Environment and Climate Change Canada
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INTERNATIONAL COMPARISON: AIR POLLUTANT EMISSIONS IN SELECTED COUNTRIES

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

INTERNATIONAL COMPARISON: AIR POLLUTANT EMISSIONS IN SELECTED COUNTRIES

December 2021

Table of contents

List of Figures

List of Tables

International comparison: air pollutant emissions in selected countries

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. Air pollution can affect human health, the environment, buildings, structures and the economy. These 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 (OECD).

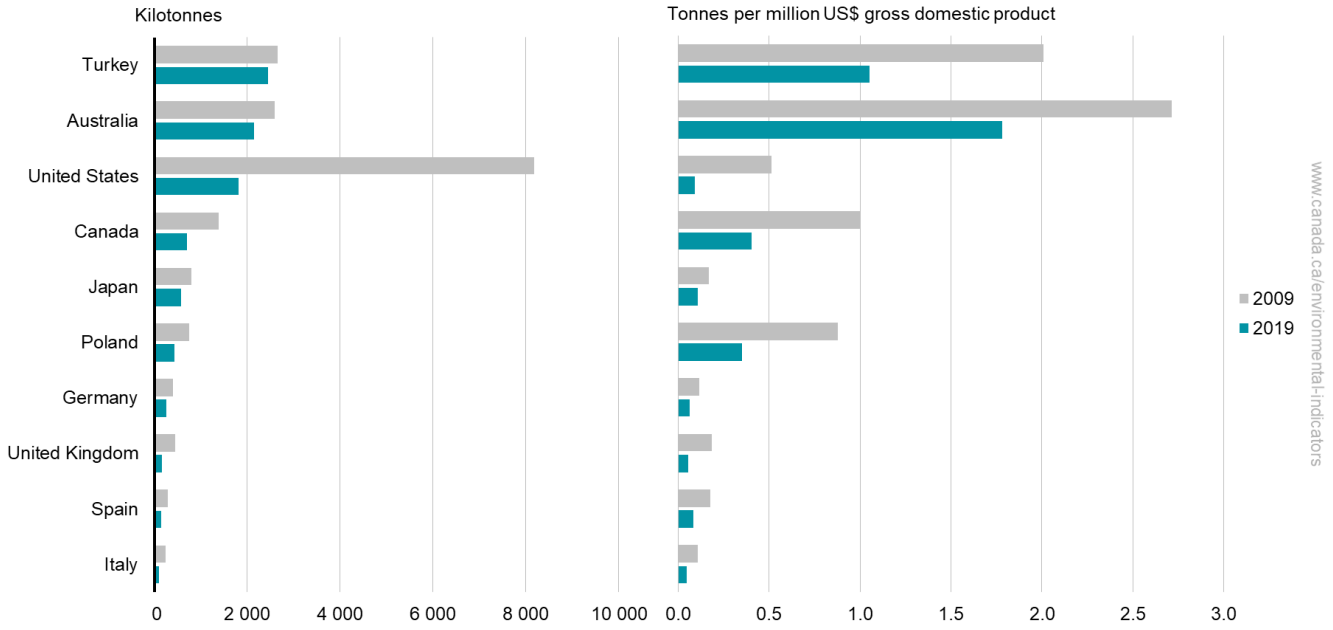
Sulphur oxides

Key results

In 2019, Canada:

- saw a decrease of 50% in sulphur oxides (SO_X) emissions from 2009 levels
- ranked fourth highest in SO_X emissions among OECD member countries
- had the third highest ratio of SO_X emissions to gross domestic product among the top 10 emitting OECD member countries

Figure 1. Sulphur oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and 2019



Data for Figure 1

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Although Canada's SO_X emissions declined by 692 kilotonnes from 2009 to 2019, Canada ranked as one of the highest emitters among OECD member countries, behind Turkey, Australia and the United States. Of the top 10 emitters, the United States experienced the largest decrease (6 362 kilotonnes, or 78%), driven by reduced emissions from the coal-fired electricity production industry.

All of the top 10 emitting member countries experienced declines in emissions between 2009 and 2019.

In terms of the ratio of SO_X emissions to gross domestic product, all top 10 emitting member countries reported declines ranging between 34% and 82% from 2009 to 2019.

Note that, in 2009, South Korea was the 10th highest in SO_X emissions among OECD member countries with 388 kilotonnes. Since no data was available for 2019, South Korea is not represented in the comparison as the top 10 emitting countries are based on 2019 emissions.

