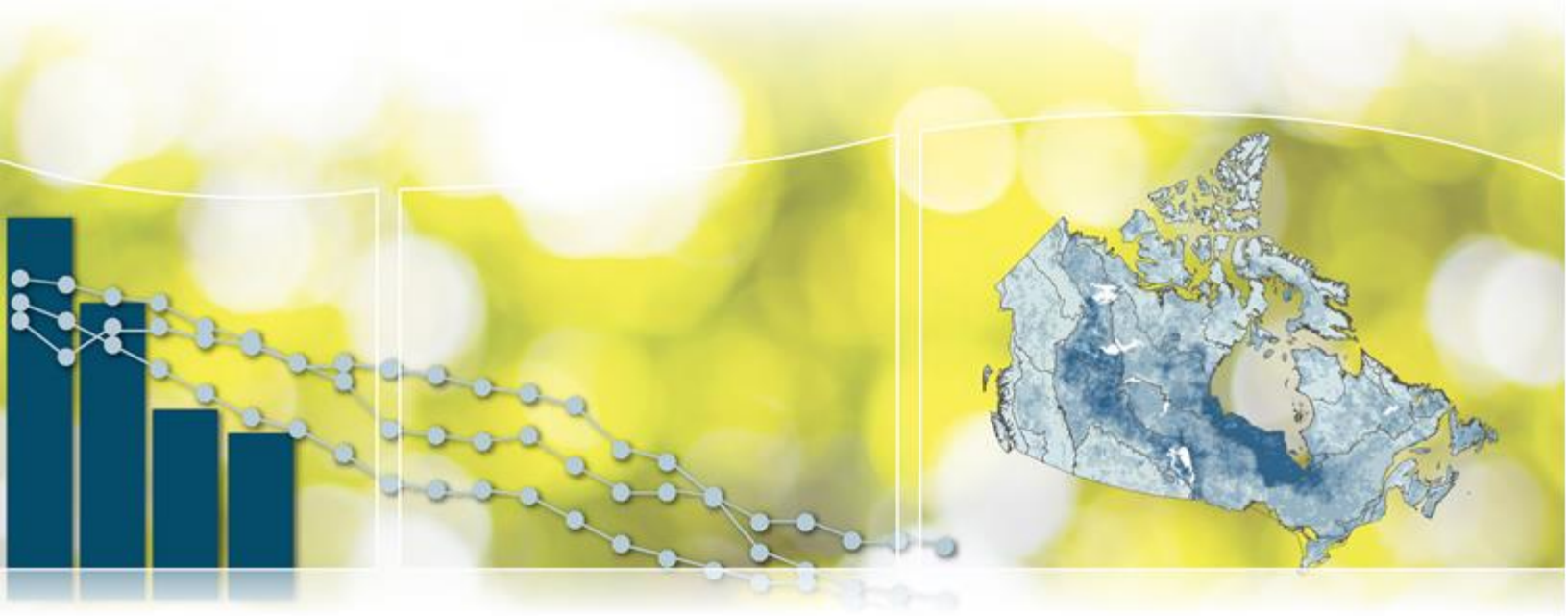
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

Air pollutant emissions



Canada

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Canadian Environmental Sustainability Indicators

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Table of Contents

List of Figures

List of Tables

Air pollutant emissions

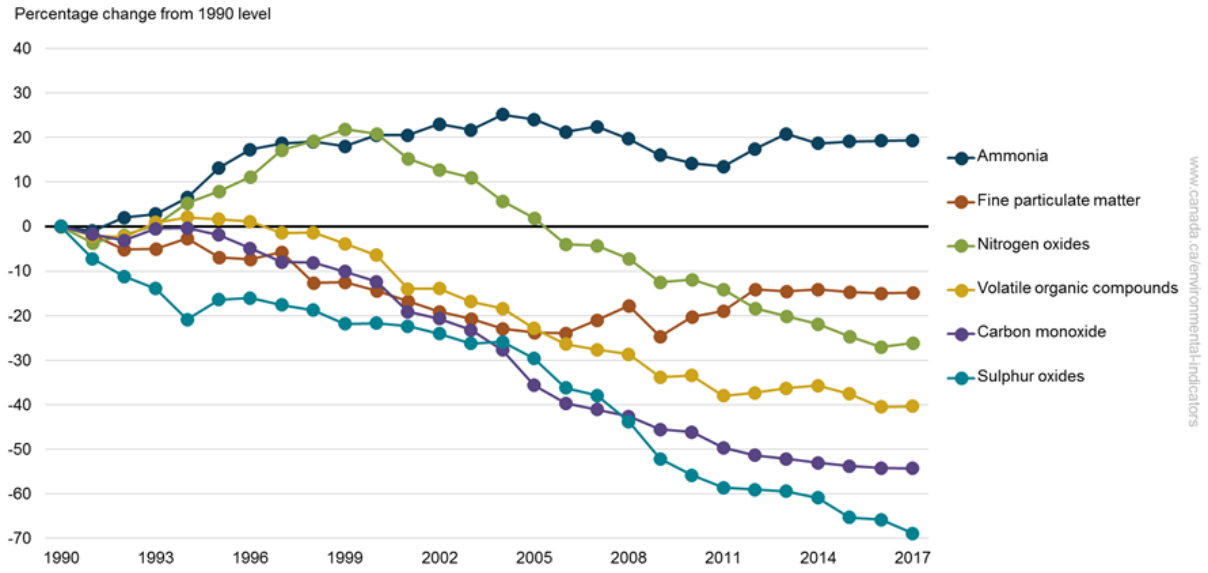
Air pollution problems, such as smog and acid rain, result from the release of pollutants into the atmosphere. The majority of these pollutants are released through human activities, such as transportation, the burning of fuels for electricity and heating, and a variety of industrial activities. The indicators on sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$) report emissions released through human activities.

Summary

Key results

- In 2017, emissions of 5 key air pollutants SO_X, NO_X, VOCs, CO and $PM_{2.5}$ ranged from 69% to 15% lower than in 1990
- Emissions of NH_3 were 19% higher than in 1990

Figure 1. Air pollutant emissions, Canada, 1990 to 2017



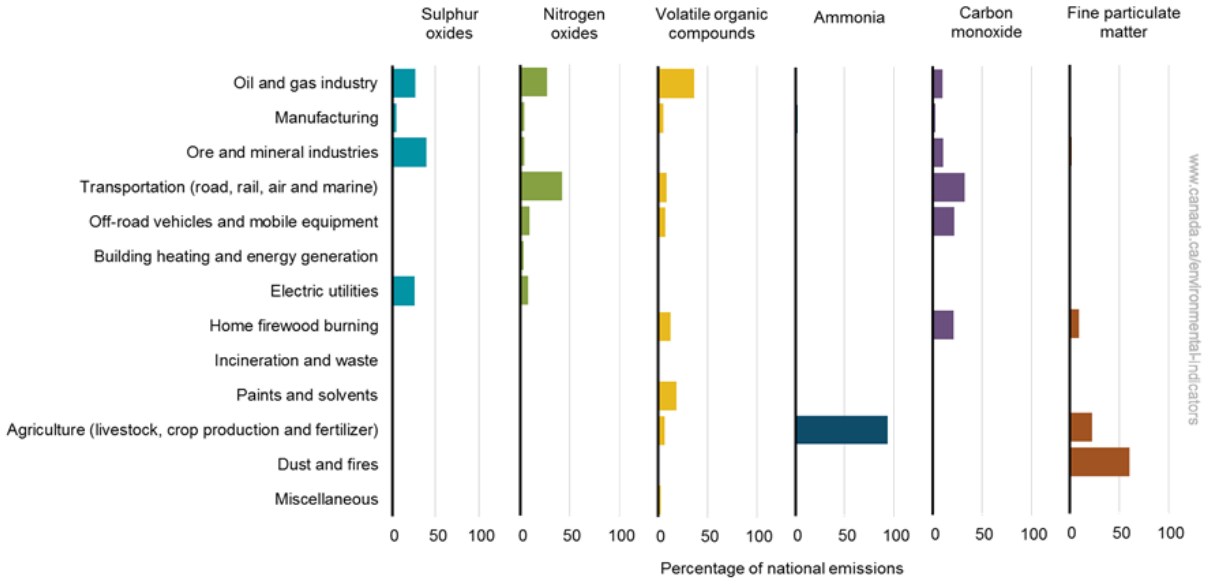
Data for Figure 1

Note: This indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Between 1990 and 2017, the largest emission reductions were observed for SO_X, which decreased by 69%. It was followed by CO emissions (54% reduction), VOCs (40%), NO_X (26%) and $PM_{2.5}$ (15%). These reductions since 1990 are due in part to government actions and voluntary initiatives from key industrial emitters that were put in place to restrict or eliminate the release of air pollutants in Canada.

In 2017, the majority of emissions of the 6 key air pollutants in Canada came from ore and mineral industries, transportation, the oil and gas industry, agriculture, and dust and fires (for example, road dust, prescribed burning).

Figure 2. Distribution of air pollutant emissions by source, Canada, 2017



Data for Figure 2

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

The human made sources most contributing to Canada's air pollutant emissions in 2017 were the following:

- the ore and mineral industries, electric utilities and the oil and gas industries together represented the majority of SO_X emissions
- transportation (road, rail, air and marine) was the main source of NO_X and CO emissions
- off-road vehicles and mobile equipment and home firewood burning were also important sources of CO emissions and the oil and gas industry was an important source of NO_X emissions
- most of the VOC emissions came from the oil and gas industry and from the use of paints and solvents
- agriculture (livestock, crop production and fertilizer) accounted for the majority of NH_3 emissions
- dust and fires were the most important sources of $PM_{2.5}$ emissions

At the provincial level, emissions of the 6 key air pollutants in 2017 were:

- the highest in Alberta for SO_X, (25% of national emissions), NO_X (36%), VOCs (31%), NH_3 (27%) and $PM_{2.5}$ (35%)
- the highest in Quebec for CO (28%)
- the second highest in Ontario for SO_X (19% of national emissions), NO_X (17%), VOCs (20%) and CO (25%)
- also important in Saskatchewan for NH_3 and $PM_{2.5}$, accounting for 22% and 21% of the national emissions of these pollutants

Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2017

Data for Figure 3

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

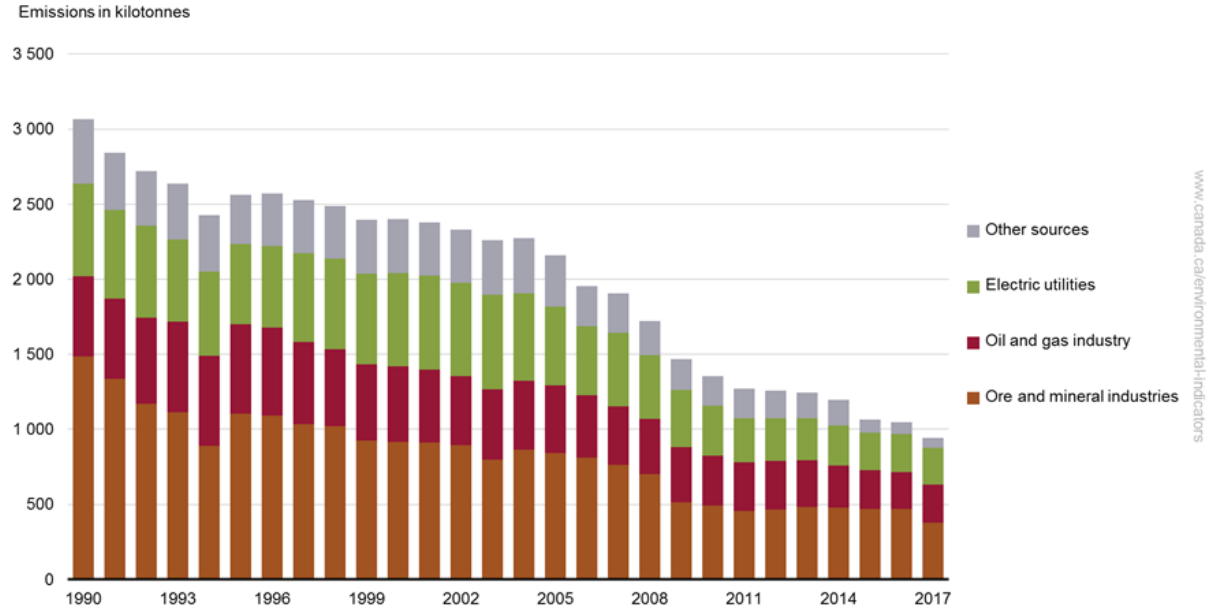
Sulphur oxide emissions by source

Emissions of sulphur oxides (SO_X) in the atmosphere can have adverse effects on human health and the environment. The SO_X emissions released by human activities consist mostly of sulphur dioxides (SO_2). Sulphur dioxide can affect respiratory systems of humans and animals and cause damage to vegetation, buildings and materials. It is also a precursor to fine particulate matter ($PM_{2.5}$) and acid rain.

Key results

- Between 1990 and 2017, SO_X emissions decreased by 69% to 954 kilotonnes (kt) in 2017
- In 2017, the largest proportion of SO_X emissions came from ore and mineral industries. The source represented 40% (377 kt) of total emissions

Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2017



Data for Figure 4

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from transportation (road, rail, air and marine), off-road vehicles and mobile equipment, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, building heating and energy generation, manufacturing, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, the non-ferrous smelting and refining industry accounted for 71% (266 kt) of SO_X emissions from the ore and mineral industries, the main contributor to total national emissions. Emissions from the oil and gas industry and electric utilities followed with 27% (256 kt) and 26% (246 kt) of total national emissions, respectively.

The largest reduction in emissions between 1990 and 2017 was from ore and mineral industries. The largest driver of the reduction from the source was from the non-ferrous smelting and refining industry with a reduction in emissions of 1 006 kt.

This significant decrease in SO_X emissions from 1990 to 2017 is due in large part to government actions to fight acid rain and related federal-provincial and United States agreements[1,2] on capping SO_X emissions by 1994. Further reductions were also realized through:

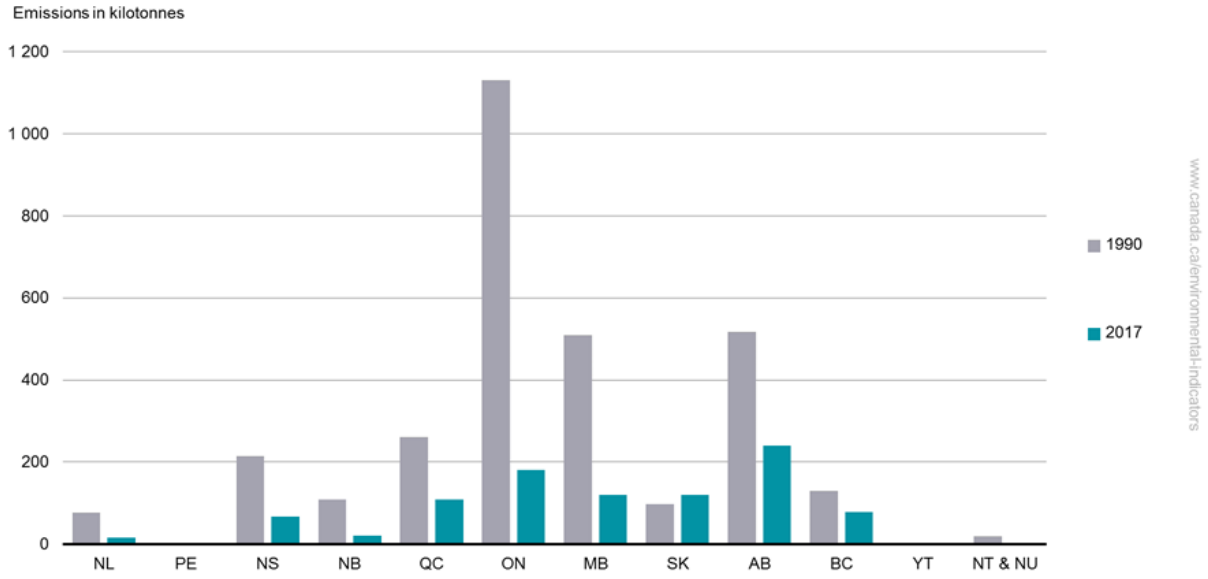
- technological upgrades, new air pollution controls for non-ferrous metal smelters and the closure of 3 major smelters in Manitoba, Ontario and Quebec
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better technologies and plant closures (for example, the phase-out of coal electricity generation in Ontario)
- implementation of regulations on low-sulphur fuels[3,4]

Sulphur oxide emissions by province and territory

Key results

- In 2017, Ontario and Alberta accounted for 44% (420 kt) of national SO_X emissions
- Between 1990 and 2017,
    - the largest reduction was observed in Ontario. Emissions in the province decreased by 950 kt (84%)
    - Saskatchewan was the only province that experienced an increase in SO_X (24%, or 23 kt)

Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2017



Data for Figure 5

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

[1] Environment and Climate Change Canada (1991) Canada-United States Air Quality Agreement. Retrieved on January 25, 2019.
[2] Canadian Council of Ministers of the Environment (1998) The Canada-Wide Acid Rain Strategy for Post-2000. Retrieved on January 25, 2019.
[3] Environment and Climate Change Canada (2015) Sulphur in Gasoline Regulations. Retrieved on January 25, 2019.
[4] Environment and Climate Change Canada (2012) Sulphur in Diesel Fuel Regulations. Retrieved on January 25, 2019.

Alberta had the highest SO_X emissions level in 2017, accounting for 25% (240 kt) of total national emissions. Emissions in the province mainly came from the oil and gas industry and electric utilities, combined accounting for 94% (226 kt) of the emissions.

Ontario was the second-highest emitter of SO_X in 2017, accounting for 19% (180 kt) of total national emissions. Ore and mineral industries were the largest contributor to SO_X emissions of the province in 2017. The sharp reduction in SO_X emissions in Ontario between 1990 and 2017 was mainly due to emission reductions from ore and mineral industries (notably the non-ferrous smelting and refining industry) and electric utilities.

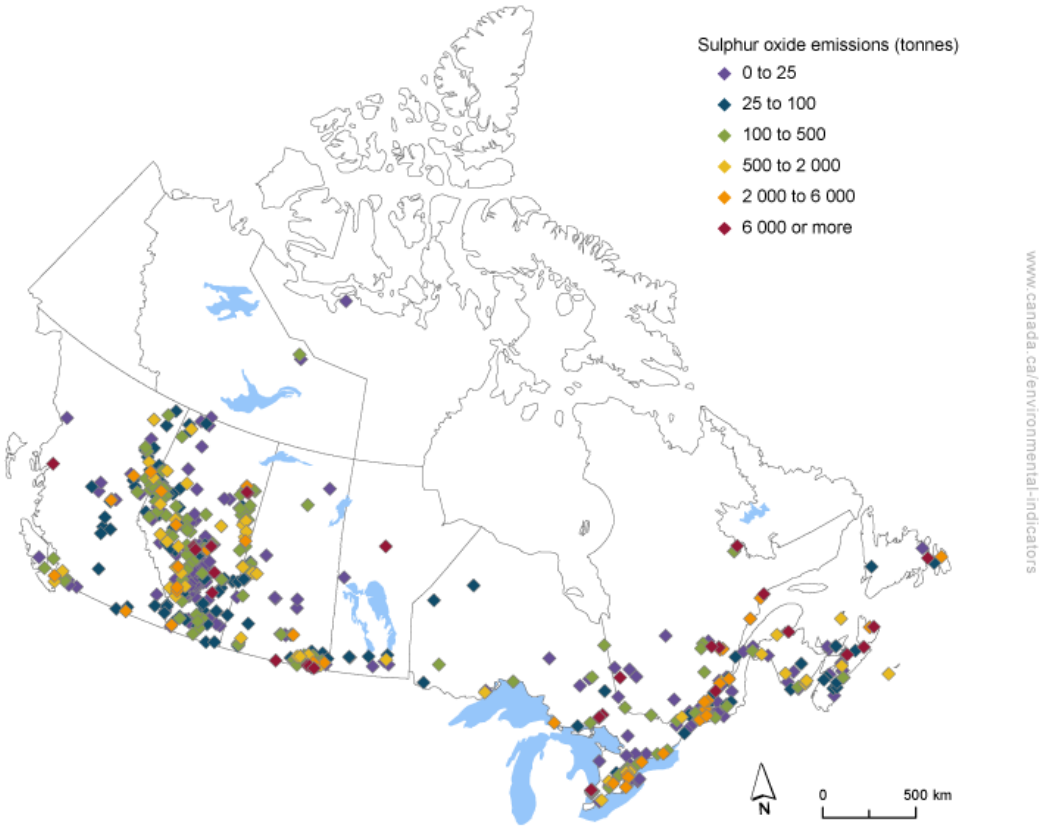
Saskatchewan and Manitoba both ranked third, with 13% (120 kt and 119 kt) of total national emissions; electric utilities was the most important source of emissions in Saskatchewan and ore and mineral industries in Manitoba.

