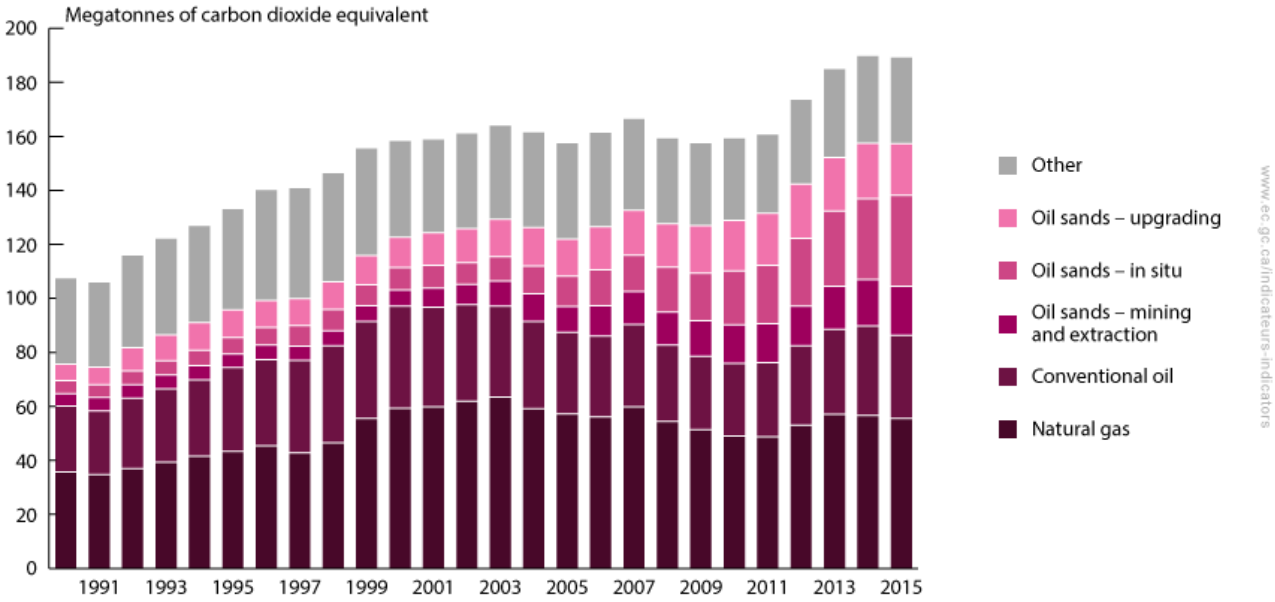
Emissions of GHGs from the oil and gas sector have increased 76% from 108 Mt CO_2 eq in 1990 to 189 Mt CO_2 eq in 2015. This increase is mostly attributable to the increased production of crude oil and the expansion of the oil sands industry.

[2] This sector consists of mining, smelting and refining, pulp and paper, iron and steel, cement, lime and gypsum, and chemicals and fertilizers.

Between 1990 and 2015, GHG emissions from conventional oil production have increased by 26%, while emissions from oil sands production have increased more than fourfold. About 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 between 2008 and 2011 is mostly attributable to the world economic downturn that resulted in a lower global demand for petroleum products.

Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2015



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 (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Between 1990 and 2015, 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. 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.