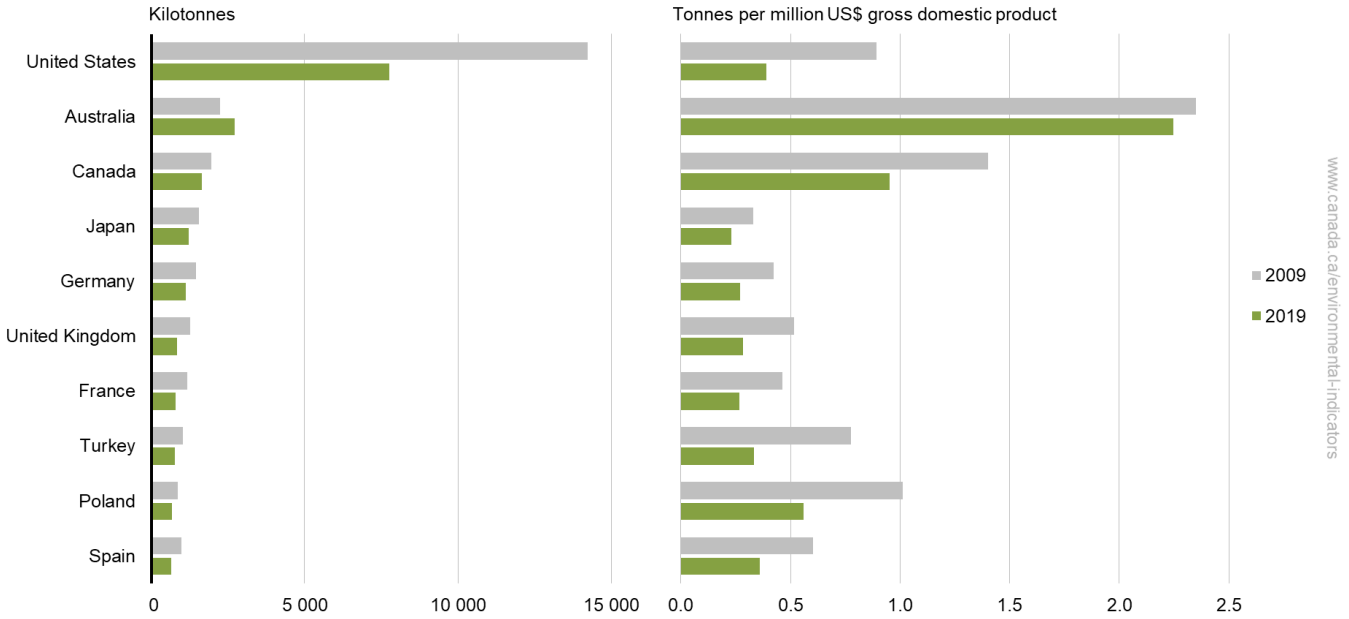
Nitrogen oxides

Key results

In 2019, Canada:

- saw a decrease of 15% in nitrogen oxides (NO_X) emissions from 2009 levels
- ranked third highest in NO_X emissions among OECD member countries
- had the second highest ratio of NO_X emissions to gross domestic product among the top 10 emitting OECD member countries

Figure 2. Nitrogen oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and 2019



Data for Figure 2

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

In 2019, Canada ranked as one of the highest emitters among OECD member countries, behind the United States and Australia, despite a reduction of 300 kilotonnes in NO_X emissions between 2009 and 2019. Of the top 10 emitting members, the United States experienced the largest reduction over that period (6 458 kilotonnes, or 45%). In 2019, emissions in Australia were 21% higher than in 2009.

Emissions intensity, the ratio of NO_X emissions to gross domestic product, was lower in 2019 than it was in 2009 for all top 10 emitting member countries. The reductions in intensity were between 4% and 57%.

Note that, in 2009, South Korea was the ninth highest in NO_X emissions among OECD member countries with 1 014 kilotonnes. Since no data was available for 2019, South Korea is not represented in the comparison as the top 10 emitting countries are based on 2019 emissions.