Sulphur oxide emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore SO_X emissions from individual facilities.

Figure 6. Sulphur oxide emissions by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported sulphur oxide emissions represent 92% of total national sulphur oxide emissions.
Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

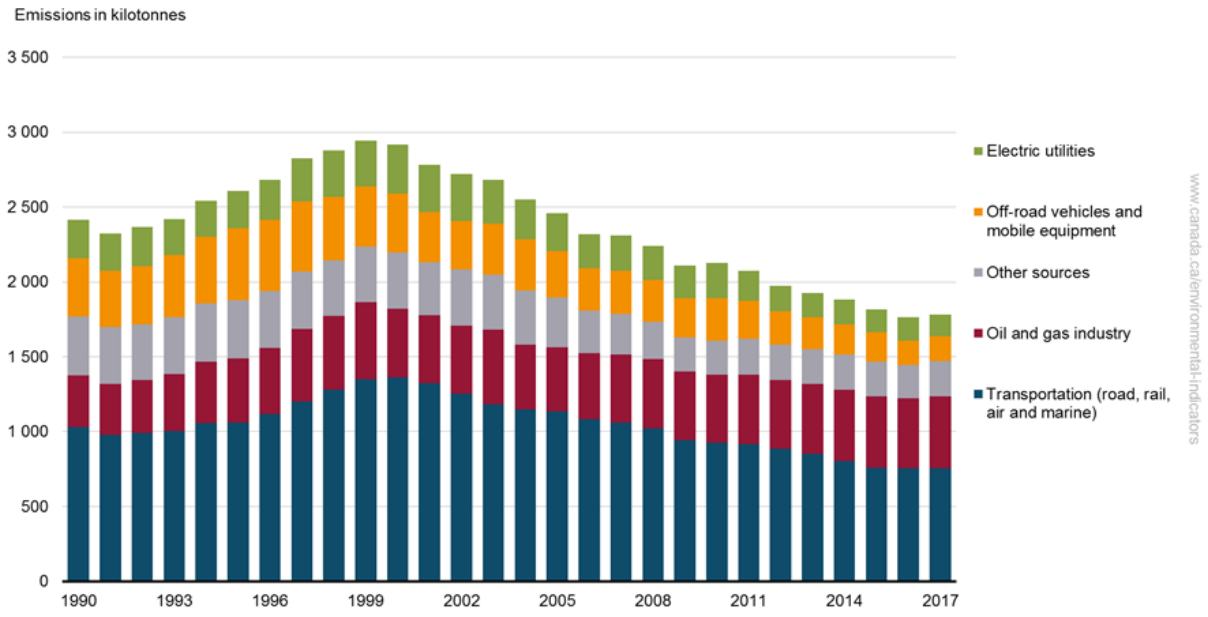
Nitrogen oxide emissions by source

Nitrogen oxides (NO_X) include emissions of nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen dioxide can have adverse effects on human health and the environment. Nitrogen oxides contribute to acid rain, which can lead to the acidification of aquatic and terrestrial ecosystems. It also contributes to the eutrophication of lakes and to the formation of ground-level ozone (O_3) and fine particulate matter ($PM_{2.5}$).

Key results

- In 2017, NO_X emissions were 1 783 kilotonnes (kt). This is 26% lower than in 1990
- Transportation (road, rail, air and marine) was a major source of NO_X representing 42% (754 kt) of total emissions in 2017

Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2017



Data for Figure 7

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, manufacturing, building heating and energy generation, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

While transportation (road, rail, air and marine) was the main contributor of NO_X, it was also the sector that experienced the largest reduction between 1990 and 2017. Emissions of NO_X from this sector decreased by 274 kt (27%) during that period.

The oil and gas industry emitted the next largest proportions of NO_X emissions in 2017, representing 27% (481 kt) of total national emissions. This sector also experienced the largest increase 39% (135 kt) in emissions between 1990 and 2017, partly offsetting reductions from other sectors.

The decline in NO_X emissions between 1990 and 2017 is mostly attributable to 2 factors:

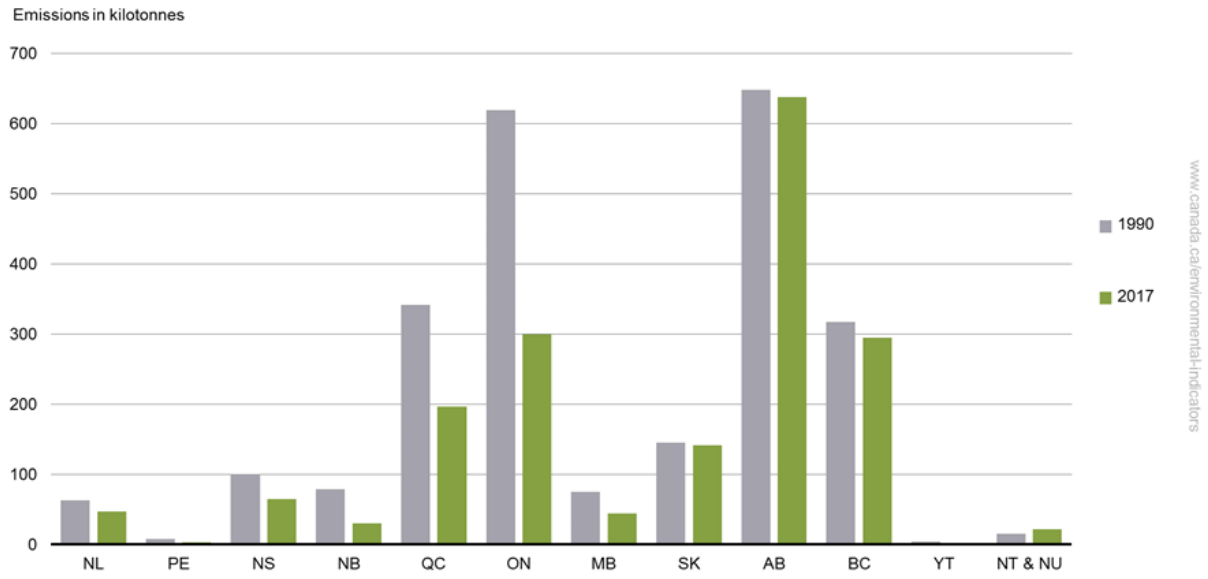
- the reduction in emissions from transportation after 2000, given the progressive introduction of cleaner technology and fuels for vehicles
- lower emissions from fossil-fuel-fired (for example, coal-fired) power-generating utilities as a result of better emissions control technologies and certain plant closures (for example, the closure of coal power plants in Ontario)

Nitrogen oxide emissions by province and territory

Key results

- Among provinces and territories, Alberta emitted the most NO_X in 2017. The province accounted for 36% (637 kt) of national emissions
- Between 1990 and 2017,
  - the largest reduction was observed in Ontario. Emissions decreased by 319 kt (52%) in the province
  - NO_X emissions only increased in Nunavut and Northwest Territories (38%, or 6 kt)

Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2017



Data for Figure 8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

The oil and gas industry is an important source of NO_X emissions in Alberta, accounting for 59% (374 kt) of the province's NO_X emissions in 2017. The increasing contribution of this sector to the province's emissions between 1990 and 2017 was offset by similar emission reductions from the transport and electric utilities sectors.

Ontario contributed the second-largest proportion of NO_X emissions in 2017, accounting for 17% (300 kt) of total national emissions, with transportation (road, rail, air and marine) being the most important source followed by off-road vehicles and mobile equipment. Ontario experienced the largest decrease in emissions levels (319 kt) between 1990 and 2017 in large part due to emission reductions from transportation, electric utilities and off-road vehicles and mobile equipment.

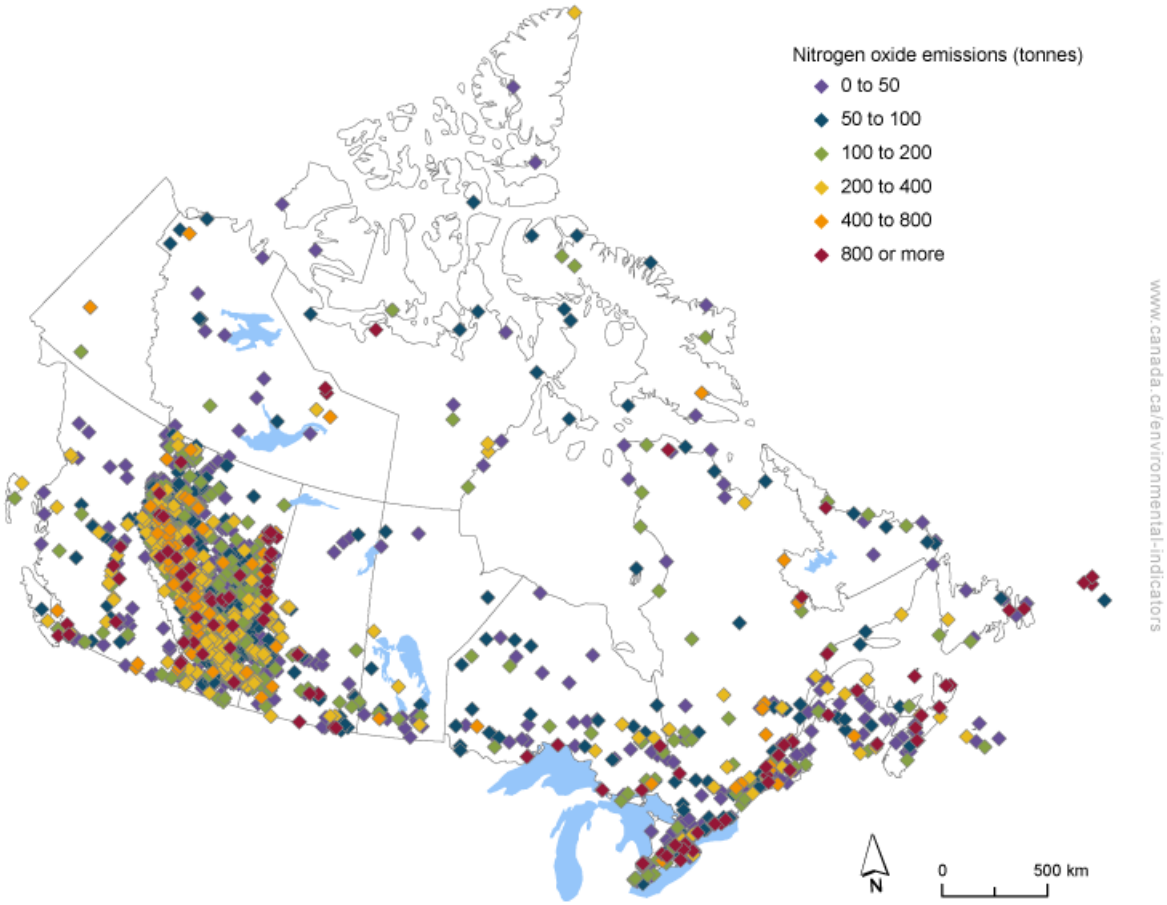
British Columbia ranked third, with 17% (295 kt) of total national emissions. Transportation (road, rail, air and marine) was the most important source of NO_X in this province.

Nitrogen oxide emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore NO_X emissions from individual facilities.

Figure 9. Nitrogen oxide emissions by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported nitrogen oxide emissions represent 33% of total national nitrogen oxide emissions.

Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

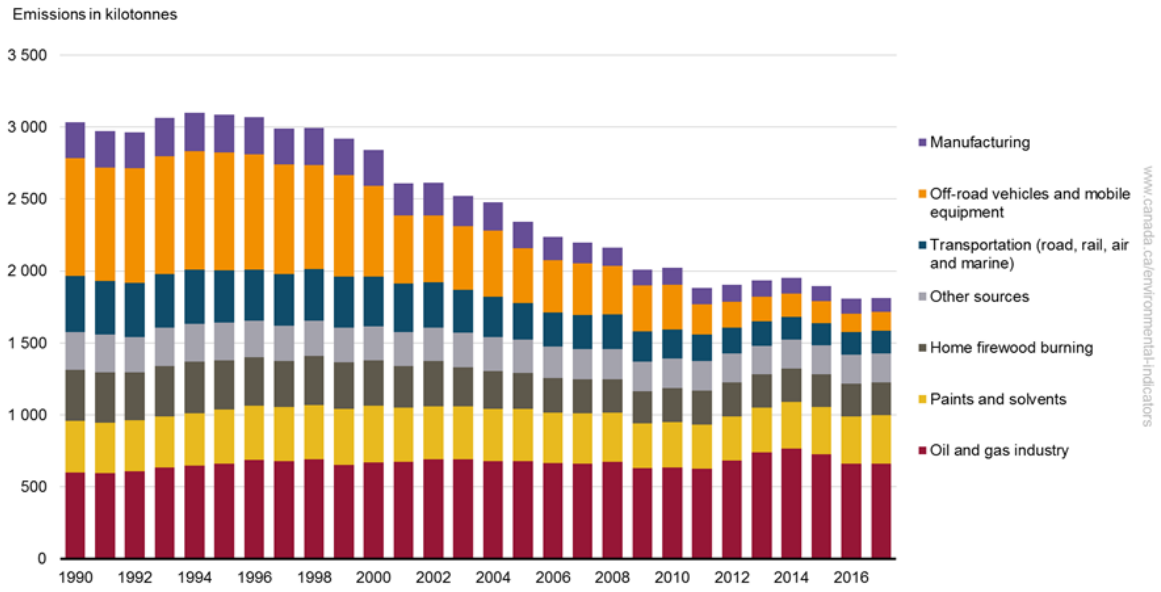
Volatile organic compound emissions by source

Volatile organic compounds (VOCs) are carbon-containing gases and vapours released into the atmosphere by natural sources and human activities.[5] There are hundreds of VOCs that are emitted and that affect the health of Canadians and the environment. VOCs are primary precursors to the formation of ground-level ozone and particulate matter which are the main pollutants contributing to the formation of smog.

Key results

- In 2017, VOC emissions in Canada were 1 811 kilotonnes (kt). This is a 1 224 kt (40%) decrease from 1990 levels
- Since 2000, the oil and gas industry has been the highest contributor to VOC emissions. In 2017, the sector accounted for 37% (663 kt) of total emissions

Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2017



Data for Figure 10

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, ore and mineral industries, dust and fires, building heating and energy generation, electric utilities, agriculture (livestock, crop production and fertilizer) and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

The oil and gas industry was the main source of VOC emissions in 2017 with 663 kt emitted (37% of total emissions). Paints and solvents and home firewood burning were also important sources contributing 18% (335 kt) and 13% (230 kt) of total emissions.

The source with the largest emissions reduction between 1990 and 2017 was off-road vehicles and mobile equipment, with emissions reductions of 685 kt (84%). From 1990 to 1999, off-road vehicles and mobile equipment was the highest contributor to national VOC emissions.

[5] Under the Canadian Environmental Protection Act, carbon dioxide, carbon monoxide, methane and chlorofluorocarbons are not considered volatile organic compounds.

The long-term decrease in VOC emissions is mainly attributable to 3 factors:

- the progressive introduction of cleaner technologies and fuels resulting in emission reductions from transportation, off-road vehicles and mobile equipment
- emission reductions from most industrial and non-industrial sources from improved emission controls
- lower levels of VOCs in products such as paints, solvents and cleaners

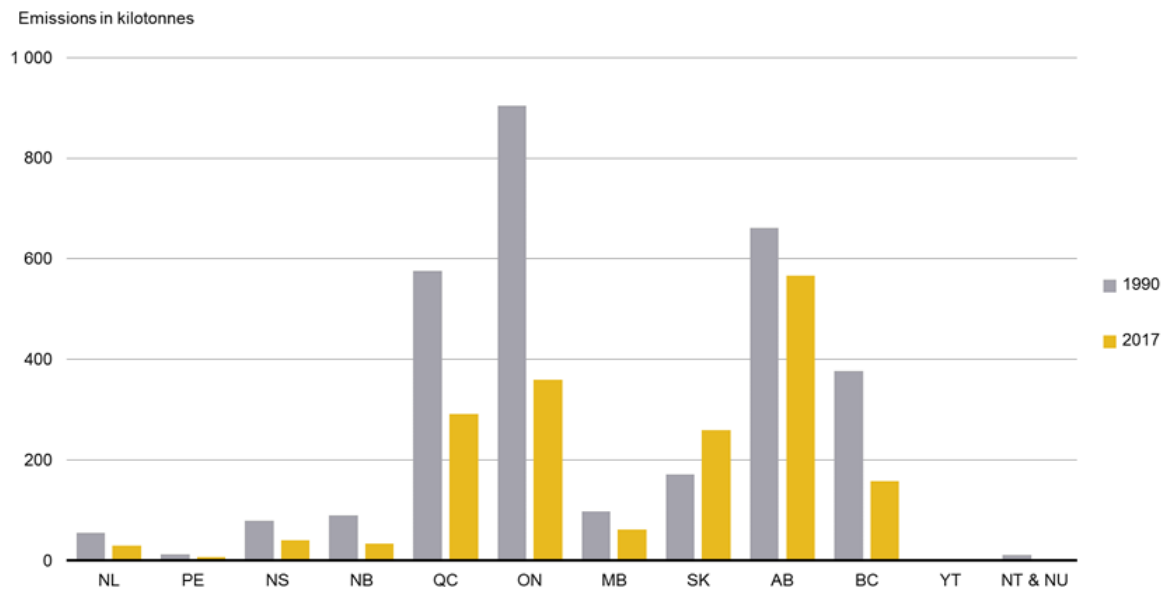
The only source with significant emissions growth over the 1990 to 2017 period was the oil and gas industry with an increase of 63 kt (10%).

Volatile organic compound emissions by province and territory

Key results

- Alberta emitted the highest proportion of VOCs in 2017. The province represented 31% (566 kt) of national emissions
- Between 1990 and 2017,
    - Ontario experienced the largest reduction in VOC emissions. Emissions in the province decreased by 60% (545 kt)
    - Saskatchewan was the only province that experienced an increase in VOC emissions (52%, or 89 kt)

Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990 and 2017



Data for Figure 11

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Alberta was the highest emitting province of VOCs in 2017 (566 kt), with the oil and gas industry as the main source, contributing 72% (410 kt) of the province's emissions.

Ontario was the second-highest emitter of VOCs, accounting for 20% (360 kt) of total national emissions in 2017. The main emission sources are paints and solvents, home firewood burning and off-road vehicles and mobile equipment. Ontario also experienced the largest reduction in emissions,

with 545 kt (60%) between 1990 and 2017, mainly as a result of emission reductions from the closure of coal-fired power plants and from off-road vehicles and mobile equipment.

Quebec was the third largest emitter, with 16% (291 kt) of total national emissions, where home firewood burning and paints and solvents accounted for 62% of the emissions in that province.