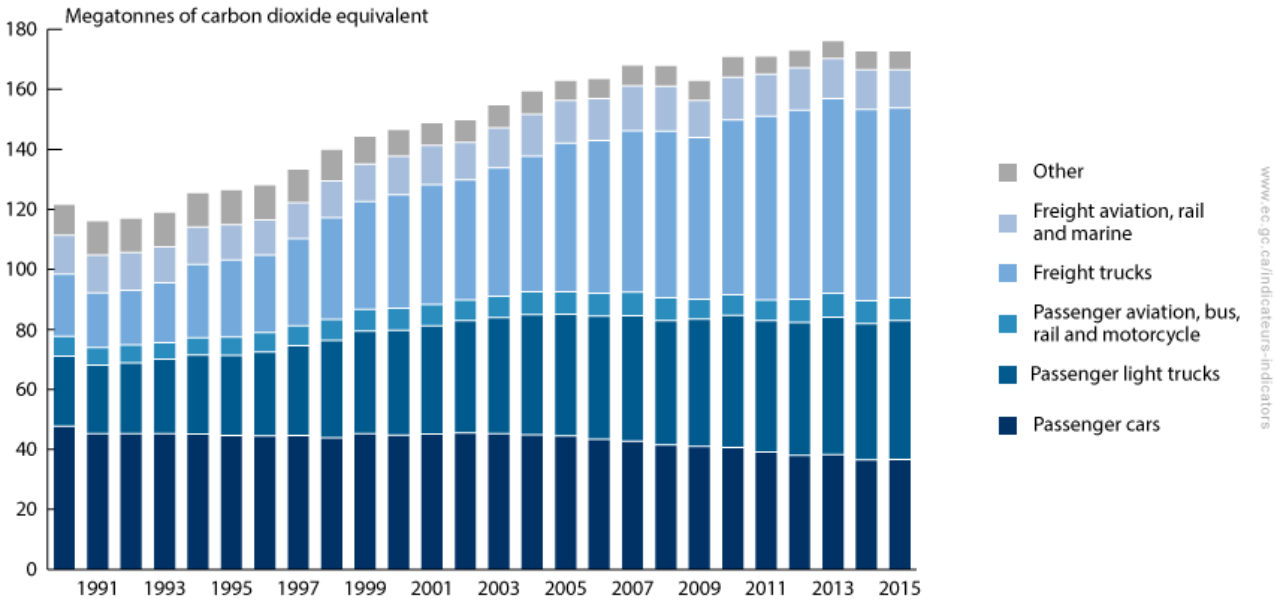
Greenhouse gas emissions from the transportation sector

In 2015, the transportation sector was the second largest source of GHG emissions, accounting for 24% (173 Mt CO_2 eq) of total national emissions. Emissions from passenger and freight travel amounted to 96% of these emissions, or 91 Mt CO_2 eq and 76 Mt CO_2 eq of transportation emissions, respectively.

Between 1990 and 2015, GHG emissions from the transportation sector grew by 42%. Part of this 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 17%, emissions from cars declined by 23%, while emissions from light trucks (including trucks, vans and sport utility vehicles) doubled. Freight travel emissions grew by 125% between 1990 and 2015, with emissions

from freight trucks tripling and emissions from other modes of freight transportation decreasing by 2%.

Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2015



Data for Figure 5

Note: The Other category includes other recreational, commercial and residential uses.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

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 to choose light trucks rather than more fuel-efficient passenger cars, played an important role in shaping the evolution of GHG emissions. Since 1990, the increase in the number of light trucks has been more than three times greater than the increase in the number of the overall fleet of 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.[3] However, these improvements were not sufficient to offset the increases in emissions due to the change in composition of the vehicle fleet.

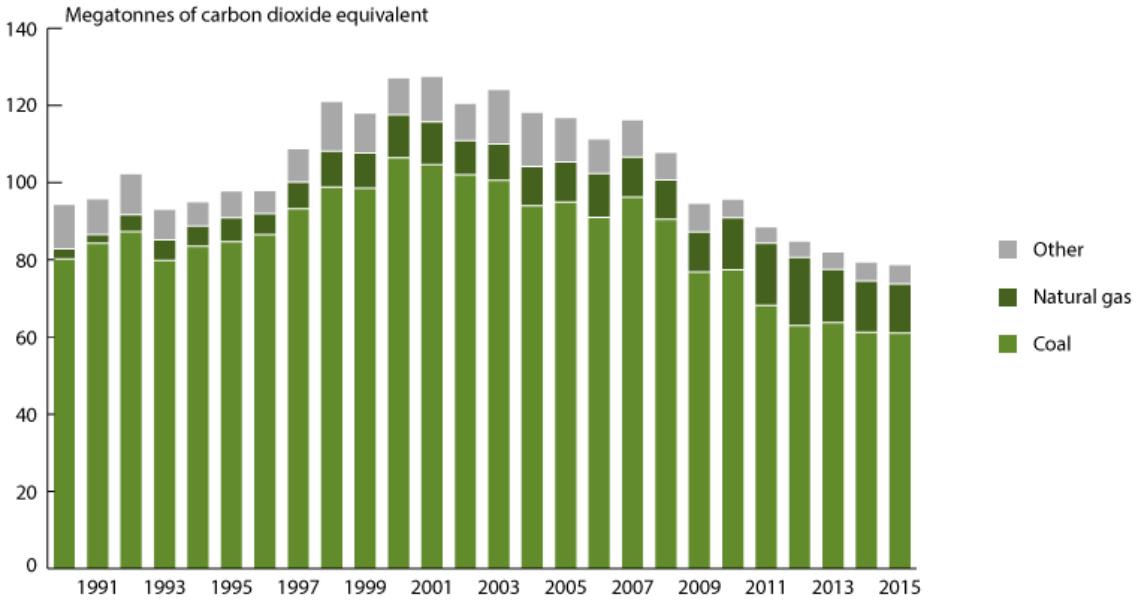
[3] Natural Resources Canada (2015) Energy Efficiency Trends Analysis Tables – Transportation Sector – Energy Use Analysis.