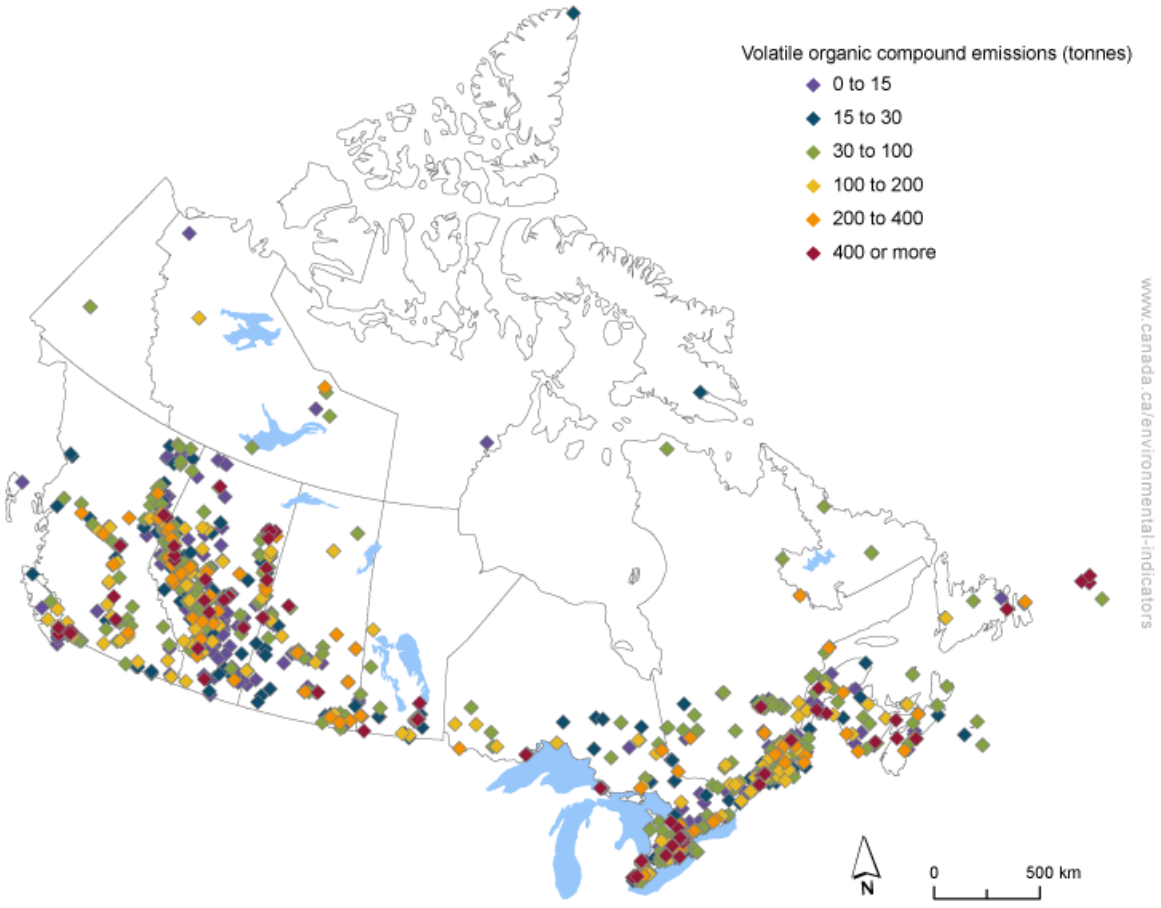
Most provinces and territories experienced reductions in emissions of more than 35% between 1990 and 2017 with the exception of Alberta (a 14% reduction in emissions due to an increase in the oil and gas industry) and Saskatchewan, where emissions increased 52% over the period. The oil and gas industry is responsible for the increase in emissions in Saskatchewan.

Volatile organic compound emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore VOC emissions from individual facilities.

Figure 12. Volatile organic compound emissions by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported volatile organic compound emissions represent 11% of total national volatile organic compound emissions.
Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

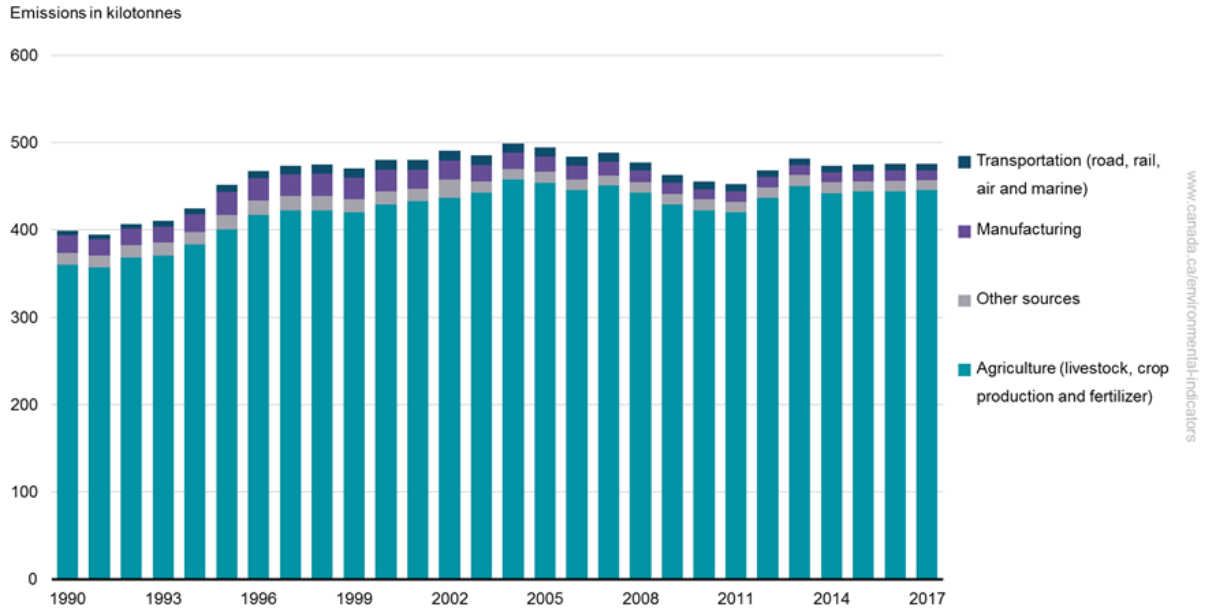
Ammonia emissions by source

Ammonia (NH_3) is a colourless gas with a noticeable odour at high concentrations. It can be poisonous if inhaled in great quantities and is irritating to the eyes, nose, and throat. It can also contribute to the nitrification and eutrophication of aquatic systems. In the air, the gas combines with sulphates and nitrates to form secondary fine particulate matter ($PM_{2.5}$).

Key results

- In 2017, NH_3 emissions were 476 kilotonnes (kt). This is 19% higher than in 1990
- Agriculture (livestock, crop production and fertilizer) was the main source of NH_3 emissions in 2017. Emissions from this source accounted for more than 94% (446 kt) of total national emissions

Figure 13. Total ammonia emissions by source, Canada, 1990 to 2017



Data for Figure 13

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, the oil and gas industry, home firewood burning, ore and mineral industries, electric utilities, building heating and energy generation, off-road vehicles and mobile equipment, dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Between 1990 and 2017, agriculture (livestock, crop production and fertilizer) experienced the largest increase (24% or 86 kt) in NH_3 emissions. It also remained the key source of NH_3 emissions throughout that period. Emissions from other sources (12 kt), manufacturing (11 kt), and transportation (road, rail, air and marine) (8 kt) combined represented 6% of national emissions in 2017.

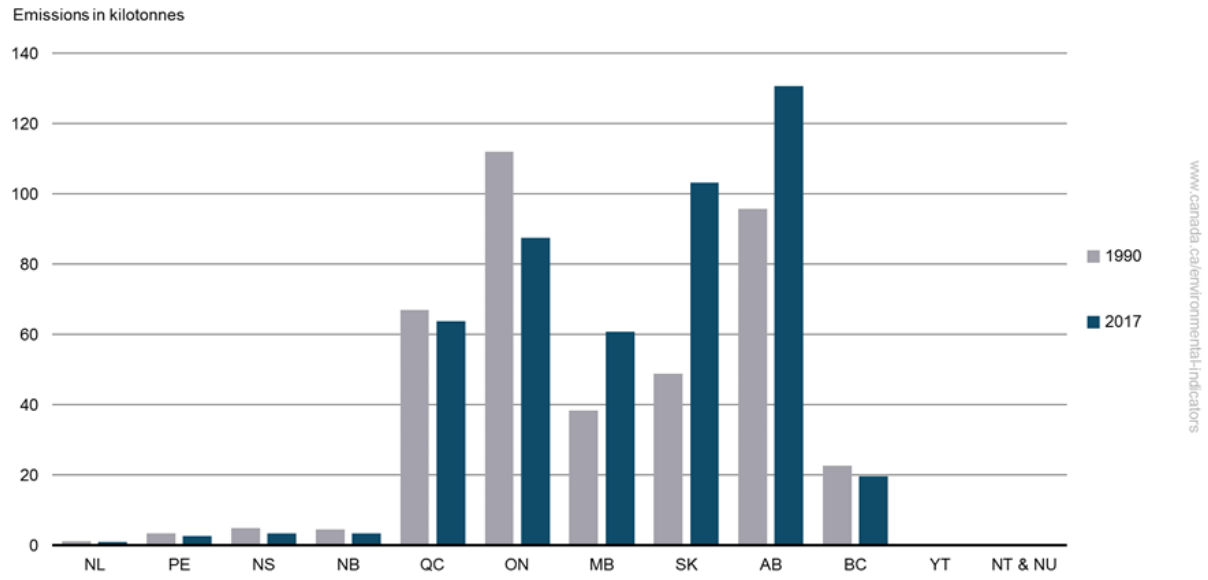
The growth in NH_3 emissions from agriculture (livestock, crop production and fertilizer) between 1990 and 2017 is mainly due to the increased use of synthetic nitrogen fertilizers and, up to 2005, larger livestock populations.

Ammonia emissions by province and territory

Key results

- In 2017, Alberta and Saskatchewan accounted for almost half (234 kt) of national NH_3 emissions
- Between 1990 and 2017,
    - Ontario experienced the largest emissions reduction. Emissions in the province decreased by 25 kt (22%)
    - The largest increase in NH_3 emissions was in Saskatchewan. Emissions in the province doubled (a 54 kt increase)

Figure 14. Ammonia emissions by province and territory, Canada, 1990 and 2017



Data for Figure 14

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, Alberta emitted the most NH_3 of all the provinces and territories, accounting for 27% (131 kt) of total national emissions. Saskatchewan contributed the second-largest proportion of NH_3, representing 22% (103 kt).

Ontario and Quebec followed with 18% and 13% (87 kt and 64 kt) of total national emissions, respectively. For all provinces, livestock farms and the application of fertilizers were the most important sources of NH_3 emissions.

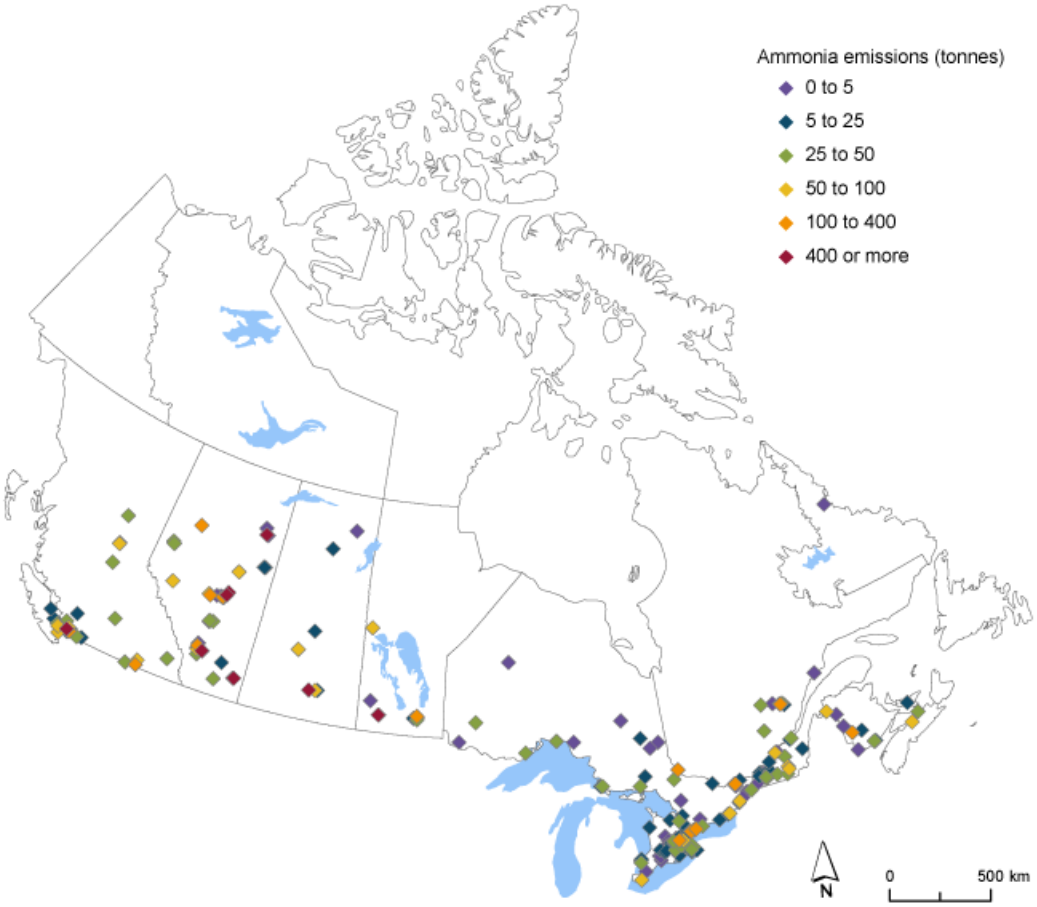
Almost all of the increase in emissions between 1990 and 2017 took place in Saskatchewan, Alberta and Manitoba.

Ammonia emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria..

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore NH_3 emissions from individual facilities.

Figure 15. Ammonia emissions by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported ammonia emissions represent 4% of total national ammonia emissions.
Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

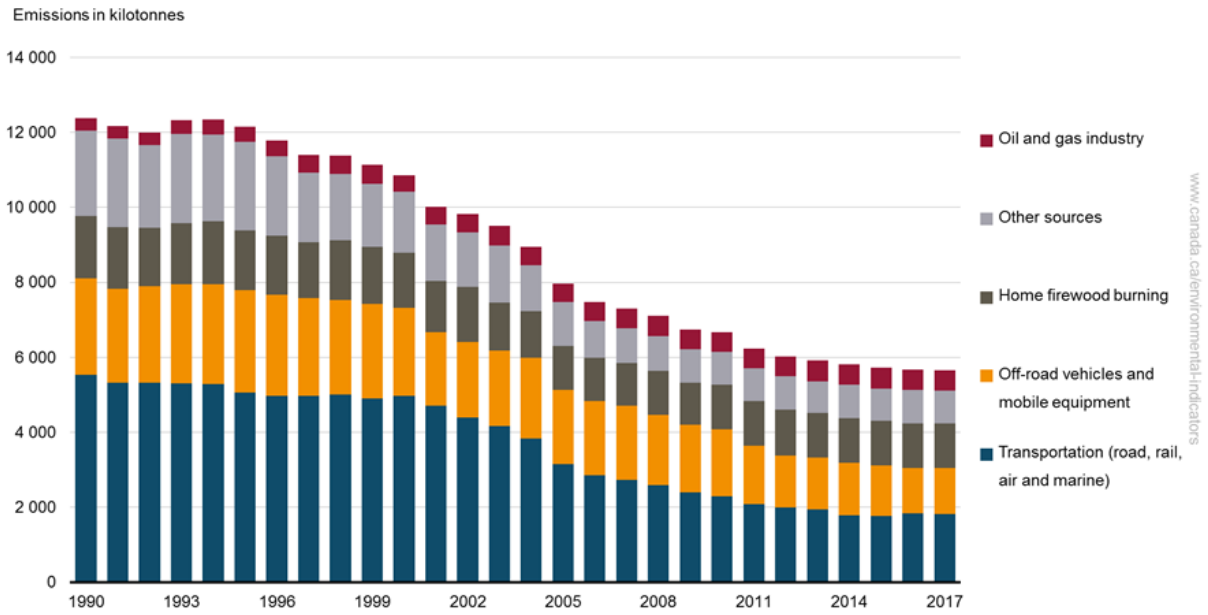
Carbon monoxide emissions by source

Carbon monoxide (CO) is a colourless, odourless, tasteless and poisonous gas. Once inhaled into the bloodstream, it can inhibit the blood's capacity to carry oxygen to organs and tissues, affecting human health.

Key results

- In 2017, CO emissions in Canada were 5 662 kilotonnes (kt), a decrease of 54% from 1990 levels
- Transportation (road, rail, air and marine) was the largest source of CO emissions in Canada. In 2017, the sector represented 32% (1 819 kt) of total emissions

Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2017



Data for Figure 16

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from dust and fires, electric utilities, building heating and energy generation, incineration and waste, agriculture (livestock, crop production and fertilizer), paints and solvents, ore and mineral industries, manufacturing and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, transportation, off-road vehicles and mobile equipment, and home firewood burning were the 3 most important sources of CO. These sources combined represented 75% (4 239 kt) of national emissions.

The largest reduction in emissions between 1990 and 2017 occurred in transportation (road, rail, air and marine) with an emission decrease of 3 711 kt (67%).

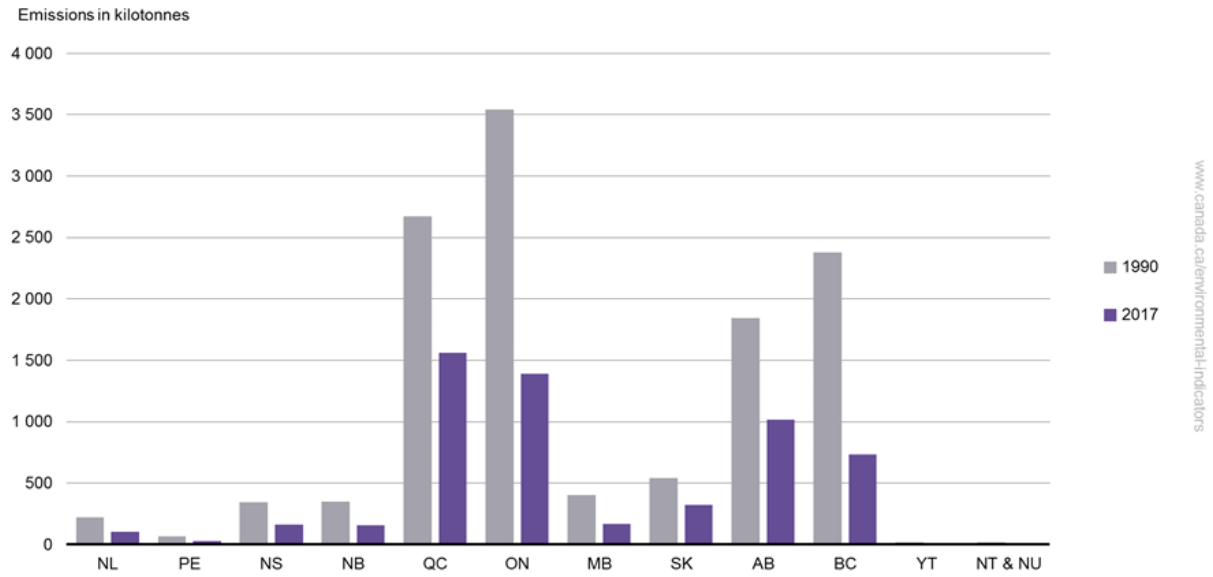
The decline in CO emissions between 1990 and 2017 is mainly due to the progressive introduction of cleaner and more efficient technology in vehicles (for example, catalytic converters).

Carbon monoxide emissions by province and territory

Key results

- In 2017, Ontario and Quebec accounted for 52% (2 952 kt) of national CO emissions
- Between 1990 and 2017,
    - all provinces and territories experienced significant reductions in emissions
    - the largest reductions occurred in Ontario (by 2 149 kt or 61%), British Columbia (by 1 644 kt or 69%) and Quebec (by 1 111 kt or 42%)

Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990 and 2017



Data for Figure 17

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, Quebec emitted the most CO of all the provinces and territories, representing 28% (1 560 kt) of the total national emissions. Home firewood burning was the most important source of CO emissions for Quebec.

The province of Ontario ranked second, with 25% (1 392 kt) of total national emissions in 2017, with 36% of those emissions from transportation (road, rail, air and marine).

Alberta, the third largest CO emitter, accounted for 18% (1 016 kt) of total national emissions. The oil and gas industry accounted for 42% of the province's CO emissions.

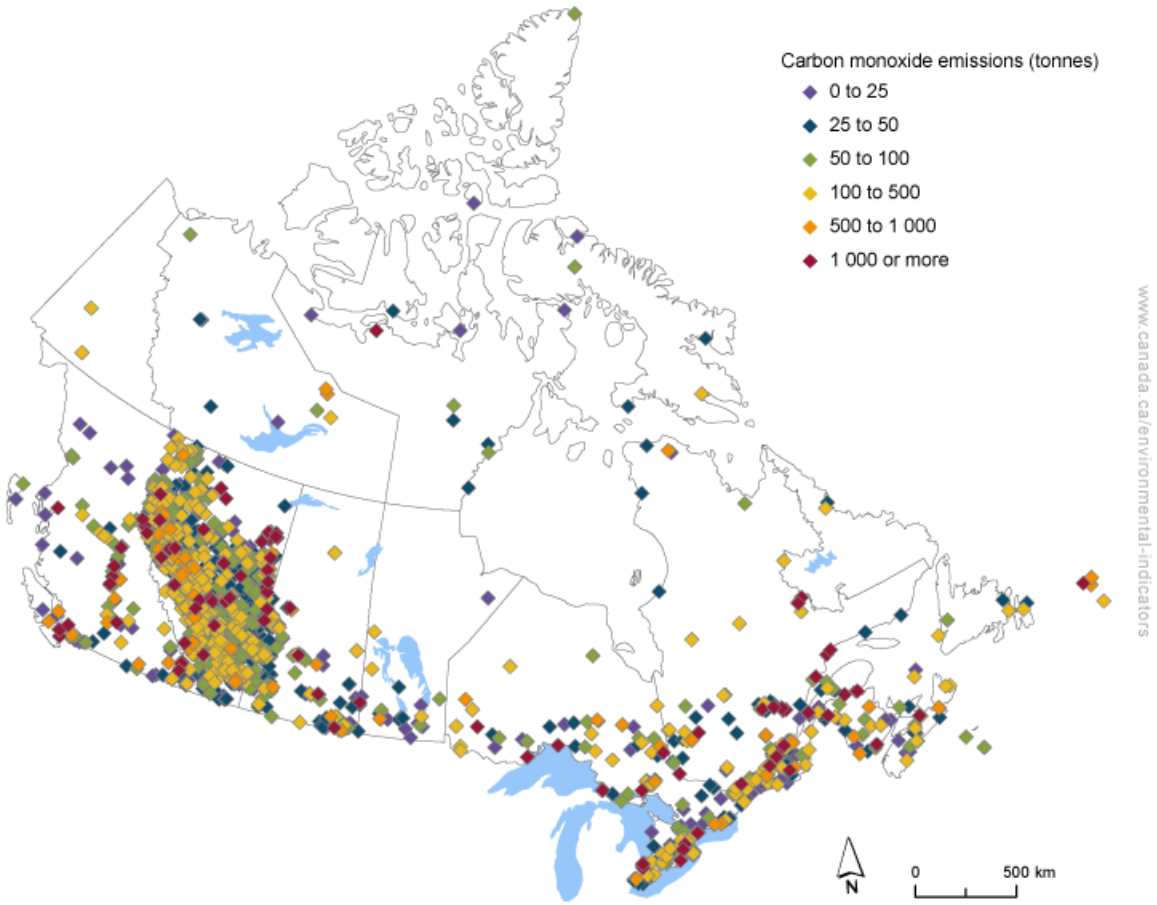
The sharp decrease in emissions between 1990 and 2017 in all provinces is mainly attributable to emission reductions from transportation (road, rail, air and marine).

Carbon monoxide emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore CO emissions from individual facilities.

Figure 18. Carbon monoxide emissions by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported carbon monoxide emissions represent 16% of total national carbon monoxide emissions.
Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

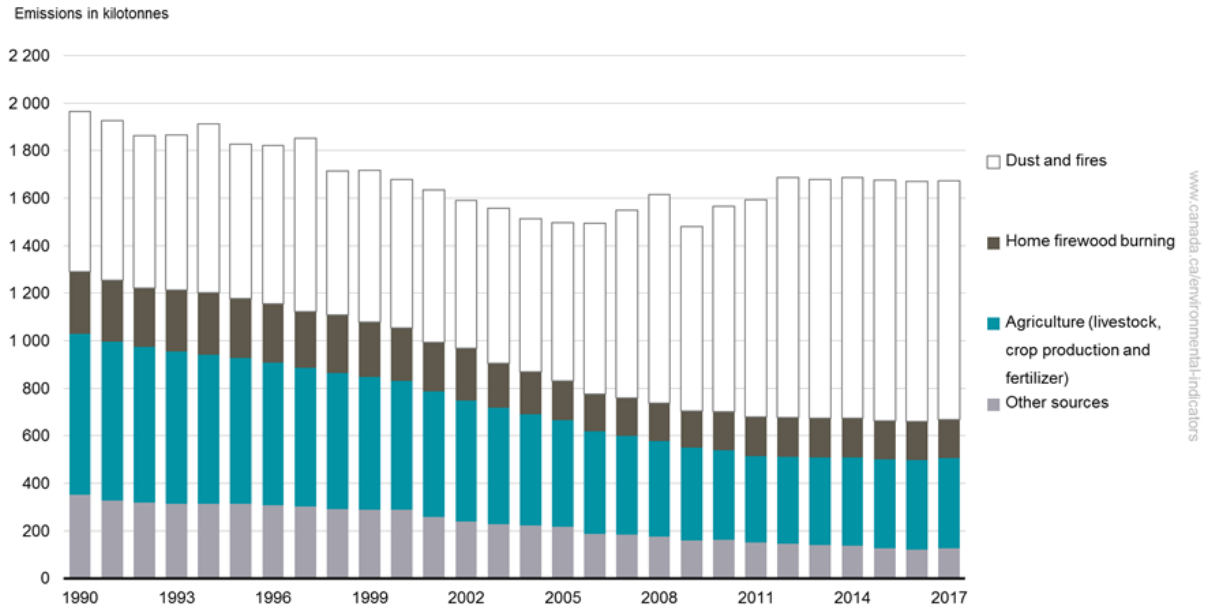
Fine particulate matter emissions by source

Particulate matter (PM) is directly emitted into the air in solid or liquid form. It is also formed in the air from precursor substances such as sulphur oxides, nitrogen oxides, volatile organic compounds and ammonia.[6] Fine particulate matter ($PM_{2.5}$) refers to particulate matter with a size of less than 2.5 micrometres (also called microns). It is one of the major components of smog. When inhaled deeply into the lungs, even small amounts of $PM_{2.5}$ can cause serious health problems. It can also damage vegetation and structures, contribute to haze and reduce visibility.

Key results

- In 2017, $PM_{2.5}$ emissions were 1 674 kilotonnes (kt). This is 15% lower than in 1990
- Emissions from dust and fires (for example, road dust and prescribed burning) accounted for the majority of $PM_{2.5}$ emissions, reaching 60% (1 007 kt) of total national emissions in 2017. These emissions increased by almost 50% (333 kt) between 1990 and 2017

Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2017



Data for Figure 19

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, 83% of $PM_{2.5}$ emissions came from open source emissions, such as dust and fires, and agriculture (livestock, crop production and fertilizer). In general, these emissions are spread over large geographical areas, are highly dependent on weather conditions (for example, wind and rain) and are located outside of urban areas.

[6] Emissions of PM formed in the air from precursor substances are not included in the indicator.

The remaining 17% of $PM_{2.5}$ emissions in 2017 came from home firewood burning (162 kt or 10%) and other sources, including:

- ore and mineral industries, representing 2% (35 kt) of the emissions
- transportation (road, rail, air and marine), representing 1% (20 kt)
- manufacturing (16 kt) and off-road vehicles and mobile equipment (14 kt), each representing about 1% of emissions
- miscellaneous sources, such as emissions from cigarette smoking, representing 1% (16 kt)
- the oil and gas industry, representing less than 1% (13 kt)
- other emissions (less than 1%) coming from building heating and energy generation, electric utilities, incineration and wastes, and the use of paints and solvents

Many of the sources above, despite representing a small proportion of national emissions, can have a disproportionate impact on the population because they are generally concentrated in populated areas.

The decreases in $PM_{2.5}$ emissions between 1990 and 2017 are mainly attributable to emission reductions from agriculture (livestock, crop production and fertilizer) and home firewood burning. These reductions outweigh the increase in emissions from dust and fires over the period. The adoption of conservation practices in crop production and the use of new fireplace inserts, furnaces and stoves in homes that control emissions and burn more efficiently were the main drivers leading to the reductions.

Table 1. Source emissions changes between 1990 and 2017

Source	$PM_{2.5}$ (change in kilotonnes from 1990 to 2017)	$PM_{2.5}$ (percentage change from 1990 to 2017)
Dust and fires	332.8	49.4
Miscellaneous	0.9	6.0
Oil and gas industry	0.6	4.9
Building heating and energy generation	0.2	4.0
Paints and solvents	0.02	505.6
Incineration and waste	-2.3	-45.6
Transportation (road, rail, air and marine)	-20.8	-50.8
Ore and mineral industries	-22.1	-38.9
Off-road vehicles and mobile equipment	-39.2	-73.1
Electric utilities	-45.1	-93.1
Manufacturing	-97.6	-85.7
Home firewood burning	-99.9	-38.1
Agriculture (livestock, crop production and fertilizer)	-297.5	-43.9
Total	**-290.1**	**-14.8**

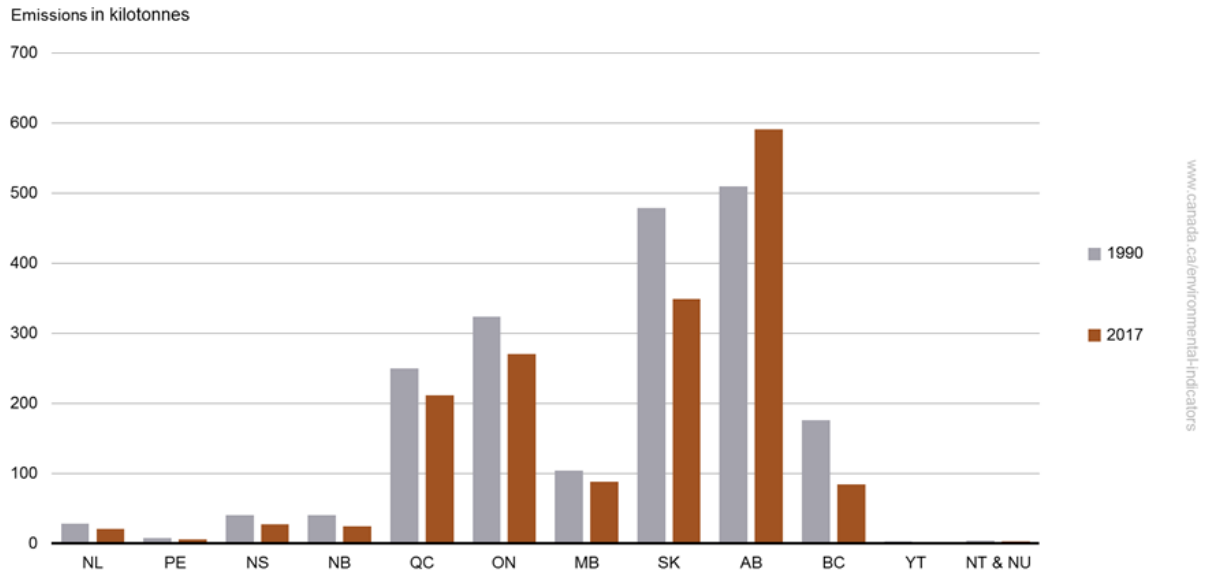
Note: The changes have been calculated using source data that are not rounded.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Fine particulate matter emissions by province and territory

Key results

- In 2017, Alberta emitted the most $PM_{2.5}$. The province represented 35% (591 kt) of total national emissions
- Between 1990 and 2017, all provinces, with the exception of Alberta, decreased their emissions.
    - The largest decrease was observed in Saskatchewan with 130 kt (27%)
    - Alberta's $PM_{2.5}$ emissions increased by 16% (81 kt)

Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990 and 2017



Data for Figure 20

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Dust and fires (for example, road dust and prescribed burning) were the largest sources of $PM_{2.5}$ emissions in Alberta, the highest emitting province in 2017, accounting for 77% (455 kt) of total national dust and fires emissions in 2017.

Saskatchewan ranked second in 2017, with 21% (348 kt) of $PM_{2.5}$ emissions. Agriculture (livestock, crop production and fertilizer) was the largest source, with dust and fires being the second-largest source of $PM_{2.5}$.

Ontario ranked third, with 16% (271 kt), and Quebec ranked fourth with 13% (211 kt). For both provinces, dust and fires were the largest sources of emissions, with home firewood burning (for example, woodstoves and fireplaces) being the second-largest source.

The increase in emissions in Alberta between 1990 and 2017 can be attributed to growth in construction operations for the oil and gas industries.

The exclusion of emissions from dust and fires and agriculture (livestock, crop production and fertilizer) provides a different breakdown of $PM_{2.5}$ emissions in each province and territory. With these emissions removed, Quebec becomes the largest emitting province of $PM_{2.5}$ in 2017, representing 34% (96 kt) of total emissions (287 kt). Ontario ranks second with 24% (70 kt) of emissions. British Columbia and Alberta rank third and fourth, both representing 12% and 11% (34 kt and 31 kt,

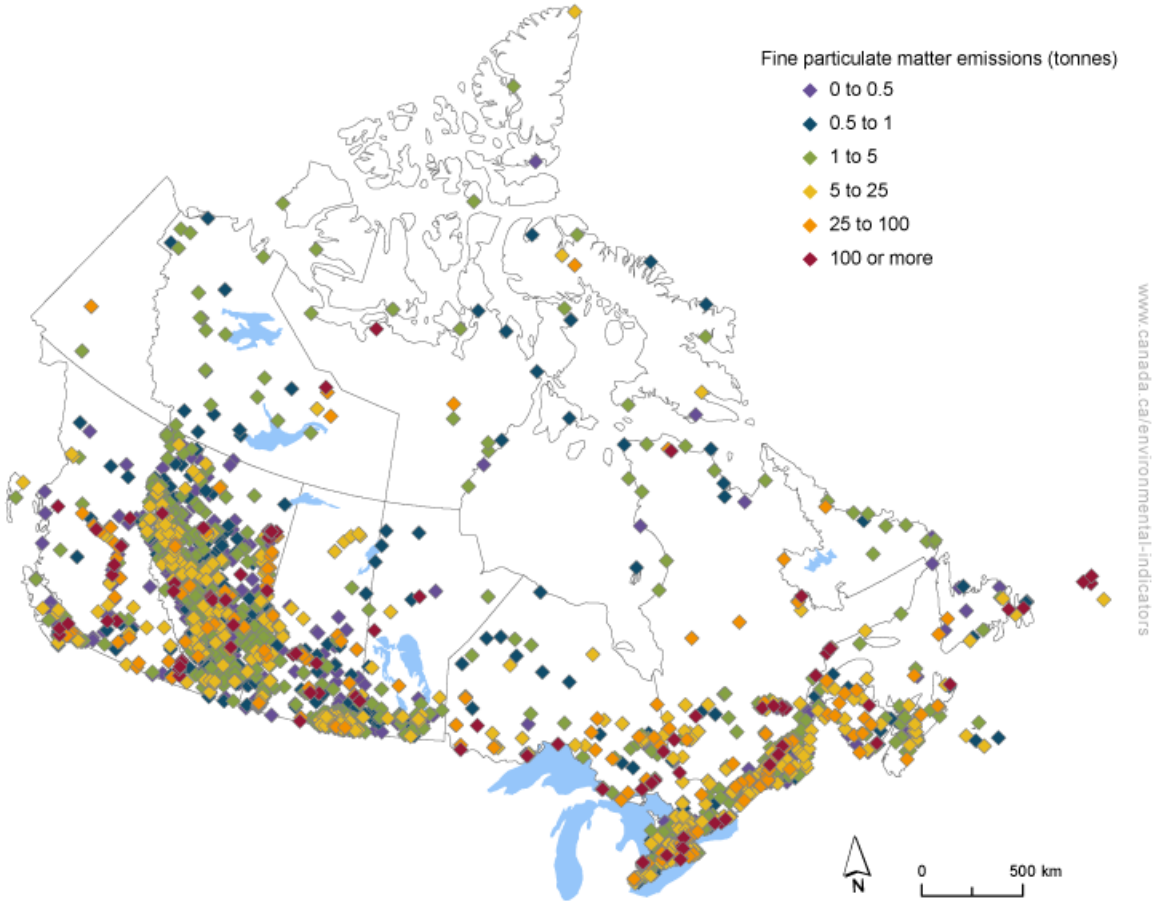
respectively) of emissions. Between 1990 and 2017, all of the provinces and territories experienced emissions reductions between 68% (British Columbia) and 25% (Prince Edward Island).

Fine particulate matter emissions by facilities

The National Pollutant Release Inventory provides detailed information on air pollutant emissions from industrial and commercial facilities that meet its reporting criteria.

The Canadian Environmental Sustainability Indicators provide access to this information through an interactive map. The map allows you to explore $PM_{2.5}$ emissions from individual facilities.

Figure 21. Fine particulate matter by reporting facilities, Canada, 2017



Navigate data using the interactive map

Note: Facility-reported fine particulate matter emissions represent 3% of total national fine particulate matter emissions.
Source: Environment and Climate Change Canada (2018) National Pollutant Release Inventory Data Search, 2017 Facility Reported Data.

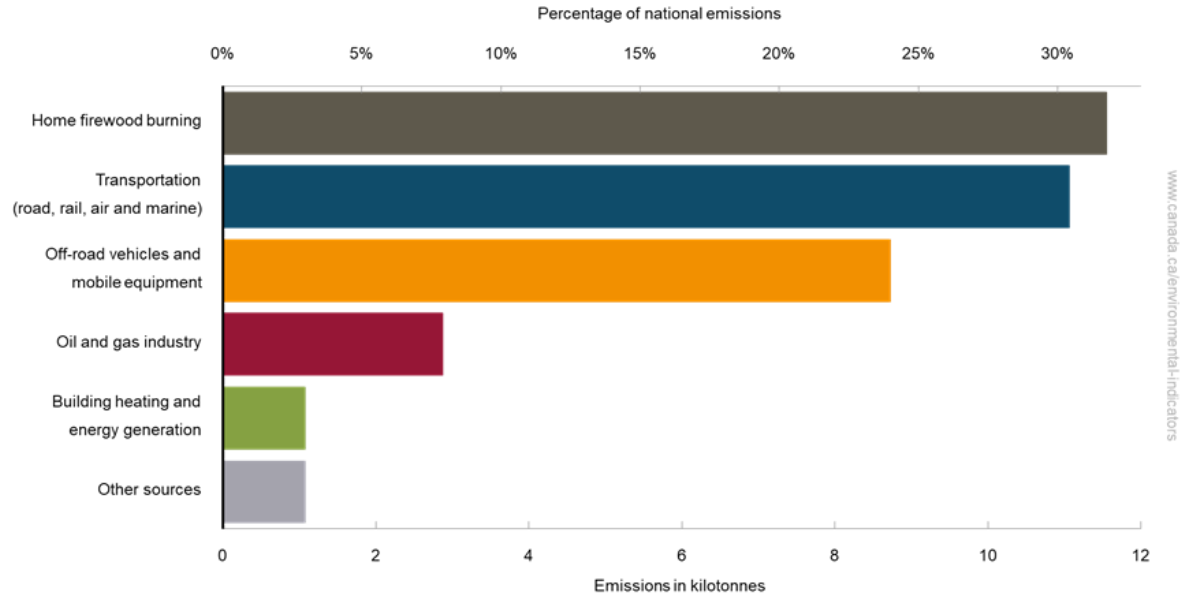
Black carbon emissions by source

Black carbon is a component of $PM_{2.5}$ and is generated by the incomplete combustion of fossil fuels and biomass. It is a short-lived climate pollutant, and is linked to both climate warming and adverse human health effects. Reductions in black carbon emissions have near-immediate and local benefits to climate and air quality.

Key results

- Emissions of black carbon were 36 kt in 2017
- In 2017, 3 sectors accounted for 86% of national black carbon emissions:
    - home firewood burning
    - transportation (road, rail, air and marine)
    - off-road vehicles and mobile equipment

Figure 22. Total black carbon emissions by source, Canada, 2017



Data for Figure 22

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires. The chart includes emissions from the most significant sources of black carbon. "Other sources" includes emissions from ore and mineral industries, manufacturing, electric utilities and agriculture. Consult Table 2 in the Data sources and methods for more details.
Source: Environment and Climate Change Canada (2019) Canada's Black Carbon Emissions Inventory.

In 2017, home firewood burning and transportation (road, rail, air and marine) accounted for the largest proportions of total national emissions, representing 32% (11.5 kt) and 30% (11 kt) respectively. Off-road vehicles and mobile equipment (for example, lawn and garden equipment, recreational vehicles, excavators, graders) were also large contributors, representing about 24% (8.7 kt) of total national emissions. The remaining 14% of emissions came from the oil and gas industry, other sources (such as ore and mineral industries) and building heating and energy generation.

For both transportation and off-road vehicles and mobile equipment, the use of diesel engines was the main source of black carbon emissions.