Greenhouse gas emissions from the electricity sector

In 2015, the electricity sector was the fourth largest source of GHG emissions, accounting for 11% of total national emissions.

Greenhouse gas emissions from combustion-based electricity generation have decreased from 94 Mt CO_2 eq in 1990 to 79 Mt CO_2 eq in 2015, a decrease of 15% over the period. 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 this decline in GHG emissions.

Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2015



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 (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

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 generation of public electric utilities from 1990 to 2015 can be attributed partly to a change in the mix of plant types used to produce electricity.

Greenhouse gas emissions by province and territory

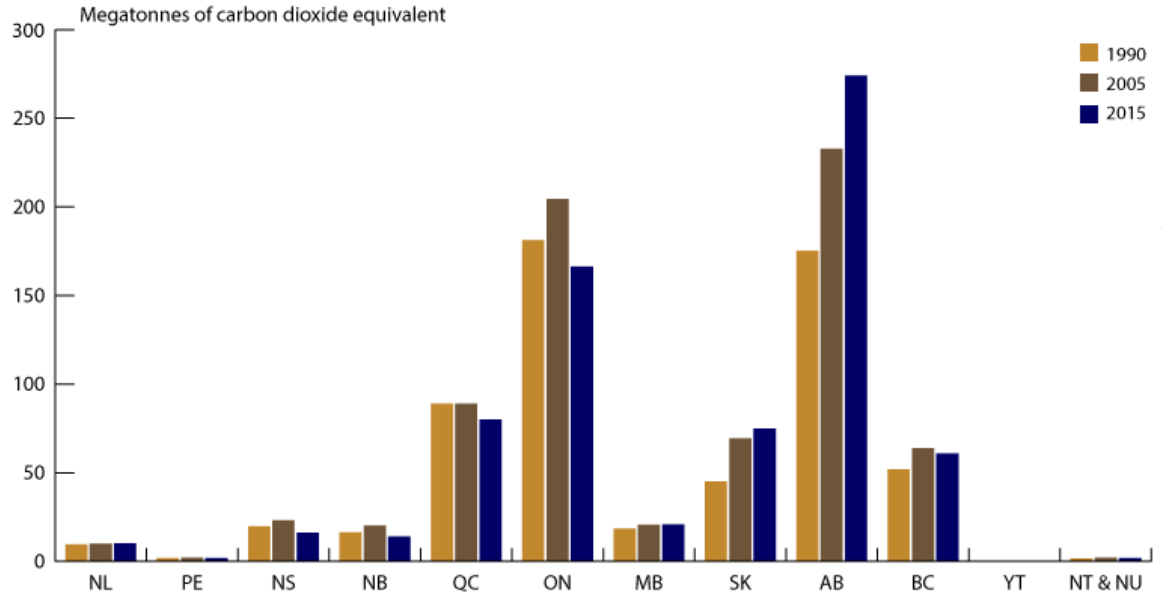
Emissions vary significantly by province, owing to factors such as population, energy sources and economic base. Everything else being equal, economies based on resource extraction will tend to have higher emission levels than service-based economies. Similarly, provinces that rely on fossil fuels for their electricity generation will have higher emissions than provinces relying more on renewable sources.