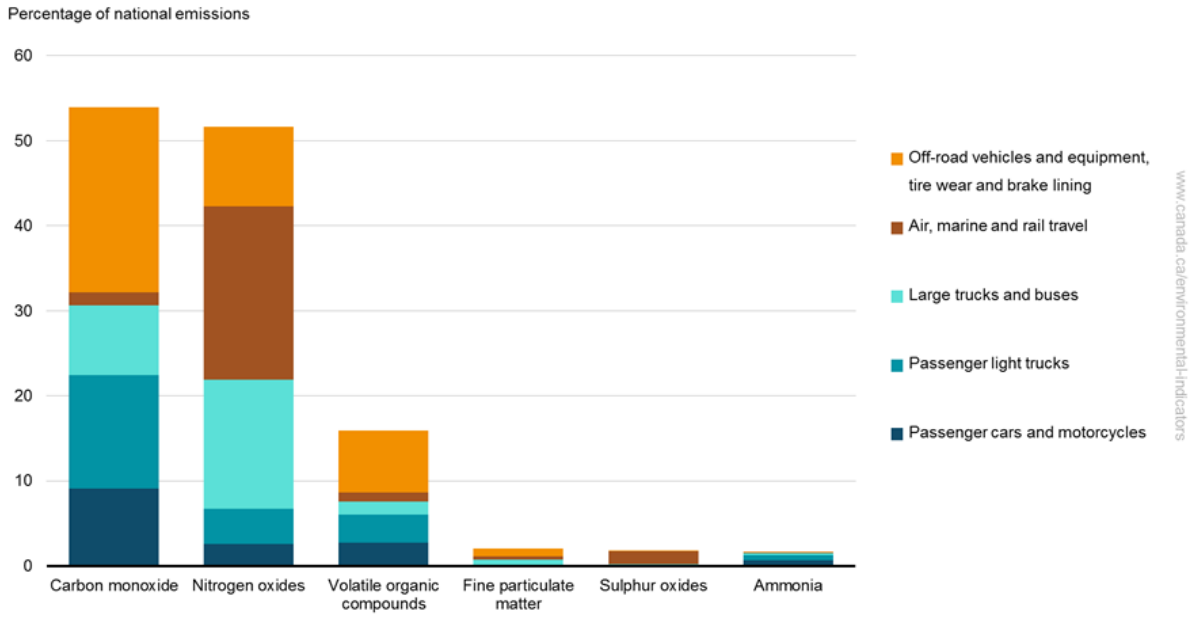
Air pollutant emissions from transportation, off-road vehicles and mobile equipment

Transportation, off-road vehicles and mobile equipment are among the largest sources of air pollutants in Canada. Burning fossil fuels to power vehicles and engines causes emissions of many air pollutants. Air pollutants are responsible for the formation of fine particulate matter, ozone, smog and acid rain. They also adversely affect human heath, the environment and the economy.

Key results

- In 2017, transportation, off-road vehicles and mobile equipment accounted for more than half of total national emissions of carbon monoxide (CO) and nitrogen oxides (NO_X) and 16% of total emissions of volatile organic compounds (VOCs)
- While also a source of emissions for fine particulate matter ($PM_{2.5}$), sulphur oxides (SO_X) and ammonia (NH_3), the sectors represented less than 3% of total national emissions of these other pollutants

Figure 23. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2017



Data for Figure 23

Note: "Passenger cars and motorcycles" include cars powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

The mix of fuels used explains in large part the contribution of each transportation mode to emissions of different air pollutants.

Large trucks and buses, and rail and marine mostly rely on diesel fuel. Aviation relies on aviation turbo fuel. These transportation modes are the largest sources of NO_X transportation-related emissions accounting for 36% (634 kilotonnes [kt]) of total NO_X emissions.

Passenger cars and light trucks mostly use gasoline and are a main source of pollutants, especially in urban centres. In 2017, emissions from passenger cars, motorcycles and light trucks amounted to 1 269 kt of CO, 120 kt of NO_X and 109 kt of VOCs. These emissions represented 22%, 7% and 6% of all emissions of these pollutants respectively.

Other sources (mainly composed of off-road vehicles and equipment)[7] are also a significant source of pollution. Their combined emissions make up 22%, 9% and 7% of the total emissions of CO, NO_X and VOCs, respectively. Emissions mostly come from household use of gasoline- or diesel-powered recreational and lawn and garden equipment and from the operation of agricultural, construction and mining equipment.

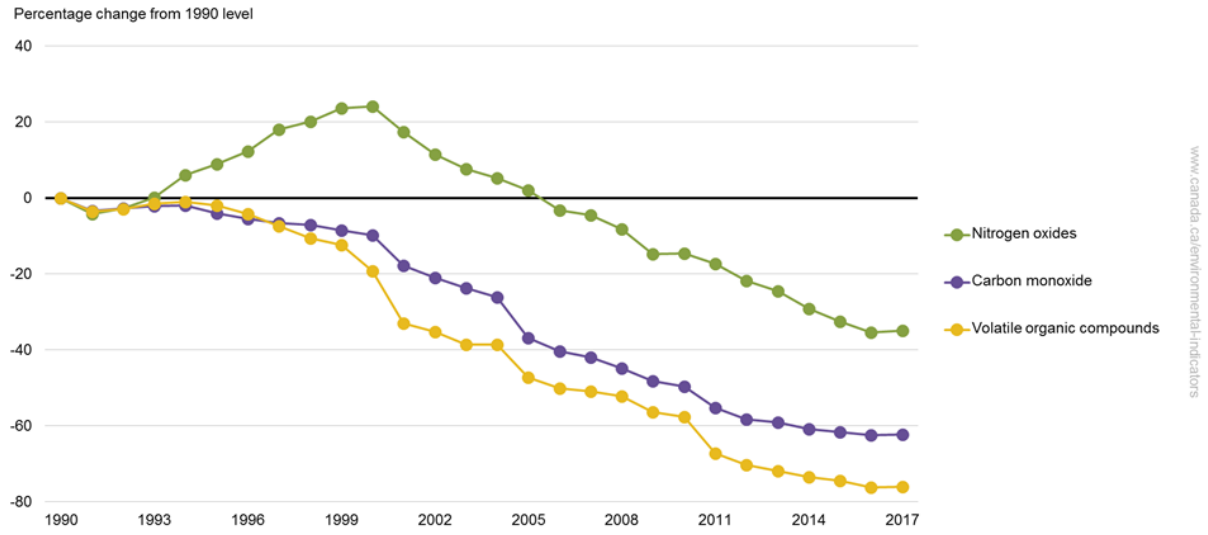
The largest source of sulphur oxide (SO_X) emissions in the transportation sector is marine vessels. Emissions of SO_X from marine vessels decreased by 91% between 2014 and 2017 due to the introduction of more stringent regulations.

Changes in emissions from transportation, off-road vehicles and mobile equipment

Key results

- Between 1990 and 2017, total emissions of NO_X, CO and VOCs from transportation, off-road vehicles and mobile equipment decreased by 35%, 62% and 76%, respectively
- Since 2000, all pollutants demonstrated the same downward trend in their emissions level

Figure 24. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2017



Data for Figure 24

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

[7] Off-road vehicles and mobile equipment include airport ground support equipment, commercial equipment (such as forklifts and ice resurfacers), farming, construction, forestry and mining equipment, industrial equipment, lawn and garden equipment, railway maintenance equipment, and recreational equipment and recreational marine equipment.

Pollutant emissions have decreased despite economic and population growth as well as growth in transport activities for the period between 1990 and 2017. This decrease is mainly attributable to the adoption of new regulations that lead to the gradual introduction of technologies and clean fuel for vehicles.

Between 1990 and 2000, NO_X emissions increased by 24%. It includes the increase in emissions of large trucks and buses (44%), marine (34%) and air (25%) transportation. From 2000 to 2017, new regulations contributed to a 49% decrease in emissions from large trucks and buses, while emissions from air and marine travel continued to increase by 25% and 3%, respectively. Emissions from air, marine and rail travel represented 20% of national emissions of NO_X in 2017.

Transportation emissions are influenced by a variety of factors. These include population and economic growth, volume of passenger and freight travel, vehicle type, emission control technologies, fuel efficiency and fuel type.

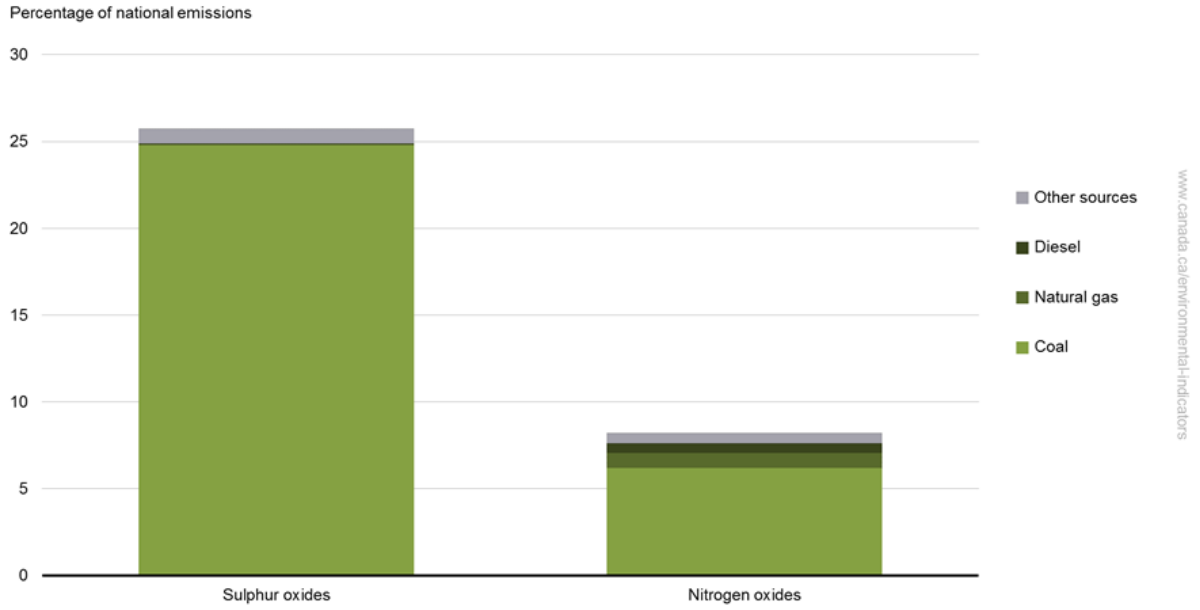
Air pollutant emissions from the electric utilities

Electricity generation produces a large share of total national sulphur oxides (SO_X) and nitrogen oxides (NO_X). SO_X and NO_X are mostly emitted from power plants burning fossil fuels such as coal and, to a lesser extent, natural gas and diesel. These air pollutants are responsible for the formation of fine particulate matter, ozone, smog and acid rain. They also adversely affect human health, the environment, and the economy.

Key results

- In 2017, electric utilities were the source of 26% and 8% of total national emissions of sulphur oxides (SO_X) and nitrogen oxides (NO_X)
- Most of the air pollutant emissions from electric utilities come from burning coal
- Electric utilities are also a source of carbon monoxide (CO), volatile organic compounds (VOCs), fine particulate matter ($PM_{2.5}$) and ammonia (NH_3) emissions. However, they account for less than1% of the total national emissions of these pollutants

Figure 25. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2017



Data for Figure 25

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other" fuel sources include waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, 96% of SO_X and 75% of NO_X emissions from electric utilities came from burning coal.

While generating electricity by burning fossil fuels causes air pollutant emissions, the use of non-fossil energy sources, such as wind, nuclear and other renewable sources to generate electricity does not emit air pollutants. A large share of the electricity generated in Canada comes from sources that do not emit air pollutants:

- 59% of electricity comes from hydro

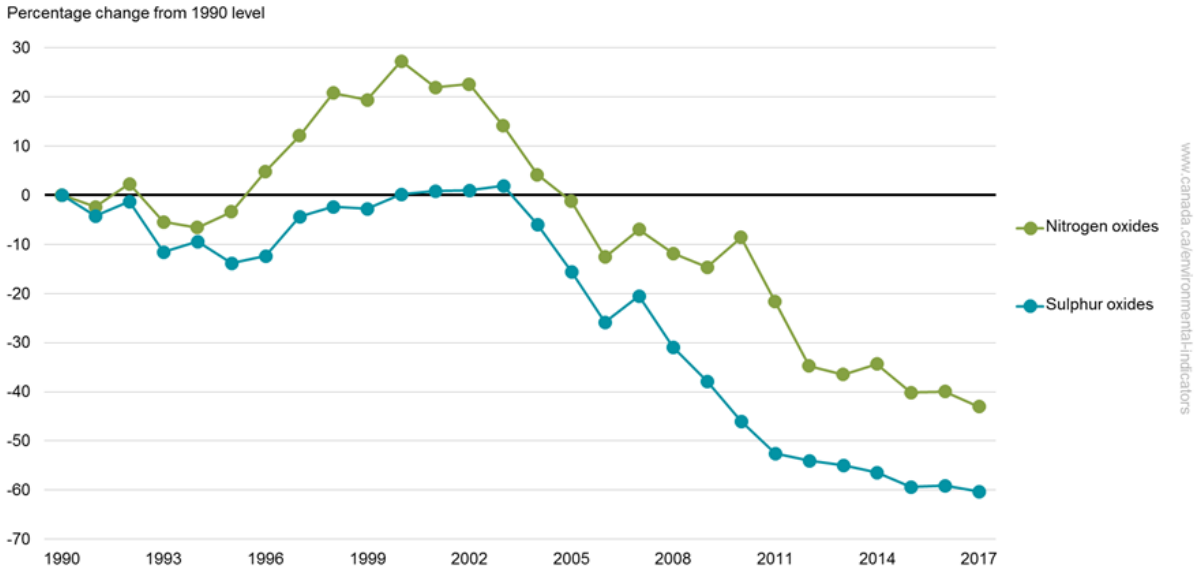
- 15% comes from nuclear power plants
- 7% comes from non-hydro renewable sources, such as wind, solar, tidal power and biomass[8]

Changes in emissions from the electric utilities

Key results

- Emissions of SO_X and NO_X from electric utilities declined by 60% and 43%, respectively, between 1990 and 2017
- Most of that decline occurred from 2005 onward

Figure 26. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2017



Data for Figure 26

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Between 2005 and 2017, emissions of NO_X and SO_X from electric utilities decreased by 42% and 53%, respectively. Over the same period, the share of electricity that came from burning fossil fuels fell from 26% to 20%. This decline was mostly the result of a gradual drop in electricity generation from coal power plants.[9]

The emissions reductions since 2005 are mainly due to:

- the change in the mix of energy sources used to generate electricity
- the introduction of regulations
- domestic and international agreements
- better removal technologies
- plant closures

[8] Natural Resources Canada (2018) Electricity facts. Retrieved on January 31, 2019.

[9] Statistics Canada (2016) CANSIM Table 127-0007 - Electric power generation, by class of electricity producer, annual (megawatt hour). Retrieved on January 31, 2019.

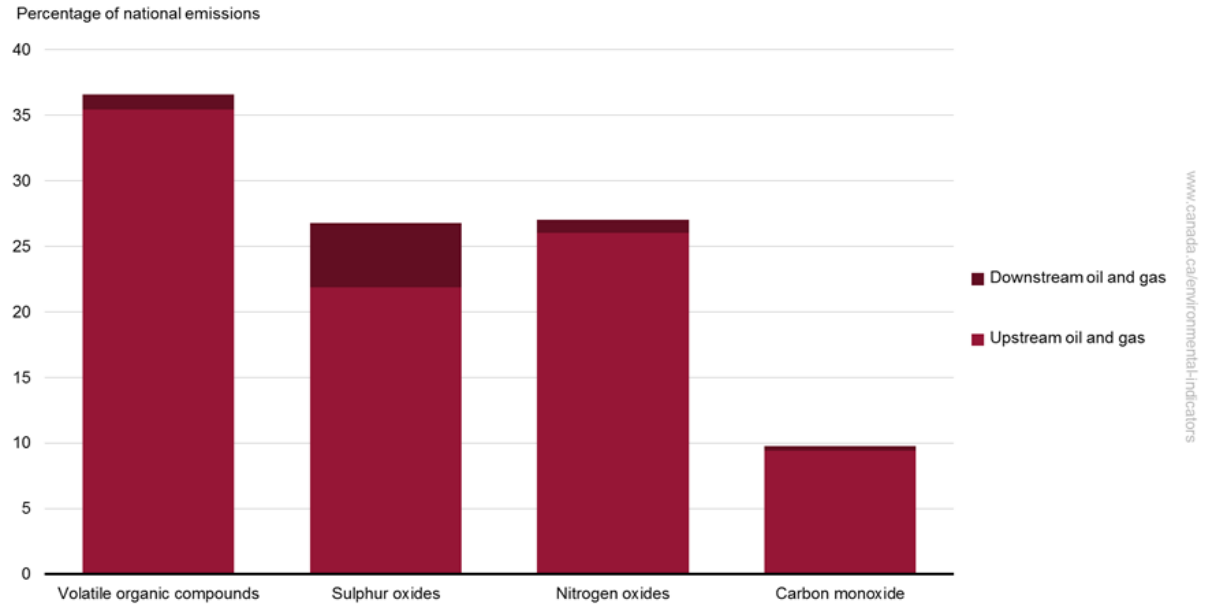
Air pollutant emissions from the oil and gas industry

The oil and gas sector is an important contributor to air pollutant emissions. Air pollutants are responsible for the formation of fine particulate matter ($PM_{2.5}$), ozone (O_3), smog and acid rain. They also adversely affect human health, the environment, and the economy. Most emissions from the oil and gas sector come from activities such as exploration, drilling, production and field processing.

Key results

- In 2017, the oil and gas industry was a major contributor to total national emissions of volatile organic compounds (VOCs) (37%), sulphur oxides (SO_X) (27%), nitrogen oxides (NO_X) (27%) and carbon monoxide (CO) (10%)
- The oil and gas industry is also a source of emissions of fine particulate matter ($PM_{2.5}$) and ammonia (NH_3). However, in 2017, it made up less than 1% of the total emissions of these pollutants

Figure 27. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2017



Data for Figure 27

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

In 2017, the oil and gas industry was the sector contributing the most to total national emissions of VOCs. It was also the second-largest contributor to emissions of NO_X and SO_X, and the fifth-largest contributor to emissions of CO.

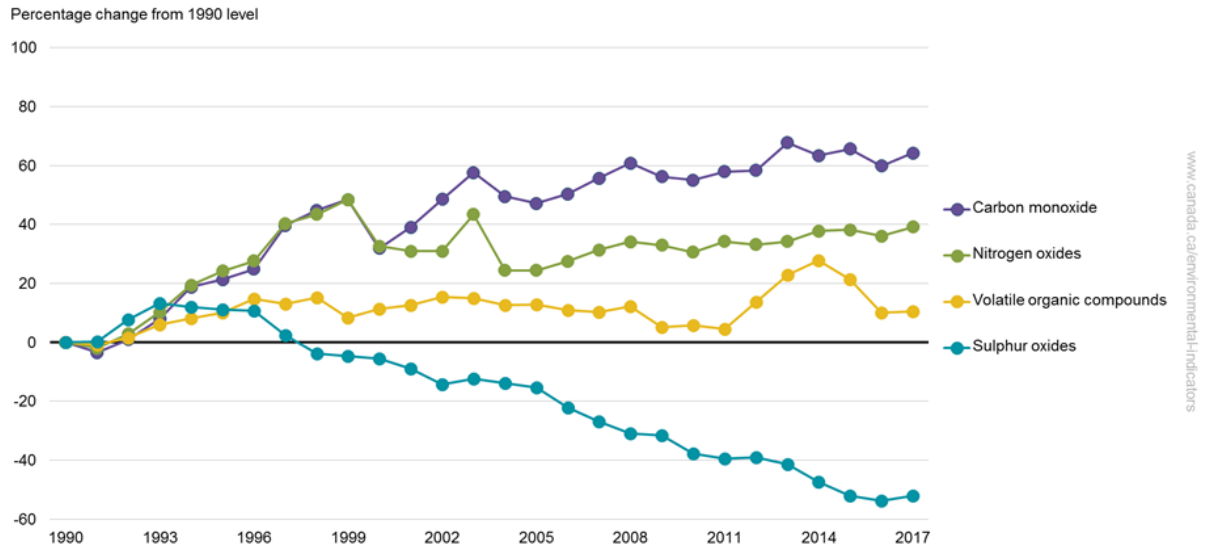
Most of emissions from the oil and gas industry came from upstream activities (exploration, drilling, production and field processing) compared to downstream activities (refining, storage and distribution). In 2017 97% of VOC, 82% of SO_X, 96% of NO_X and CO emissions from the oil and gas sector were from upstream activities.

Changes in emissions from the oil and gas industry

Key results

- Emissions of CO, NO_X and VOCs increased by 64%, 39% and 10%, respectively, between 1990 and 2017
- SO_X emissions decreased (52%) over that period

Figure 28. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2017



Data for Figure 28

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

The increases in CO, NO_X and VOC emissions were due to growth in oil and gas production (the upstream sector of the industry), as emissions from the downstream sector declined during that period. This increase is in part explained by the fact that crude oil production had more than doubled in Canada since 1990. The growth was mostly driven by a rapid increase in oil sands production. 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.

The decrease in SO_X emissions was mostly the result of a decrease in emissions from bitumen and heavy oil upgrading and natural gas processing, attributed to better emission control technologies.

About the indicators

What the indicators measure

Air pollutant emissions indicators track emissions from human activities of 6 key air pollutants: sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), ammonia (NH_3), carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$). Black carbon, which is a component of $PM_{2.5}$, is also reported.[10] Sectoral indicators on air pollutant emissions from transportation, off-road vehicles and mobile equipment, electric utilities and the oil and gas industry provide additional analysis on the largest sources of Canada's air pollutant emissions.

For each air pollutant, the indicators are provided at the national and provincial/territorial levels. They also identify the major sources of emissions and provide links to detailed information on air pollutant emissions from facilities.[11]

Why these indicators are important

Canadians are exposed to air pollutants on a daily basis, which can cause adverse health and environmental effects. Fine particulate matter ($PM_{2.5}$) and ground-level ozone (O_3) are key components of smog and have been associated with pulmonary and cardiovascular health issues even at very low levels. While causing effects of their own, NO_X (such as nitrogen dioxide [NO_2]) and VOCs are the main contributors to the formation of O_3. Nitrogen oxides, SO_X (such as sulphur dioxide [SO_2]), NH_3 and VOCs also lead to the formation of $PM_{2.5}$ in the air, in addition to the $PM_{2.5}$ that is emitted directly. Sulphur oxides and NO_X can also lead to the formation of acid deposition (acid rain) that can harm the environment, materials, living organisms, and humans.

Consult Air pollution: drivers and impacts for information on the impacts of air pollution on health, the economy and the environment, as well as information on the federal regulations administered under the Canadian Environmental Protection Act (1999) addressing air pollution.

Black carbon is estimated to be the third largest contributor in the world to current global warming. Black carbon is of particular significance in Polar Regions, where the deposition of particles on ice and snow darken the surface, increasing the absorption of sunlight, and accelerate melting.

The Air pollutant emissions indicators are intended to inform Canadians and decision makers about progress made towards reducing emissions from human-related sources of air pollutants and about the effectiveness of emission reduction measures implemented to improve ambient air quality in Canada.

[10] Black carbon is emitted from combustion processes in the form of $PM_{2.5}$. It is not emitted on its own, but as a component of $PM_{2.5}$ along with other components, such as organic carbon and inorganic compounds like sulphates. Fine particulate matter emissions from non-combustion sources, such as dust raised by traffic on paved and unpaved roads or by wind and machinery on open fields or mine sites, are not considered sources of black carbon. Environment and Climate Change Canada (2019) Canada's Black Carbon Emissions Inventory. Retrieved on June 28, 2019.

[11] Only facilities that had air pollutant emissions over a certain reporting threshold were included in the National Pollutant Releases Inventory (NPRI) reported data.

Safe and healthy communities

These indicators support the measurement of progress towards the following 2019 to 2022 Federal Sustainable Development Strategy long-term goal: All Canadians live in clean, sustainable communities that contribute to their health and well-being. It is used to assess progress towards the target: Continued decrease in emissions from 1990 of fine particulate matter, nitrogen oxides, sulphur oxides and volatile organic compounds from all sources.

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 11: Sustainable cities and communities.

Related indicators

The International comparison of air pollutant emissions indicators compare Canada's emissions of 5 key air pollutants with those of top emitting member countries of the Organisation for Economic Co-operation and Development.

The Air health trends indicator provides an overview of the public health impacts attributable to outdoor air pollution in Canada.

The Air quality indicators track ambient concentrations of $PM_{2.5}$, O_3, SO_2, NO_2, and VOCs at the national and regional level and at local monitoring stations.

The Greenhouse gas emissions indicators report trends on Canada's GHG emissions nationally, by province and territory, per person and per unit gross domestic product, by economic sector.

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

Data sources and methods

Data sources

The Air pollutant emissions indicators track emissions of 6 key air pollutants: sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOCs), ammonia (NH_3), carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$). The emissions data used are from Canada's Air Pollutant Emissions Inventory for the years 1990 to 2017.

Data for the black carbon indicator, a component of $PM_{2.5}$, come from Canada's Black Carbon Emissions Inventory and are reported for 2017 by source at the national level.

Facility data for local air pollutant emissions reported in interactive maps come from the National Pollutant Release Inventory and are available for the years 2008 to 2017.

More information

The Air Pollutant Emissions Inventory and the Black Carbon Emissions Inventory provide data and estimates on releases of air pollutants from human activities. These pollutants contribute to the issues of smog, acid rain, reduced air quality and climate change. Improvements to data are made periodically as new emission estimation methodologies are adopted and additional information is made available. Historical emissions are updated on the basis of these improvements.

Air Pollutant Emissions Inventory

The Air Pollutant Emissions Inventory fulfills many of Canada's international pollution levels reporting obligations. It is a comprehensive inventory of 17 air pollutants,[12] combining emissions reported by facilities to the National Pollutant Release Inventory, with emissions estimated by Environment and Climate Change Canada. Estimates are developed using the latest estimation methods and are based on published statistics or other sources of information such as surveys and reports. The Air Pollutant Emissions Inventory provides a comprehensive overview of pollutant emissions across Canada.

The national and provincial/territorial inventory data are current as of March 15, 2019, and cover the period from 1990 to 2017. Emissions data are reported in the inventory approximately one year after data collection, validation, calculation and interpretation have been completed. The indicators are reported following the public release of the inventory data.

Black carbon emissions inventory

As a member of the Arctic Council, Canada committed under the Framework for Action on Enhanced Black Carbon and Methane Emissions Reductions to submit annual inventories of its black carbon emissions to the United Nations Economic Commission for Europe beginning in 2015. The Black Carbon Emissions Inventory is compiled using $PM_{2.5}$ emissions data from combustion-related sources from the Air Pollutant Emissions Inventory. Black carbon estimates are published separately from the Air Pollutant Emissions Inventory. The data are current as of June 28, 2019.

Black carbon is considered a short-lived climate pollutant, meaning it has a relatively short lifespan in the atmosphere (from a few days to a few weeks) compared to carbon dioxide (CO_2) (which can persist in the atmosphere for thousands of years) and other longer-lived greenhouse gases (GHGs). Although their life spans are short, short-lived climate pollutants are potent global warmers contributing to warming of the Earth's surface.[13] Black carbon absorbs solar radiation 460 to 1 500 times more than CO_2.[14] Short-lived climate pollutants, including black carbon, are important pollutants to consider when addressing climate change because they can respond relatively quickly to efforts to control their releases and thus impact near-term warming, which is particularly important in the Polar Regions, such as the Arctic.[15] The Intergovernmental Panel on Climate Change (IPCC) special report on Global Warming states that reductions in short-lived climate pollutants are required to limit warming to a maximum of 1.5°C, and Canada's Changing Climate Report flags short-lived climate pollutants as an important part of climate policy discussions.

National Pollutant Release Inventory

The National Pollutant Release Inventory is a database of pollutant releases (to air, water and land), disposals and transfers for recycling from industrial, commercial and institutional facilities. The data from these facilities is provided by the operators of the facilities as mandated by the *Canadian Environmental Protection Act* (the Act). Under the Act, owners or operators of facilities that manufacture, process or otherwise use or release one or more of the substances tracked by the inventory, and meet substance-specific reporting thresholds and other requirements, must report their pollutant releases, disposals and transfers annually to the department. The inventory data from 1994 to 2017 are current as of September 13, 2018.

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[12] Includes the 6 key air pollutants (sulphur oxides, nitrogen oxides, volatile organic compounds, ammonia, carbon monoxide and fine particulate matter) along with cadmium, lead, mercury, dioxins and furans, 4 types of polycyclic aromatic hydrocarbons, hexachlorobenzene, coarse particulate matter and total particulate matter.
[13] Environment and Climate Change Canada (2017) Short-lived climate pollutants. Retrieved on January 31, 2019.
[14] Climate and Clean Air Coalition (2018) Science: Black carbon. Retrieved on January 31, 2019.
[15] Environment and Climate Change Canada (2019). Canada's Black Carbon Inventory 2019: Executive summary. Retrieved on June 28, 2019.

Methods

Emissions data from Canada's national inventories are used to produce the indicators for the 6 key air pollutants. Data are grouped to report on the sources that contribute the majority of emissions for each pollutant. Canada's national inventories use the latest advancements in scientific knowledge to estimate or measure emissions for the various air pollutant sources.

More information

Compilation of air pollutant emissions

The Air Pollutant Emissions Inventory is developed using 2 types of information:

- facility-reported data, consisting of emissions from relatively large industrial, commercial and institutional facilities
- in-house estimates, including diffuse sources and other sources that are too numerous to be accounted for individually, such as road and non-road vehicles, agricultural activities, construction and solvent use

The Air Pollutant Emissions Inventory is developed using many sources of information, procedures and emission estimation models. Emissions data reported by individual facilities to the department's National Pollutant Release Inventory are supplemented with documented, science-based estimation tools to quantify total emissions. Together, these data sources provide a comprehensive overview of pollutant emissions across Canada.

A compilation framework has been developed that makes use of the best available data, while ensuring that there is no double-counting or omissions. Additional information on the inventory compilation process is provided in Annex 2 of the Air Pollutant Emissions Inventory Report.

Facility-reported emissions data

Facility-reported emissions data generally refers to any stationary sources that emit pollutants through stacks or other equipment at specific locations. The major source of facility-reported data is the National Pollutant Release Inventory.

Facility-reported data from the National Pollutant Release Inventory are used in the Air Pollutant Emissions Inventory without modifications, except when data quality issues are detected and not addressed during the quality control exercise. The National Pollutant Release Inventory reporting requirements and thresholds vary by pollutant and, in some cases, by industry. Details on these reporting requirements and thresholds are available on the National Pollutant Release Inventory website.

A distinction has been made between reporting facilities and non-reporting facilities. Reporting facilities meet the threshold required to report to the National Pollutant Release Inventory; while non-reporting facilities do not meet these thresholds due to their size or emission levels, and therefore are not required to report to the inventory. Some facilities may be required to report emissions on only certain pollutants. Therefore, emissions from the non-reporting facilities or of non-reported pollutants must be estimated in-house to ensure complete coverage.

In-house emission estimates

In-house emission estimates are calculated with information such as production data and activity data, using various estimation methodologies and emission models. These emission estimates are at the national level rather than at any specific geographic locations. These include emissions from non-industrial, residential, commercial, transportation, and other sources, such as open burning, agricultural activities and construction operations. The Air Pollutant Emissions Inventory uses in-house estimates for the following emission sources:

- any residential, governmental, institutional, or commercial operation that does not report to the National Pollutant Release Inventory
- on-site solid waste disposal facilities
- motor vehicles, aircraft, vessels or other transportation equipment or devices
- other sources, such as open burning, agricultural activities and construction operations

In general, in-house emission estimates are calculated from activity data and emission factors.[16] Activity data usually comprise statistical production or process data at the provincial, territorial or national level. This information is typically provided by provincial/territorial agencies, federal government departments, industry associations, etc. For each source category, activity data are combined with emission factors to produce provincial/territorial-level emission estimates.

The in-house emission estimate methodologies and emission models used in Canada are often based on those developed by the United States Environmental Protection Agency (U.S. EPA) and are adapted to reflect the Canadian climate, fuels, technologies and practices. Methods used in Canada's Air Pollutants Emission Inventory are therefore generally consistent with those used in the United States or those recommended in the emission inventory guidebook.[17]

The Air Pollutant Emissions Inventory reports air pollutant emissions from mobile sources such as on-road vehicles, off-road vehicles and engines. For the current edition of the Air Pollutant Emissions Inventory, an emissions estimation model developed by the U.S. EPA (MOVES) was used. The emissions for off-road vehicles and engines (such as graders, heavy trucks, outboard motors and lawnmowers) were estimated using the U.S. EPA's NONROAD emission estimation model (see "off-road vehicles and equipment" in Table A2-5 of Annex 2 of the Air Pollutant Emissions Inventory Report). The parameters in both models were modified to take into account variations in the Canadian vehicle fleet, emission control technologies, types of fuels, vehicle standards, and types of equipment engines and their application in various industries. The emission estimates for civil and international aviation, railways and navigation are estimated using detailed vehicle movement statistics coupled with fuel consumption, engine information, and emission rates by vehicle types.

[16] The United States Environmental Protection Agency defines an emission factor as "…a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (for example, kilograms of particulate emitted per megagram of coal burned)."

[17] European Monitoring and Evaluation Programme / European Environment Agency (2013) EMEP/EEA Air Pollutant Emissions Inventory Guidebook 2013. Technical Guidance to Prepare National Emission Inventories. Luxembourg: Publications Office of the European Union. Technical Report No. 12/2013.

Calculation of black carbon emissions

Emissions of black carbon are calculated by applying factors to estimate the fraction of black carbon in $PM_{2.5}$ emissions from combustion-related sources, with the exception of mobile sources, where models are used. The factors primarily come from the United States Environmental Protection Agency's SPECIATE database. SPECIATE is a repository of particulate matter speciation profiles[18] of air pollution sources. Annex B of Canada's Black Carbon Emissions Inventory lists all the ratios used for each source.

Recalculations

Emission recalculation is an essential practice in the maintenance of an up-to-date air pollutant emissions inventory. The Air Pollutant Emissions Inventory is continuously updated with improved estimation methodologies, statistics and more recent and appropriate emission factors. As new information and data become available, previous estimates are updated and recalculated to ensure a consistent and comparable trend in emissions. Recalculations of previously reported emission estimates are common for both in-house estimates and facility-reported emission data. More information on recalculations is provided in Annex 2 of the Air Pollutant Emissions Inventory Report.

Emissions reconciliation

In several sectors, estimation of total emissions involves combining estimates provided by facilities with estimates developed in-house by the department. To prevent double counting of emissions and to confirm that the Air Pollutant Emissions Inventory includes all emissions, a comparison and reconciliation of emission estimates from various sources is performed for each pollutant, industry sector and geographical region, as appropriate. More information on the reconciliation process is provided in Annex 2 of the Air Pollutant Emissions Inventory Report.

Temporal coverage

Historical data are provided at the national level for the period from 1990 to 2017. For the regional indicators (provincial/territorial), emissions are presented for 1990 and 2017. Facility level emissions information are available from 2008 to 2017.

Air pollutant emissions by source classification

For the purpose of reporting the indicators, calculated emissions data from the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory are grouped into the following 13 sources:

1. agriculture (livestock, crop production and fertilizer)
2. building heating and energy generation
3. dust and fires
4. electric utilities
5. home firewood burning
6. incineration and waste
7. manufacturing
8. miscellaneous
9. off-road vehicles and mobile equipment
10. oil and gas industry
11. ore and mineral industries
12. paints and solvents
13. transportation (road, rail, air and marine)

[18] A speciation profile is the dataset that breaks down $PM_{2.5}$ emitted from a particular source into its different components (black carbon and organic carbon). Environment and Climate Change Canada (2019) Canada's Black Carbon Emissions Inventory. Retrieved on June 28, 2019.

Table 2 shows the allocation of air pollutant emission sources reported in the indicators compared with the sources and sectors reported by the Air Pollutant Emissions Inventory.

Table 2. Alignment of sources reported in the indicators with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Agriculture (livestock, crop production and fertilizer)	Agriculture: Animal production
Agriculture (livestock, crop production and fertilizer)	Agriculture: Crop production
Agriculture (livestock, crop production and fertilizer)	Agriculture: Fuel use
Building heating and energy generation	Commercial/Residential/Institutional: Commercial and institutional fuel combustion
Building heating and energy generation	Commercial/Residential/Institutional: Construction fuel combustion
Building heating and energy generation	Commercial/Residential/Institutional: Residential fuel combustion
Dust and fires	Dust: Coal transportation
Dust and fires	Dust: Construction operations
Dust and fires	Dust: Mine tailings
Dust and fires	Dust: Paved roads
Dust and fires	Dust: Unpaved roads
Dust and fires	Fires: Prescribed burning
Dust and fires	Fires: Structural fires
Electric utilities	Electric power generation (utilities): Coal
Electric utilities	Electric power generation (utilities): Diesel
Electric utilities	Electric power generation (utilities): Natural gas
Electric utilities	Electric power generation (utilities): Waste materials[A]
Electric utilities	Electric power generation (utilities): Other (electric power generation)
Home firewood burning	Commercial/Residential/Institutional: Home firewood burning
Incineration and waste	Incineration and waste: Crematoriums
Incineration and waste	Incineration and waste: Waste incineration
Incineration and waste	Incineration and waste: Waste treatment and disposal
Manufacturing	Manufacturing: Abrasives manufacture
Manufacturing	Manufacturing: Bakeries
Manufacturing	Manufacturing: Biofuel production
Manufacturing	Manufacturing: Chemicals industry
Manufacturing	Manufacturing: Electronics

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Manufacturing	Manufacturing: Food preparation
Manufacturing	Manufacturing: Glass manufacturing
Manufacturing	Manufacturing: Grain industry
Manufacturing	Manufacturing: Metal fabrication
Manufacturing	Manufacturing: Plastics manufacturing
Manufacturing	Manufacturing: Pulp and paper industry
Manufacturing	Manufacturing: Textiles
Manufacturing	Manufacturing: Vehicle manufacturing (engines, parts, assembly, painting)
Manufacturing	Manufacturing: Wood products
Manufacturing	Manufacturing: Other (manufacturing)
Miscellaneous	Commercial/Residential/Institutional: Cigarette smoking
Miscellaneous	Commercial/Residential/Institutional: Commercial cooking
Miscellaneous	Commercial/Residential/Institutional: Human[B]
Miscellaneous	Commercial/Residential/Institutional: Marine cargo handling
Miscellaneous	Commercial/Residential/Institutional: Other (commercial/residential/institutional)
Miscellaneous	Commercial/Residential/Institutional: Service stations
Off-road vehicles and mobile equipment	Transportation and mobile equipment: Off-road diesel vehicles and equipment
Off-road vehicles and mobile equipment	Transportation and mobile equipment: Off-road gasoline / liquefied petroleum gas / natural gas vehicles and equipment
Oil and gas industry	Oil and gas industry: Downstream oil and gas industry
Oil and gas industry	Oil and gas industry: Upstream oil and gas industry
Ore and mineral industries	Ore and mineral industries: Aluminum industry
Ore and mineral industries	Ore and mineral industries: Asphalt paving industry
Ore and mineral industries	Ore and mineral industries: Cement and concrete industry
Ore and mineral industries	Ore and mineral industries: Foundries
Ore and mineral industries	Ore and mineral industries: Iron and steel industry
Ore and mineral industries	Ore and mineral industries: Iron ore industry
Ore and mineral industries	Ore and mineral industries: Mineral products industry
Ore and mineral industries	Ore and mineral industries: Mining and rock quarrying
Ore and mineral industries	Ore and mineral industries: Non-ferrous smelting and refining industry[C]
Paints and solvents	Paints and solvents: Dry cleaning
Paints and solvents	Paints and solvents: General solvent use
Paints and solvents	Paints and solvents: Printing

Sources in the indicators	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Paints and solvents	Paints and solvents: Surface coatings
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Air transportation
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty diesel vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty gasoline vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Heavy-duty liquefied petroleum gas / natural gas vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty diesel trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty diesel vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty gasoline trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty gasoline vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas trucks
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas vehicles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Marine transportation
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Motorcycles
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Rail transportation
Transportation (road, rail, air and marine)	Transportation and mobile equipment: Tire wear and brake lining

Note: [A] Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use. [B] Includes human respiration, perspiration and dental amalgams. [C] These sectors from the Air Pollutant Emissions Inventory are sometimes shown as individual sources in the indicators.

For display purposes, smaller emitting sources are sometimes grouped together under the title "other sources" in the charts of air pollutant emissions by source. The names of the sources grouped as such are listed in the notes of each chart.

Sectoral indicators

Sectoral indicators on air pollutant emissions from transportation, off-road vehicles and mobile equipment, electric utilities and the oil and gas industry provide additional analysis on the largest sources of Canada's air pollutant emissions. These indicators also rely on calculated emissions data from the Air Pollutant Emissions Inventory.

These indicators are provided at the national level. They identify the contribution of each sector to the national emissions of air pollutants for the year 2017. They also provide information about emissions of selected pollutant, by sector, for the period from 1990 to 2017.

Tables 3 through 5 below show the alignment of air pollutant emission sources reported in the Air pollutant emissions indicators compared with those reported by the sectoral indicators.