Greenhouse gas (GHG) emissions for Ontario and Quebec were lower in 2015 than in 1990 by a total of about 24 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq) (9 Mt CO_2 eq for Quebec and 15 Mt CO_2 eq for Ontario). Emissions in Saskatchewan, Alberta and British Colombia were higher in 2015 than in 1990 by 30 Mt CO_2 eq, 99 Mt CO_2 eq and 9 Mt CO_2 eq respectively. In 2015, the top five emitters (Alberta, Ontario, Quebec, Saskatchewan and British Columbia) together released 656 Mt CO_2 eq or 91% of Canada's national total GHG emissions of 722 Mt CO_2 eq.

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, increasing 56% since 1990, primarily due to the increase in the oil and gas sector for export markets. Ontario's emissions decreased between 1990 and 2015 primarily because of the closure of coal-fired electricity generation plants. In 2015, the combined emissions from Alberta and Ontario represented 61% (38% and 23%, respectively) of the national total.

The provinces of Quebec and British Columbia, which rely on abundant hydroelectric resources for their electricity production, show more stable emission patterns across the time series and a decreasing pattern since 2005. Quebec had a 10% (9 Mt CO_2 eq) decrease from its 2005 emissions level; while British Columbia had a decline of 5% (3 Mt CO_2 eq). In contrast to these decreases, emissions in Saskatchewan increased by 8% (5 Mt CO_2 eq) between 2005 and 2015, primarily due to increases in activity from sectors such as transportation, oil and gas, and mining.

Figure 7. Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2015



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 (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Part 2. Data Sources and Methods for the Greenhouse Gas Emissions Indicators

Introduction

The Greenhouse Gas Emissions indicators are part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues. These indicators are also used to report and measure progress towards the goals of the 2016–2019 Federal Sustainable Development Strategy.

Description and rationale of the Greenhouse Gas Emissions indicators

Description

The Greenhouse Gas Emissions indicators report trends in anthropogenic (human-made) greenhouse gas (GHG) emissions at the national level (total emissions, emissions per person and emissions per unit of gross domestic product),[4] at the provincial/territorial level and by economic sector for seven GHGs: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride.

Emissions from natural processes (e.g., material decay, plant and animal respiration, volcanic and thermal venting) and removal of emissions from the atmosphere by natural sinks (e.g., forests, oceans), are not captured by these indicators.

Rationale

The Greenhouse Gas Emissions indicators are used to track the progress of Canada's efforts to lower emissions and reach environmental performance objectives. Use of the GHG indicators in conjunction with economic performance indicators such as the gross domestic product supports national-level 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.

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 the seven GHGs. 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.

[4] Greenhouse gas intensity per unit of gross domestic product is calculated using real inflation-adjusted gross domestic product in 2007 dollars.

Recent changes to the indicators

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, with a brief description, justification and summary of individual impacts on previously reported emission estimates. This chapter also provides details on specific inventory improvements implemented in 2017 as well as planned improvements.

Data

Data source

The Greenhouse Gas Emissions indicators are based on greenhouse gas (GHG) emissions data taken from Environment and Climate Change Canada's National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada. 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. The methods used to prepare the emission and removal estimates are consistent with internationally accepted Intergovernmental Panel on Climate Change methodologies and reference documents. Figures 1-2 and 1-3 of the National Inventory Report illustrate the inventory preparation process and show the main partners involved in preparing the annual inventory. A comprehensive discussion of emissions from all data sources (disaggregated by sector and sub-sector) can be found in chapters 3 through 7 of the National Inventory Report.

Spatial coverage

Greenhouse gas emission estimates are provided at the national and provincial/territorial levels and by economic sector.

Temporal coverage

Greenhouse gas emission and removal estimates are compiled annually and reported for the period from 1990 to 2015. 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.

Data completeness

Although the Greenhouse Gas Emissions indicators are comprehensive, 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.