Table 3. Alignment of sources reported in the transportation, off-road vehicles and mobile equipment indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from transportation, off-road vehicles and mobile equipment	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Air, marine and rail travel	Transportation and mobile equipment: Air transportation
Air, marine and rail travel	Transportation and mobile equipment: Marine transportation
Air, marine and rail travel	Transportation and mobile equipment: Rail transportation
Large trucks and buses	Transportation and mobile equipment: Heavy-duty diesel vehicles
Large trucks and buses	Transportation and mobile equipment: Heavy-duty gasoline vehicles
Large trucks and buses	Transportation and mobile equipment: Heavy-duty liquefied petroleum gas / natural gas vehicles
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Off-road diesel vehicles and equipment
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Off-road gasoline / liquefied petroleum gas / natural gas vehicles and equipment
Off-road vehicles and equipment, tire wear and brake lining	Transportation and mobile equipment: Tire wear and brake lining
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty diesel vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty gasoline vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas vehicles
Passenger cars and motorcycles	Transportation and mobile equipment: Motorcycles
Passenger light trucks	Transportation and mobile equipment: Light-duty diesel trucks
Passenger light trucks	Transportation and mobile equipment: Light-duty gasoline trucks
Passenger light trucks	Transportation and mobile equipment: Light-duty liquefied petroleum gas / natural gas trucks

Table 4. Alignment of sources reported in the electric utilities indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from electric utilities	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Coal	Electric power generation (utilities): Coal
Diesel	Electric power generation (utilities): Diesel
Natural gas	Electric power generation (utilities): Natural gas
Other	Electric power generation (utilities): Waste materials[A]
Other	Electric power generation (utilities): Other (electric power generation)

Note: [A] Includes electric power generation from combustion of waste materials by utilities and by industry for commercial sale and/or private use.

Table 5. Alignment of sources reported in the oil and gas industry indicator of Air pollutant emissions with the sources and sectors from the Air Pollutant Emissions Inventory/Black Carbon Emissions Inventory

Air pollutant emissions from the oil and gas industry	Sources and sectors in the Air Pollutant Emissions Inventory and Black Carbon Emissions Inventory
Downstream oil and gas	Oil and gas industry: Downstream oil and gas industry
Upstream oil and gas	Oil and gas industry: Upstream oil and gas industry

Recent changes

The emission estimates reported in the Air Pollutant Emissions Inventory used in the indicators have undergone a number of significant recalculations. Specifically, the sector emissions for the oil and gas industry, manufacturing, transportation, agriculture, commercial/residential/institutional, incineration and waste sources, following the implementation of improved quantification methods. For more information about these recent changes, consult Annex 2.3 of the Air Pollutant Emissions Inventory Report.

Canada's Black Carbon Emissions Inventory has undergone a number of recalculations of emissions estimates. Specifically, methodological improvements have been made to all sources to improve the accuracy of estimates. Consult section 2.9 of Canada's Black Carbon Emissions Inventory for more information.

Caveats and limitations

The methodologies for compiling air pollutant emissions generally improve over time, and revisions are made to the Air Pollution Emission Inventory. As a result of this, the emissions and trends reported for the indicators may be different from those previously published.

Some area source emissions were not updated for 2017 due to the unavailability of activity-level statistics at the time of compilation. In these cases, the emission estimates from the most recent year available were used.

The Air Pollutant Emissions Inventory uses facility information from the National Pollutant Release Inventory and other sources. The version of the data published by the National Pollutant Release Inventory may not be identical to that used in the Air Pollutant Emissions Inventory at a given time because of updates to point source data from National Pollutant Release Inventory reporting.

Only the most significant sources of black carbon have been reported. It is estimated that emissions from these sources (home firewood burning, off-road vehicles and mobile equipment and transportation) represent approximately 86% of the national anthropogenic black carbon emissions.

Resources

References

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Related information

Air pollution: drivers and impacts

Air Pollutant Emissions Inventory: overview

Air Pollutant Emissions Inventory online search

Annex

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

Table A.1. Data for Figure 1. Air pollutant emissions, Canada, 1990 to 2017

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Ammonia (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Fine particulate matter (percentage change from 1990 level)
1990	0	0	0	0	0	0
1991	-7	-4	-2	-1	-2	-2
1992	-11	-2	-2	2	-3	-5
1993	-14	0	1	3	0	-5
1994	-21	5	2	6	0	-3
1995	-16	8	2	13	-2	-7
1996	-16	11	1	17	-5	-7
1997	-18	17	-1	19	-8	-6
1998	-19	19	-1	19	-8	-13
1999	-22	22	-4	18	-10	-13
2000	-22	21	-6	20	-12	-14
2001	-22	15	-14	20	-19	-17
2002	-24	13	-14	23	-21	-19
2003	-26	11	-17	22	-23	-21
2004	-26	6	-18	25	-28	-23
2005	-30	2	-23	24	-36	-24
2006	-36	-4	-26	21	-40	-24
2007	-38	-4	-28	22	-41	-21
2008	-44	-7	-29	20	-43	-18
2009	-52	-13	-34	16	-46	-25
2010	-56	-12	-33	14	-46	-20
2011	-59	-14	-38	13	-50	-19

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Ammonia (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Fine particulate matter (percentage change from 1990 level)
2012	-59	-18	-37	17	-51	-14
2013	-59	-20	-36	21	-52	-15
2014	-61	-22	-36	19	-53	-14
2015	-65	-25	-38	19	-54	-15
2016	-66	-27	-40	19	-54	-15
2017	-69	-26	-40	19	-54	-15

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.2. Data for Figure 2. Distribution of air pollutant emissions by source, Canada, 2017

Source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
Oil and gas industry	26.8	27.0	36.6	0.6	9.8	0.8
Manufacturing	4.4	3.9	5.3	2.4	2.4	1.0
Ore and mineral industries	39.6	4.3	0.7	0.3	10.2	2.1
Transportation (road, rail, air and marine)	1.7	42.3	8.7	1.6	32.1	1.2
Off-road vehicles and mobile equipment	<0.1	9.4	7.3	<0.1	21.8	0.9
Building heating and energy generation	0.5	3.3	0.2	0.1	0.6	0.3
Electric utilities	25.7	8.2	0.1	0.1	0.7	0.2
Home firewood burning	0.3	1.1	12.7	0.4	21.0	9.7
Incineration and waste	0.3	0.3	0.6	0.8	0.3	0.2
Paints and	<0.1	<0.1	18.5	n/a	<0.1	<0.1

Source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
solvents						
Agriculture (livestock, crop production and fertilizer)	0.7	0.2	6.4	93.6	<0.1	22.7
Dust and fires	<0.1	0.1	0.2	<0.1	0.9	60.1
Miscellaneous	<0.1	<0.1	2.9	0.1	0.1	0.9

Note: n/a = not available. The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.3. Data for Figure 3. Distribution of air pollutant emissions by province and territory, Canada, 2017

Province or territory	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)
Newfoundland and Labrador	1.7	2.7	1.6	0.2	1.8	1.2
Prince Edward Island	<0.1	0.2	0.4	0.6	0.5	0.3
Nova Scotia	7.1	3.6	2.2	0.7	2.9	1.6
New Brunswick	2.2	1.7	1.9	0.7	2.7	1.5
Quebec	11.4	11.0	16.1	13.4	27.5	12.6
Ontario	18.9	16.8	19.9	18.4	24.6	16.2
Manitoba	12.5	2.5	3.4	12.8	3.0	5.3
Saskatchewan	12.6	7.9	14.3	21.7	5.7	20.8
Alberta	25.2	35.7	31.3	27.4	17.9	35.3
British Columbia	8.2	16.5	8.7	4.1	13.0	5.0
Yukon	<0.1	0.1	0.1	<0.1	0.1	<0.1
Northwest Territories and Nunavut	0.2	1.2	0.1	<0.1	0.3	0.2

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The percentages have been rounded off and their sum may not add up to 100.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.4. Data for Figure 4. Total sulphur oxide emissions by source, Canada, 1990 to 2017

Year	Ore and mineral industries (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	1483.8	533.9	618.4	429.3	3 065.4
1991	1335.3	535.6	592.1	381.0	2 844.0
1992	1169.7	574.9	610.7	366.6	2 721.9
1993	1112.6	605.0	547.2	373.2	2 637.9
1994	891.9	598.5	559.8	375.5	2 425.8
1995	1105.9	593.9	532.7	330.4	2 562.9
1996	1089.1	590.8	542.2	350.4	2 572.4
1997	1032.1	547.3	591.4	354.4	2 525.3
1998	1019.4	513.4	603.6	353.3	2 489.7
1999	925.3	509.5	601.1	359.3	2 395.2
2000	915.9	504.7	619.2	361.2	2 401.0
2001	912.8	486.6	623.9	356.5	2 379.7
2002	895.6	457.3	624.3	351.6	2 328.8
2003	799.6	468.5	630.5	362.4	2 260.9
2004	862.6	460.3	581.6	368.4	2 272.8
2005	841.8	452.4	522.0	341.3	2 157.4
2006	810.2	415.6	458.9	269.3	1 954.1
2007	761.3	390.6	491.9	259.9	1 903.7
2008	699.9	368.7	427.5	227.3	1 723.4
2009	514.5	365.5	384.0	203.6	1 467.7
2010	489.7	332.9	334.0	198.2	1 354.9
2011	457.2	323.5	293.3	194.8	1 268.7
2012	465.2	325.2	284.3	181.0	1 255.7
2013	481.1	313.0	278.2	171.3	1 243.6
2014	477.3	280.9	269.2	170.9	1 198.3

Year	Ore and mineral industries (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2015	471.3	256.1	251.5	85.5	1 064.3
2016	469.3	246.7	253.1	78.5	1 047.5
2017	377.2	255.6	245.6	75.4	953.8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from transportation (road, rail, air and marine), off-road vehicles and mobile equipment, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, building heating and energy generation, manufacturing, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.5. Data for Figure 5. Sulphur oxide emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)
Newfoundland and Labrador	76.0	16.0
Prince Edward Island	3.7	0.4
Nova Scotia	213.8	67.8
New Brunswick	109.4	21.1
Quebec	260.2	108.6
Ontario	1 130.4	180.2
Manitoba	509.3	119.4
Saskatchewan	97.1	120.3
Alberta	516.5	240.3
British Columbia	129.8	78.2
Yukon	0.7	<0.1.
Northwest Territories and Nunavut	18.6	1.6

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.6. Data for Figure 7. Total nitrogen oxide emissions by source, Canada, 1990 to 2017

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	1 028.3	346.0	395.8	387.0	257.0	2 414.0
1991	977.4	339.3	380.3	377.4	250.9	2 325.3
1992	989.4	355.9	372.6	386.7	262.9	2 367.4

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1993	1 003.7	381.4	380.8	412.6	243.0	2 421.4
1994	1 054.8	413.2	387.5	446.4	240.0	2 541.9
1995	1 060.8	429.8	386.1	481.1	248.3	2 606.1
1996	1 116.0	441.8	383.2	472.6	269.3	2 683.0
1997	1 201.9	485.5	381.8	469.8	288.1	2 827.1
1998	1 278.2	496.4	368.5	422.9	310.4	2 876.5
1999	1 350.5	513.6	371.3	400.4	306.8	2 942.6
2000	1 362.7	459.1	373.9	393.3	327.1	2 916.1
2001	1 323.8	453.2	352.8	337.9	313.3	2 781.0
2002	1 253.3	453.2	376.1	324.8	315.1	2 722.5
2003	1 182.9	496.2	368.1	340.5	293.2	2 680.9
2004	1 148.3	430.6	363.1	341.5	267.7	2 551.1
2005	1 133.4	430.7	332.7	309.9	253.8	2 460.6
2006	1 084.4	441.3	281.7	286.1	224.5	2 318.0
2007	1 062.9	454.5	267.4	288.5	239.0	2 312.3
2008	1 019.9	464.1	248.1	279.7	226.5	2 238.3
2009	942.0	460.0	224.9	264.8	219.4	2 111.0
2010	925.9	451.9	230.1	283.5	235.0	2 126.3
2011	916.5	464.8	237.9	254.2	201.2	2 074.5
2012	884.5	460.9	236.4	223.0	167.6	1 972.3
2013	853.1	464.7	231.2	214.5	163.3	1 926.8
2014	802.2	476.7	235.7	200.9	168.6	1 884.1
2015	759.0	478.1	230.4	196.6	153.7	1 817.8
2016	753.3	470.8	223.1	161.7	154.3	1 763.2
2017	753.9	481.4	234.2	167.0	146.3	1 782.9

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, manufacturing, building heating and energy generation, home firewood burning, incineration and waste, agriculture (livestock, crop production and fertilizer), dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.7. Data for Figure 8. Nitrogen oxide emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)
Newfoundland and Labrador	63.2	47.4
Prince Edward Island	7.6	3.5
Nova Scotia	99.8	65.1
New Brunswick	79.1	29.9
Quebec	341.1	196.4
Ontario	618.7	299.8
Manitoba	74.7	44.6
Saskatchewan	145.5	141.0
Alberta	648.1	637.2
British Columbia	316.7	295.0
Yukon	3.9	1.6
Northwest Territories and Nunavut	15.6	21.5

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.8. Data for Figure 10. Total volatile organic compound emissions by source, Canada, 1990 to 2017

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	599.9	357.5	356.5	260.4	391.3	816.8	252.9	3 035.2
1991	594.5	350.0	351.4	260.3	375.1	789.1	249.7	2 970.2
1992	608.8	352.2	335.9	245.7	374.5	797.7	250.8	2 965.6
1993	635.5	351.4	352.1	267.3	373.0	817.6	266.4	3 063.4
1994	648.7	362.1	358.4	265.1	374.1	821.9	268.4	3 098.8
1995	660.7	375.2	342.1	263.1	362.1	822.3	258.5	3 084.0
1996	688.6	373.0	338.4	254.9	355.8	800.8	257.6	3 069.1
1997	678.6	374.9	322.6	244.5	356.2	761.5	252.3	2 990.5
1998	691.1	377.5	342.0	246.0	358.4	721.6	256.1	2 992.7
1999	650.7	389.5	325.0	241.4	354.8	703.8	253.6	2 918.8
2000	667.5	395.9	313.6	239.3	346.2	629.4	248.8	2 840.6
2001	675.5	375.7	289.7	236.7	335.5	473.6	223.5	2 610.2
2002	691.8	368.4	313.2	232.1	316.1	465.2	225.2	2 611.9
2003	689.5	370.0	269.5	243.6	296.5	444.1	209.6	2 522.7
2004	676.1	366.4	261.5	236.1	282.2	459.1	194.9	2 476.2
2005	677.6	365.9	246.3	232.4	253.0	383.4	181.6	2 340.1

Year	Oil and gas industry (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2006	665.4	351.0	237.7	219.6	235.5	366.1	159.4	2 234.7
2007	661.4	348.9	234.9	214.4	232.9	359.0	144.5	2 195.9
2008	673.4	339.9	235.3	209.3	241.9	335.1	129.6	2 164.5
2009	630.4	309.6	224.3	207.3	206.5	320.4	111.2	2 009.8
2010	634.6	316.4	235.9	206.0	200.6	310.5	116.4	2 020.4
2011	627.6	304.4	235.2	205.3	186.7	207.9	114.7	1 881.8
2012	682.0	309.2	234.4	202.3	178.2	181.1	115.1	1 902.3
2013	737.3	313.0	233.0	197.6	171.2	167.4	114.4	1 934.0
2014	767.2	322.2	231.5	203.9	158.2	161.5	107.4	1 951.9
2015	727.8	325.2	230.0	200.8	154.2	154.0	103.4	1 895.5
2016	661.0	326.0	231.3	199.2	158.5	128.7	101.9	1 806.6
2017	662.7	334.6	229.9	199.0	156.8	131.6	96.7	1 811.2

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, ore and mineral industries, dust and fires, building heating and energy generation, electric utilities, agriculture (livestock, crop production and fertilizer) and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.9. Data for Figure 11. Volatile organic compound emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)
Newfoundland and Labrador	54.6	29.1
Prince Edward Island	12.5	7.1
Nova Scotia	78.5	39.9
New Brunswick	89.8	34.4
Quebec	576.4	291.1
Ontario	904.6	359.6
Manitoba	97.4	62.3
Saskatchewan	170.8	259.8
Alberta	660.7	566.3
British Columbia	377.4	158.2
Yukon	2.0	0.9
Northwest Territories and Nunavut	10.4	2.5

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.10. Data for Figure 13. Total ammonia emissions by source, Canada, 1990 to 2017

Year	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	360.0	14.0	19.8	5.2	398.9
1991	356.8	14.0	18.8	5.3	395.0
1992	368.5	13.9	18.8	5.7	406.9
1993	371.0	14.8	18.2	6.1	410.2
1994	383.1	14.9	19.7	7.0	424.7
1995	400.9	16.6	26.4	7.7	451.4
1996	417.2	16.2	25.9	8.4	467.8
1997	422.7	16.3	25.0	9.3	473.3
1998	422.2	16.5	25.8	10.2	474.8
1999	420.1	15.0	24.6	11.1	470.8
2000	429.6	15.0	24.7	11.3	480.6
2001	433.1	14.1	21.5	11.8	480.6
2002	436.8	20.9	21.5	11.5	490.6
2003	443.0	12.6	18.6	11.2	485.4
2004	457.9	12.1	18.4	10.9	499.2
2005	454.2	12.7	17.0	10.6	494.6
2006	445.8	11.8	16.1	10.1	483.8
2007	451.2	10.9	16.1	10.0	488.2
2008	442.4	12.1	13.6	9.4	477.5
2009	429.3	11.9	12.6	9.0	462.8
2010	422.4	12.7	11.5	8.9	455.5
2011	420.0	12.3	11.8	8.6	452.6
2012	437.0	11.5	11.9	8.1	468.5
2013	450.2	12.6	11.2	8.0	482.0
2014	441.7	12.9	11.3	7.6	473.4
2015	444.3	11.6	11.7	7.4	475.0
2016	444.0	11.9	12.0	7.6	475.6
2017	445.7	11.6	11.3	7.5	476.1

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from incineration and waste, the oil and gas industry, home firewood burning, ore and mineral industries, electric utilities, building heating and energy generation, off-road vehicles and mobile equipment, dust and fires, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.11. Data for Figure 14. Ammonia emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)
Newfoundland and Labrador	1.1	1.0
Prince Edward Island	3.5	2.7
Nova Scotia	5.0	3.4
New Brunswick	4.6	3.4
Quebec	67.0	63.8
Ontario	112.1	87.5
Manitoba	38.4	60.9
Saskatchewan	48.9	103.3
Alberta	95.7	130.6
British Columbia	22.6	19.6
Yukon	<0.1	<0.1
Northwest Territories and Nunavut	<0.1	<0.1

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.12. Data for Figure 16. Total carbon monoxide emissions by source, Canada, 1990 to 2017

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	5 530.3	2 581.7	1 660.4	2 277.1	336.3	12 385.8
1991	5 321.9	2 511.4	1 636.4	2 373.5	324.8	12 168.0
1992	5 320.2	2 572.2	1 564.8	2 199.9	339.6	11 996.7
1993	5 305.5	2 640.0	1 637.9	2 378.9	363.1	12 325.4
1994	5 281.4	2 672.0	1 668.5	2 324.8	399.4	12 346.2
1995	5 067.6	2 720.3	1 593.1	2 367.1	407.9	12 156.0
1996	4 968.7	2 698.4	1 573.8	2 116.3	420.0	11 777.2
1997	4 968.2	2 606.6	1 502.7	1 849.2	469.8	11 396.5
1998	5 001.3	2 532.2	1 597.0	1 760.4	486.9	11 377.8
1999	4 895.0	2 525.4	1 521.8	1 688.7	499.3	11 130.2
2000	4 969.6	2 352.2	1 472.7	1 618.6	443.7	10 856.8
2001	4 716.3	1 956.4	1 364.1	1 510.2	467.8	10 014.8
2002	4 388.4	2 016.4	1 482.7	1 438.4	499.5	9825.5
2003	4 163.5	2 023.7	1 278.9	1 509.5	530.2	9505.7
2004	3 837.5	2 151.0	1 247.9	1 212.8	502.7	8951.9
2005	3 157.1	1 969.5	1 180.0	1 168.9	494.9	7970.5
2006	2 858.8	1 981.2	1 144.8	978.7	505.6	7469.1