Data timeliness

The data included in the indicators cover the period from 1990 through the end of 2015. Preparation of the GHG emissions inventory takes almost 16 months from the end of the last 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

In general, greenhouse gas (GHG) emissions are estimated by multiplying activity data by emission factors.

Emissions = activity data × 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.

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. They are 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.

Greenhouse gas emissions are reported in carbon dioxide equivalents (CO_2 eq), determined by multiplying the amount of emissions of a particular 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.

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 (e.g., 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 of the National Inventory Report.

The application of quality assurance and quality control procedures is 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 choice. 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.

Caveats and limitations

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.

As part of the continuous improvement process, recalculations are performed annually on Canada's previously reported greenhouse gas emission 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, with a brief description, justification and summary of individual impacts on previously reported emission estimates. This chapter also provides details on specific inventory improvements implemented in 2017 as well as planned improvements.

Part 3. Annexes

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

Table A.1. Data for Figure 1. Greenhouse gas emissions, Canada, 1990 to 2015

Year	Total greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
1990	611
1991	604
1992	621
1993	623
1994	644
1995	661
1996	682
1997	697
1998	704
1999	717
2000	738
2001	728
2002	730
2003	749
2004	751
2005	738
2006	729
2007	750
2008	729
2009	689
2010	701
2011	707
2012	716
2013	729
2014	727
2015	722

Note: The national indicator tracks seven 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.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: 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 2015

Year	Greenhouse gases per capita (tonnes of carbon dioxide equivalent per person)	Indexed greenhouse gases per capita (percent of 1990 level)	Greenhouse gas intensity (megatonnes of carbon dioxide equivalent per $billion gross domestic product)	Indexed greenhouse gas intensity (percent of 1990 level)
1990	22.1	100.0	0.62	100.0
1991	21.5	97.6	0.62	100.9
1992	21.9	99.2	0.63	102.9
1993	21.7	98.4	0.62	100.7
1994	22.2	100.7	0.61	99.3
1995	22.6	102.3	0.61	99.3
1996	23.0	104.4	0.62	100.8
1997	23.3	105.6	0.61	98.6
1998	23.3	105.8	0.59	95.9
1999	23.6	106.8	0.57	92.5
2000	24.1	109.0	0.56	90.3
2001	23.5	106.3	0.54	87.8
2002	23.3	105.5	0.53	85.6
2003	23.7	107.3	0.53	86.1
2004	23.5	106.5	0.52	83.8
2005	22.9	103.8	0.49	79.9
2006	22.4	101.4	0.47	77.0
2007	22.8	103.3	0.48	77.4
2008	21.9	99.4	0.46	74.6
2009	20.5	92.8	0.45	72.8
2010	20.6	93.4	0.44	71.9
2011	20.6	93.4	0.43	70.4
2012	20.6	93.4	0.43	70.2
2013	20.7	94.0	0.43	69.8
2014	20.5	92.7	0.42	67.8
2015	20.1	91.3	0.41	66.8

Note: Greenhouse gas per unit of gross domestic product is calculated using real inflation-adjusted gross domestic product in 2007 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 (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada. Statistics Canada. Table 051-0001 – Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual. Statistics Canada. Table 380-0106 – Gross domestic product at 2007 constant prices, expenditure-based, annual.

Table A.3. Data for Figure 3. Greenhouse gas emissions by Canadian economic sector, Canada, 1990 to 2015

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	107.7	121.8	73.5	94.5	96.6	60.1	56.9
1991	106.2	116.2	72.7	96.0	96.4	60.8	55.5
1992	116.1	117.1	74.2	102.4	93.8	62.7	54.9
1993	122.4	119.2	77.9	93.0	92.9	64.5	53.0
1994	127.0	125.6	78.4	95.1	98.2	66.7	53.3
1995	133.3	126.6	79.1	98.0	99.0	69.7	55.6
1996	140.4	128.4	85.1	97.9	101.6	72.2	56.1
1997	141.1	133.5	82.4	108.9	101.7	72.7	56.7
1998	146.7	140.0	75.0	121.0	95.9	72.1	53.1
1999	155.8	144.6	78.6	118.1	93.8	71.7	53.9
2000	158.6	146.7	85.1	127.2	93.2	72.3	55.1
2001	159.1	149.1	81.6	127.6	87.0	69.9	53.5
2002	161.4	150.0	86.4	120.6	88.5	69.4	53.9
2003	164.1	154.9	91.3	124.3	87.4	72.3	54.5
2004	161.9	159.6	89.6	118.3	91.4	74.0	55.9
2005	157.9	163.2	85.5	116.9	86.0	74.4	54.4
2006	161.6	163.9	80.4	111.4	85.9	72.6	53.3
2007	166.7	168.2	86.0	116.3	84.9	73.1	54.3
2008	159.5	168.2	85.7	107.9	83.4	73.0	51.6
2009	157.7	163.2	83.8	94.7	70.7	70.0	48.7
2010	159.7	171.1	81.0	95.8	73.4	70.1	49.7
2011	160.9	171.3	86.7	88.5	79.7	70.0	50.3
2012	173.8	173.2	85.0	84.9	78.8	71.4	49.1
2013	185.1	176.3	85.5	82.1	76.9	73.9	49.4
2014	189.9	172.9	88.0	79.5	76.8	72.4	47.7
2015	189.5	173.0	85.6	78.7	74.6	72.8	47.6

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. Totals may not add up due to rounding.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Table A.4. Data for Figure 4. Oil and gas sector greenhouse gas emissions, Canada, 1990 to 2015

Year	Natural gas (megatonnes of carbon dioxide equivalent)	Conven-tional 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	35.7	24.5	4.5	4.8	6.1	32.1
1991	34.7	23.7	4.9	4.8	6.4	31.7
1992	37.0	26.0	5.1	5.1	8.5	34.5
1993	39.3	27.2	5.1	5.3	9.6	35.9
1994	41.5	28.3	5.3	5.7	10.3	36.0
1995	43.4	31.0	5.0	6.1	10.3	37.5
1996	45.4	31.9	5.4	6.5	10.1	41.1
1997	42.8	34.2	5.3	7.7	9.9	41.2
1998	46.6	35.8	5.6	7.9	10.2	40.6
1999	55.5	36.0	5.8	7.8	10.7	40.0
2000	59.3	37.9	5.9	8.4	11.2	35.9
2001	59.9	36.8	7.1	8.4	12.1	34.8
2002	61.9	35.8	7.5	8.0	12.7	35.5
2003	63.5	33.7	9.2	9.1	13.8	34.9
2004	59.2	32.3	10.2	10.3	14.3	35.5
2005	57.2	30.2	9.6	11.3	13.7	35.8
2006	56.1	30.0	11.2	13.3	15.9	35.1
2007	59.8	30.5	12.3	13.4	16.6	34.1
2008	54.4	28.4	12.1	16.7	16.0	31.9
2009	51.4	27.2	13.1	17.7	17.6	30.8
2010	49.1	26.8	14.3	20.0	18.7	30.7
2011	48.7	27.5	14.4	21.7	19.2	29.4
2012	53.1	29.4	14.7	25.1	20.0	31.5
2013	57.1	31.5	15.9	27.9	19.8	33.0
2014	56.7	33.1	17.2	29.9	20.5	32.6
2015	55.6	30.8	18.1	33.7	19.1	32.2

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). Totals may not add up due to rounding.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Table A.5. Data for Figure 5. Transportation sector greenhouse gas emissions, Canada, 1990 to 2015