Year	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
2007	2 738.0	1 970.7	1 146.8	924.1	523.5	7303.0
2008	2 591.4	1 878.9	1 161.2	935.9	540.9	7108.2
2009	2 398.4	1 805.3	1 121.1	897.1	525.4	6747.2
2010	2 289.9	1 792.0	1 193.9	873.5	521.3	6670.6
2011	2 088.7	1 545.2	1 204.2	868.4	531.0	6237.5
2012	1 990.7	1 392.3	1 213.9	897.6	532.4	6026.9
2013	1 945.6	1 372.8	1 206.3	834.1	564.2	5923.1
2014	1 790.2	1 389.2	1 198.2	888.9	549.5	5816.0
2015	1 765.6	1 344.6	1 190.3	865.9	557.0	5723.4
2016	1 841.2	1 205.0	1 195.1	896.2	537.6	5675.2
2017	1 819.1	1 232.8	1 187.5	870.1	552.4	5662.0

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from dust and fires, electric utilities, building heating and energy generation, incineration and waste, agriculture (livestock, crop production and fertilizer), paints and solvents, ore and mineral industries, manufacturing and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.13. Data for Figure 17. Carbon monoxide emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)
Newfoundland and Labrador	222.3	103.4
Prince Edward Island	63.6	29.2
Nova Scotia	343.3	163.6
New Brunswick	350.7	154.6
Quebec	2 670.4	1 559.7
Ontario	3 541.0	1 392.2
Manitoba	403.2	168.7
Saskatchewan	538.4	321.3
Alberta	1 842.0	1 015.6
British Columbia	2 377.4	733.6
Yukon	15.6	5.3
Northwest Territories and Nunavut	17.9	14.8

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.14. Data for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2017

Year	Dust and fires (emissions in kilotonnes)	Agriculture (livestock, crop production and fertilizer) (emissions in kilotonnes)	Home firewood burning (emissions in kilotonnes)	Other sources (emissions in kilotonnes)	Total emissions (emissions in kilotonnes)
1990	673.8	677.6	262.1	350.6	1 964.1
1991	670.3	670.4	258.4	326.4	1 925.5
1992	643.7	655.5	247.0	318.2	1 864.3
1993	652.0	641.0	258.5	313.1	1 864.6
1994	707.5	626.6	263.1	314.2	1 911.4
1995	651.0	612.2	251.2	314.0	1 828.4
1996	665.9	598.3	248.0	308.5	1 820.7
1997	729.8	584.5	234.8	302.7	1 851.8
1998	605.4	570.8	247.0	292.3	1 715.5
1999	638.2	557.2	232.9	289.7	1 717.9
2000	625.5	543.7	223.2	287.6	1 680.0
2001	642.8	530.4	204.2	257.3	1 634.7
2002	621.8	510.1	219.2	238.1	1 589.2
2003	652.2	489.9	186.4	228.4	1 556.9
2004	644.7	469.3	179.2	221.7	1 514.9
2005	663.6	449.4	166.8	216.0	1 495.8
2006	716.9	429.5	158.8	188.1	1 493.3
2007	791.6	415.9	158.5	184.6	1 550.6
2008	876.9	402.4	160.3	175.2	1 614.8
2009	775.9	389.2	154.4	159.8	1 479.3
2010	863.3	376.4	163.8	162.5	1 566.0
2011	913.5	363.1	164.8	151.0	1 592.5
2012	1 008.4	366.2	165.8	145.6	1 686.0
2013	1 003.7	369.0	164.7	141.0	1 678.3
2014	1 013.3	371.8	163.6	137.5	1 686.1
2015	1 012.2	374.7	162.5	125.6	1 674.9
2016	1 010.0	377.4	163.3	120.2	1 670.9
2017	1 006.6	380.1	162.2	125.1	1 674.0

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.14. Additional information for Figure 19. Total fine particulate matter emissions by source, Canada, 1990 to 2017

Year	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Incineration and waste (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)
1990	56.8	40.9	113.9	14.8	53.7	12.3	4.6	48.4	5.1	<0.1
1991	53.7	38.3	104.7	13.0	51.4	12.3	4.6	43.4	5.0	<0.1
1992	51.4	37.7	101.6	13.0	51.6	12.5	4.7	40.6	5.1	<0.1
1993	51.0	37.5	99.9	13.3	55.6	13.2	4.9	32.5	5.2	<0.1
1994	52.7	38.1	100.2	13.7	60.3	13.8	4.9	24.9	5.5	<0.1
1995	52.4	37.3	101.5	14.2	63.1	14.5	4.9	20.7	5.4	<0.1
1996	54.4	37.8	96.3	14.2	62.2	14.4	5.2	18.9	5.1	<0.1
1997	55.6	39.5	86.2	14.6	61.9	14.8	5.0	20.1	5.0	<0.1
1998	52.5	40.9	81.5	15.3	56.9	16.1	4.6	19.7	4.8	<0.1
1999	51.3	42.0	81.5	15.9	54.2	13.9	4.8	21.4	4.6	<0.1
2000	53.0	43.0	77.1	16.3	52.2	13.3	5.3	23.0	4.4	<0.1
2001	49.4	42.5	63.7	16.5	43.2	13.3	5.0	19.2	4.4	<0.1
2002	41.9	41.3	57.6	17.0	41.3	14.2	5.2	15.1	4.5	<0.1
2003	38.6	41.4	55.8	17.2	41.8	12.7	5.6	10.9	4.3	<0.1
2004	37.8	41.5	51.5	17.6	41.4	12.0	5.3	10.2	4.3	<0.1
2005	42.4	43.7	45.4	17.9	35.9	12.4	5.2	8.9	4.1	<0.1
2006	40.1	41.9	29.3	17.9	32.9	12.0	4.9	6.0	3.1	<0.1
2007	38.3	40.4	28.7	17.9	32.6	11.3	5.2	7.0	3.1	<0.1
2008	36.5	39.2	25.0	18.3	31.4	9.8	5.1	6.8	3.0	<0.1
2009	31.3	36.4	20.9	18.4	29.5	9.1	5.0	6.1	3.1	<0.1

Year	Ore and mineral industries (emissions in kilotonnes)	Transportation (road, rail, air and marine) (emissions in kilotonnes)	Manufacturing (emissions in kilotonnes)	Miscellaneous (emissions in kilotonnes)	Off-road vehicles and mobile equipment (emissions in kilotonnes)	Oil and gas industry (emissions in kilotonnes)	Building heating and energy generation (emissions in kilotonnes)	Electric utilities (emissions in kilotonnes)	Incineration and waste (emissions in kilotonnes)	Paints and solvents (emissions in kilotonnes)
2010	34.4	35.7	20.9	18.1	30.9	9.0	4.7	5.7	3.1	<0.1
2011	33.0	33.8	20.5	17.3	24.6	9.5	5.0	4.4	2.9	<0.1
2012	35.1	31.7	19.6	17.4	21.2	10.0	4.6	3.3	2.7	<0.1
2013	32.3	29.9	19.8	17.2	19.8	11.1	4.8	3.3	2.7	<0.1
2014	32.0	27.7	18.6	16.6	18.3	12.9	5.1	3.6	2.7	<0.1
2015	31.0	20.2	18.0	15.6	17.7	12.0	4.8	3.5	2.7	<0.1
2016	32.0	20.1	16.5	15.7	14.0	11.2	4.6	3.4	2.7	<0.1
2017	34.7	20.1	16.3	15.7	14.5	12.9	4.8	3.3	2.8	<0.1

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation. The category "other sources" includes emissions from ore and mineral industries, transportation (road, rail, air and marine), manufacturing, off-road vehicles and mobile equipment, the oil and gas industry, building heating and energy generation, electric utilities, incineration and wastes, paints and solvents, and other miscellaneous sources. Consult Table 2 in the Data sources and methods for a complete list of the air pollutant emissions sources included under each category. The numbers have been rounded off and their sum may not correspond to the total.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.15. Data for Figure 20. Fine particulate matter emissions by province and territory, Canada, 1990 and 2017

Province or territory	1990 (emissions in kilotonnes)	2017 (emissions in kilotonnes)	1990, excluding open sources [A] (emissions in kilotonnes)	2017, excluding open sources [A] (emissions in kilotonnes)
Newfoundland and Labrador	28.4	20.2	19.3	9.2
Prince Edward Island	7.2	5.8	3.3	2.5
Nova Scotia	40.3	26.7	25.1	12.8
New Brunswick	40.4	24.6	23.9	9.7
Quebec	249.6	211.3	159.3	96.5
Ontario	323.3	270.5	155.3	70.2
Manitoba	104.0	87.9	16.7	7.6
Saskatchewan	478.8	348.4	25.1	12.6
Alberta	509.4	590.7	76.8	30.7
British Columbia	175.6	84.2	106.0	34.4
Yukon	3.1	0.8	0.3	0.1
Northwest Territories and Nunavut	4.1	3.1	1.6	1.0

Note: [A] Open sources include emissions associated with dust and fires and agriculture (livestock, crop production and fertilizer). The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires and from vegetation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.16. Data for Figure 22. Total black carbon emissions by source, Canada, 201

Source	2017 (emissions in kilotonnes)	2017 (percentage of national emissions)
Home firewood burning	11.5	31.8
Transportation (road, rail, air and marine)	11.0	30.4
Off-road vehicles and mobile equipment	8.7	24.0
Oil and gas industry	2.9	7.9
Building heating and energy generation	1.1	3.0
Other sources	1.1	3.0

Note: The indicator reports air pollutant emissions from human activities only. It does not include emissions from natural sources such as forest fires. The chart includes emissions from the most significant sources of black carbon. "Other sources" includes emissions from ore and mineral industries, manufacturing, electric utilities and agriculture. Consult Table 2 in the Data sources and methods for more details.
Source: Environment and Climate Change Canada (2019) Canada's Black Carbon Emissions Inventory.

Table A.17. Data for Figure 23. Contribution of transportation, off-road vehicles and mobile equipment to total air pollutant emissions by transportation mode, Canada, 2017

Transportation mode	Carbon monoxide (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Sulphur oxides (percentage of national emissions)	Ammonia (percentage of national emissions)
Passenger cars and motorcycles	9.1	2.6	2.7	< 0.1	< 0.1	0.6
Passenger light trucks	13.3	4.2	3.3	< 0.1	< 0.1	0.7
Large trucks and buses	8.2	15.1	1.6	0.6	< 0.1	0.2
Air, marine and rail travel	1.5	20.4	1.0	0.4	1.6	< 0.1
Off-road vehicles and equipment, tire wear and brake lining	21.8	9.4	7.3	1.0	< 0.1	< 0.1

Note: "Passenger cars and motorcycles" include light-duty vehicles powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.17. Additional information for Figure 23. Emissions of air pollutants emissions from transportation, off-road vehicles and mobile equipment by transportation mode, Canada, 2017

Transportation mode	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Passenger cars and motorcycles	515.1	45.6	49.3	1.1	0.5	2.9
Passenger light trucks	753.5	74.3	60.1	1.3	0.7	3.1
Large trucks and buses	464.9	269.7	28.5	9.4	0.3	1.0
Air, marine and rail travel	85.6	364.3	18.9	6.8	14.9	0.4
Off-road vehicles and equipment, tire wear and brake lining	1 232.8	167.0	131.6	16.0	0.2	0.3

Note: "Passenger cars and motorcycles" include light-duty vehicles powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines as well as all types of motorcycles. "Passenger light trucks" include light-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines. "Large trucks and buses" include heavy-duty trucks powered by motor gasoline, diesel, liquefied petroleum gas and compressed natural gas engines.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.18. Data for Figure 24. Changes in emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2017

Year	Nitrogen oxides (percentage change from 1990 level)	Carbon monoxide (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)
1990	0	0	0
1991	-4	-3	-4
1992	-3	-3	-3
1993	0	-2	-1
1994	6	-2	-1
1995	9	-4	-2
1996	12	-5	-4
1997	18	-7	-7
1998	20	-7	-11
1999	24	-9	-12
2000	24	-10	-19
2001	17	-18	-33
2002	11	-21	-35
2003	8	-24	-39
2004	5	-26	-39
2005	2	-37	-47
2006	-3	-40	-50
2007	-5	-42	-51
2008	-8	-45	-52
2009	-15	-48	-56
2010	-15	-50	-58
2011	-17	-55	-67
2012	-22	-58	-70
2013	-25	-59	-72
2014	-29	-61	-74
2015	-32	-62	-74
2016	-35	-62	-76
2017	-35	-62	-76

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.18 Additional information for Figure 24. Emissions of key air pollutants from transportation, off-road vehicles and mobile equipment, Canada, 1990 to 2017

Year	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)
1990	1 415.3	8 112.1	1 208.0
1991	1 354.7	7 833.3	1 164.2
1992	1 376.1	7 892.4	1 172.2
1993	1 416.2	7 945.5	1 190.7
1994	1 501.2	7 953.4	1 196.0
1995	1 541.9	7 787.8	1 184.4
1996	1 588.6	7 667.2	1 156.6
1997	1 671.7	7 574.8	1 117.7
1998	1 701.1	7 533.4	1 080.0
1999	1 750.9	7 420.4	1 058.5
2000	1 756.0	7 321.8	975.5
2001	1 661.7	6 672.7	809.1
2002	1 578.1	6 404.8	781.3
2003	1 523.4	6 187.1	740.5
2004	1 489.7	5 988.5	741.3
2005	1 443.3	5 126.7	636.3
2006	1 370.5	4 840.0	601.6
2007	1 351.5	4 708.6	591.9
2008	1 299.6	4 470.3	577.0
2009	1 206.8	4 203.6	526.9
2010	1 209.4	4 081.9	511.0
2011	1 170.7	3 633.9	394.6
2012	1 107.5	3 382.9	359.3
2013	1 067.6	3 318.4	338.6
2014	1 003.1	3 179.4	319.7
2015	955.6	3 110.2	308.2
2016	915.0	3 046.2	287.2
2017	920.9	3 052.0	288.4

Note: Fine particulate matter, sulphur oxides and ammonia are not shown in the chart due to their low share (≤ 5%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.19. Data for Figure 25. Contribution of electric utilities to total air pollutant emissions by fuel source, Canada, 2017

Fuel source	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Volatile organic compounds (percentage of national emissions)	Ammonia (percentage of national emissions)
Coal	24.8	6.2	0.3	0.1	<0.1	<0.1
Natural gas	0.1	0.9	0.2	<0.1	<0.1	<0.1
Diesel	<0.1	0.5	<0.1	<0.1	<0.1	n/a
Other sources	0.9	0.6	0.1	<0.1	<0.1	<0.1

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other" fuel sources include waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.19. Additional information for Figure 25. Emissions of air pollutants from electric utilities by fuel source, Canada, 2017

Fuel source	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Coal	236.1	110.4	18.7	2.2	0.4	0.2
Natural gas	1.1	15.8	14.0	0.3	0.5	<0.1
Diesel	0.1	9.8	1.4	0.2	0.1	n/a
Other sources	8.3	10.4	8.1	0.6	0.3	0.1

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose. "Other" fuel sources include waste material and other uncategorized sources of electricity generation.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.20. Data for Figure 26. Changes in emissions of key air pollutants from electric utilities, Canada, 1990 to 2017

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)
1990	0	0
1991	-4	-2
1992	-1	2
1993	-12	-5
1994	-9	-7
1995	-14	-3
1996	-12	5
1997	-4	12
1998	-2	21
1999	-3	19
2000	0	27
2001	1	22
2002	1	23
2003	2	14
2004	-6	4
2005	-16	-1
2006	-26	-13
2007	-20	-7
2008	-31	-12
2009	-38	-15
2010	-46	-9
2011	-53	-22

Year	Sulphur oxides (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)
2012	-54	-35
2013	-55	-36
2014	-56	-34
2015	-59	-40
2016	-59	-40
2017	-60	-43

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.20. Additional information for Figure 26. Emissions of key air pollutants from electric utilities, Canada, 1990 to 2017

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
1990	618.4	257.0
1991	592.1	250.9
1992	610.7	262.9
1993	547.2	243.0
1994	559.8	240.0
1995	532.7	248.3
1996	542.2	269.3
1997	591.4	288.1
1998	603.6	310.4
1999	601.1	306.8
2000	619.2	327.1
2001	623.9	313.3
2002	624.3	315.1
2003	630.5	293.2
2004	581.6	267.7
2005	522.0	253.8
2006	458.9	224.5
2007	491.9	239.0
2008	427.5	226.5
2009	384.0	219.4
2010	334.0	235.0
2011	293.3	201.2
2012	284.3	167.6
2013	278.2	163.3

Year	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)
2014	269.2	168.6
2015	251.5	153.7
2016	253.1	154.3
2017	245.6	146.3

Note: Carbon monoxide, fine particulate matter, volatile organic compounds and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017. Excludes emissions from industries that generate electricity and heat as a supporting activity rather than as their primary purpose.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.21. Data for Figure 27. Contribution of the oil and gas industry to total air pollutant emissions by activity type, Canada, 2017

Activity type	Volatile organic compounds (percentage of national emissions)	Sulphur oxides (percentage of national emissions)	Nitrogen oxides (percentage of national emissions)	Carbon monoxide (percentage of national emissions)	Fine particulate matter (percentage of national emissions)	Ammonia (percentage of national emissions)
Upstream oil and gas	35.4	21.9	26.0	9.4	0.7	0.5
Downstream oil and gas	1.2	4.9	1.0	0.4	0.1	<0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.21. Additional information for Figure 27. Emissions of air pollutants from the oil and gas industry, Canada, 2017

Activity type	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Carbon monoxide (emissions in kilotonnes)	Fine particulate matter (emissions in kilotonnes)	Ammonia (emissions in kilotonnes)
Upstream oil and gas	641.4	208.8	464.3	531.2	11.4	2.6
Downstream oil and gas	21.3	46.8	17.1	21.2	1.5	0.1

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.22. Data for Figure 28. Changes in emissions of key air pollutants from the oil and gas industry, Canada, 1990 to 2017

Year	Carbon monoxide (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Sulphur oxides (percentage change from 1990 level)
1990	0	0	0	0
1991	-3	-2	-1	0
1992	1	3	1	8
1993	8	10	6	13
1994	19	19	8	12
1995	21	24	10	11
1996	25	28	15	11
1997	40	40	13	3
1998	45	43	15	-4
1999	48	48	8	-5
2000	32	33	11	-5
2001	39	31	13	-9
2002	49	31	15	-14
2003	58	43	15	-12
2004	49	24	13	-14
2005	47	24	13	-15
2006	50	28	11	-22
2007	56	31	10	-27
2008	61	34	12	-31
2009	56	33	5	-32
2010	55	31	6	-38
2011	58	34	5	-39
2012	58	33	14	-39
2013	68	34	23	-41
2014	63	38	28	-47
2015	66	38	21	-52

Year	Carbon monoxide (percentage change from 1990 level)	Nitrogen oxides (percentage change from 1990 level)	Volatile organic compounds (percentage change from 1990 level)	Sulphur oxides (percentage change from 1990 level)
2016	60	36	10	-54
2017	64	39	10	-52

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Table A.22. Additional information for Figure 28. Emissions of key air pollutants from the oil and gas industry, Canada, 1990 t0 2017

Year	Carbon monoxide (emissions in kilotonnes)	Nitrogen oxides (emissions in kilotonnes)	Volatile organic compounds (emissions in kilotonnes)	Sulphur oxides (emissions in kilotonnes)
1990	336.3	346.0	599.9	533.9
1991	324.8	339.3	594.5	535.6
1992	339.6	355.9	608.8	574.9
1993	363.1	381.4	635.5	605.0
1994	399.4	413.2	648.7	598.5
1995	407.9	429.8	660.7	593.9
1996	420.0	441.8	688.6	590.8
1997	469.8	485.5	678.6	547.3
1998	486.9	496.4	691.1	513.4
1999	499.3	513.6	650.7	509.5
2000	443.7	459.1	667.5	504.7
2001	467.8	453.2	675.5	486.6
2002	499.5	453.2	691.8	457.3
2003	530.2	496.2	689.5	468.5
2004	502.7	430.6	676.1	460.3
2005	494.9	430.7	677.6	452.4
2006	505.6	441.3	665.4	415.6
2007	523.5	454.5	661.4	390.6
2008	540.9	464.1	673.4	368.7
2009	525.4	460.0	630.4	365.5
2010	521.3	451.9	634.6	332.9
2011	531.0	464.8	627.6	323.5
2012	532.4	460.9	682.0	325.2
2013	564.2	464.7	737.3	313.0
2014	549.5	476.7	767.2	280.9
2015	557.0	478.1	727.8	256.1
2016	537.6	470.8	661.0	246.7
2017	552.4	481.4	662.7	255.6

Note: Fine particulate matter and ammonia are not shown in the chart due to their low share (≤ 1%) of total emissions in 2017.
Source: Environment and Climate Change Canada (2019) Air Pollutant Emissions Inventory.

Additional information can be obtained at:

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