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	47.7	23.4	6.6	20.7	13.0	10.4
1991	45.2	22.9	5.8	18.3	12.6	11.4
1992	45.2	23.7	5.9	18.2	12.6	11.5
1993	45.3	24.8	5.5	19.9	12.0	11.6
1994	45.1	26.4	5.7	24.4	12.5	11.5
1995	44.6	26.8	6.0	25.8	11.7	11.7
1996	44.5	28.0	6.5	25.8	11.7	11.8
1997	44.6	30.0	6.6	29.1	11.9	11.3
1998	43.9	32.4	7.0	33.9	12.3	10.6
1999	45.2	34.2	7.3	35.9	12.5	9.4
2000	44.8	34.9	7.4	37.8	12.8	9.0
2001	45.1	36.1	7.1	40.0	13.0	7.7
2002	45.5	37.4	6.9	40.0	12.6	7.5
2003	45.3	38.7	7.1	42.7	13.4	7.7
2004	44.9	40.0	7.7	45.1	14.0	7.8
2005	44.5	40.6	7.5	49.5	14.2	6.8
2006	43.4	41.1	7.5	51.0	14.0	6.7
2007	42.8	41.8	7.8	53.8	15.0	7.0
2008	41.5	41.5	7.6	55.5	15.0	7.0
2009	41.0	42.4	6.7	53.9	12.3	6.8
2010	40.7	44.0	6.8	58.3	14.2	7.1
2011	39.2	43.8	6.8	61.3	13.9	6.2
2012	38.0	44.3	7.7	63.1	14.1	6.0
2013	38.3	45.8	7.9	64.9	13.4	6.0
2014	36.5	45.4	7.6	63.8	13.3	6.3
2015	36.6	46.4	7.6	63.2	12.7	6.4

Note: The Other category includes other recreational, commercial and residential uses. Totals may not add up due to rounding.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Table A.6. Data for Figure 6. Electricity sector greenhouse gas emissions, Canada, 1990 to 2015

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	84.3	2.2	9.4
1992	87.3	4.4	10.7
1993	79.8	5.4	7.9
1994	83.5	5.3	6.3
1995	84.7	6.2	7.0
1996	86.5	5.5	6.0
1997	93.2	6.9	8.8
1998	98.9	9.3	12.9
1999	98.6	9.1	10.4
2000	106.4	11.2	9.6
2001	104.7	11.1	11.8
2002	102.1	8.8	9.7
2003	100.6	9.4	14.2
2004	94.0	10.2	14.1
2005	95.0	10.4	11.5
2006	91.0	11.4	9.0
2007	96.2	10.4	9.7
2008	90.5	10.2	7.2
2009	76.8	10.4	7.5
2010	77.4	13.5	4.9
2011	68.2	16.1	4.3
2012	63.0	17.6	4.3
2013	63.7	13.8	4.6
2014	61.2	13.3	5.0
2015	61.0	12.7	5.1

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. Totals may not add up due to rounding.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: 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 2015

Province or territory	1990 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2005 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2015 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
Newfoundland and Labrador (NL)	9.5	10.1	10.3
Prince Edward Island (PE)	1.9	2.1	1.8
Nova Scotia (NS)	19.8	23.2	16.2
New Brunswick (NB)	16.3	20.3	14.1
Quebec (QC)	89.0	88.9	80.1
Ontario (ON)	181.3	204.4	166.2
Manitoba (MB)	18.6	20.6	20.8
Saskatchewan (SK)	45.2	69.5	75.0
Alberta (AB)	175.3	232.8	274.1
British Columbia (BC)	51.9	63.9	60.9
Yukon (YT)	0.5	0.4	0.3
Northwest Territories (NT)	1.7[A]	1.6	1.4
Nunavut (NU)	n/a	0.5	0.6

Note: n/a = not applicable. Emission levels for some years have been revised in light of improvements to estimation methods and availability of new data.
[A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999.
Source: Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Annex B. References and additional information

References and further reading

Environment and Climate Change Canada (2017) National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada.

Intergovernmental Panel on Climate Change (2006) Guidelines for National Greenhouse Gas Inventories. Retrieved on March 2, 2017.

Related information

Canada's Action on Climate Change

Carbon Dioxide Emissions from a Consumption Perspective

Climate Change

Drivers and Impacts of Greenhouse Gas Emissions

Global Greenhouse Gas Emissions

Greenhouse Gas Emissions from Large Facilities

Progress Towards Canada's Greenhouse Gas Emissions Reduction Target

www.ec.gc.ca

Additional information can be obtained at:

Environment and Climate Change Canada
Public Inquiries Centre
7th Floor, Fontaine Building
200 Sacré-Coeur boul.
Gatineau, QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860
Fax: 819-994-1412
TTY: 819-994-0736
Email: ec.enviroinfo.ec@canada.ca