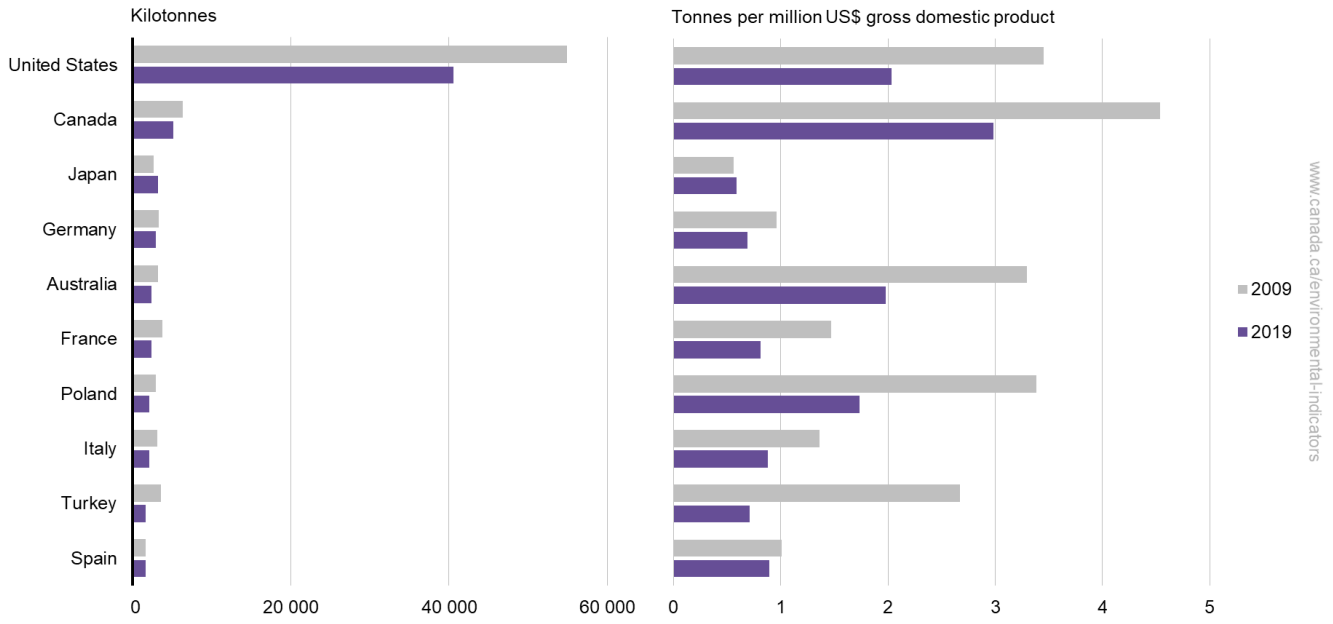
Carbon monoxide

Key results

In 2019, Canada:

- saw a decrease of 18% in carbon monoxide (CO) emissions from 2009 levels
- ranked second highest in CO emissions among OECD member countries
- had the highest ratio of CO emissions to gross domestic product among the top 10 emitting OECD member countries

Figure 3. Carbon monoxide emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and 2019



Data for Figure 3

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.

Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

In 2019, the United States was the highest CO emitting country, followed by Canada. The top 10 emitting member countries of the OECD experienced declines in emissions between 2% and 53% in 2019 from 2009 levels.

Except for Japan, declines were also observed in the ratio of CO emissions to gross domestic product between 2009 and 2019; they ranged from 12% to 73% for the top 10 emitting countries.

Note that, in 2009, Chile was the third highest in CO emissions among OECD member countries with 4 718 kilotonnes. Since no data was available for 2019, Chile is not represented in the comparison as the top 10 emitting countries are based on 2019 emissions.

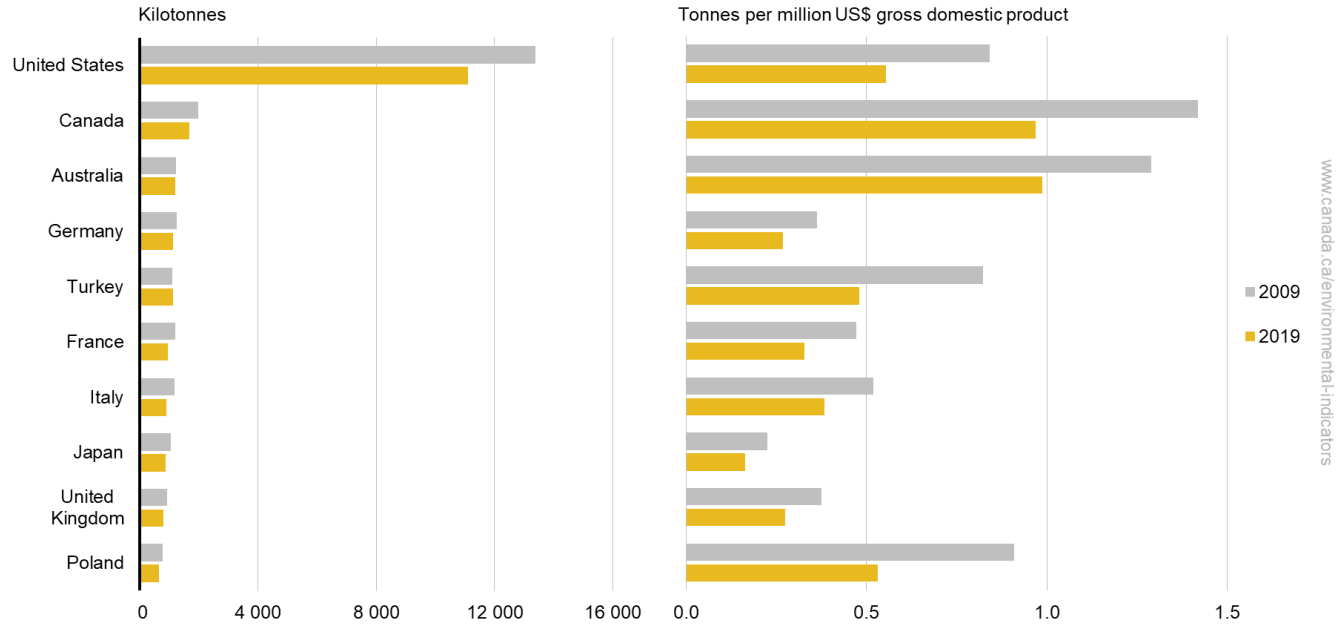
Volatile organic compounds

Key results

In 2019, Canada:

- saw a decrease of 15% in volatile organic compounds (VOC) emissions from 2009 levels
- ranked second highest in VOC emissions among OECD member countries
- had the second highest ratio of VOC emissions to gross domestic product among the top 10 emitting OECD member countries

Figure 4. Volatile organic compounds emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and 2019



Data for Figure 4

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Although Canada's VOC emissions declined by 296 kilotonnes between 2009 and 2019, Canada ranked as one of the highest emitters among the member countries of the OECD, behind the United States. Most of the top 10 emitting member countries experienced declines in emissions between 2009 and 2019, with the exception of Turkey whose emissions increased by 3%.

The reductions in emissions intensity range from 23% to 42% between 2009 and 2019 for the top 10 emitting member countries.

Note that, in 2009, Chile was the second highest in VOC emissions among OECD member countries with 2 381 kilotonnes. Since no data was available for 2019, Chile is not represented in the comparison as the top 10 emitting countries are based on 2019 emissions.

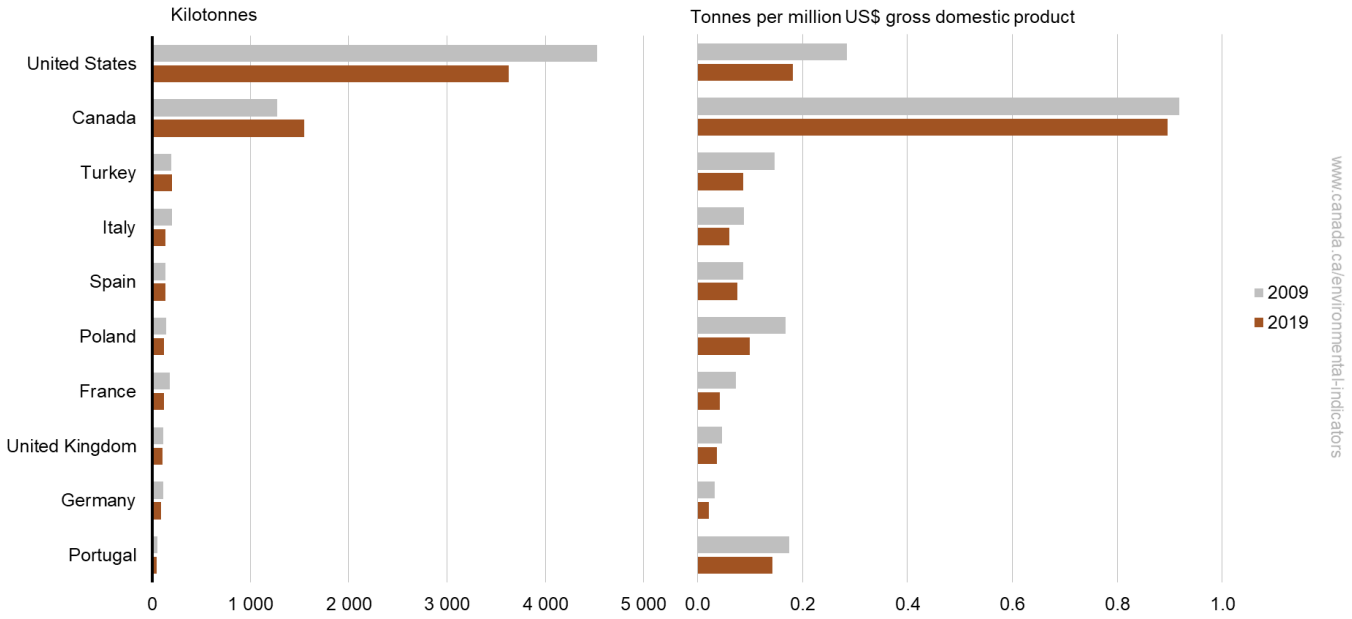
Fine particulate matter

Key results

In 2019, Canada:

- saw an increase of 21% in fine particulate matter ($PM_{2.5}$) emissions from 2009 levels
- ranked second highest in $PM_{2.5}$ emissions among OECD member countries
- had the highest ratio of $PM_{2.5}$ emissions to gross domestic product among OECD member countries

Figure 5. Fine particulate matter emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and 2019



Data for Figure 5

Note: Definitions of pollution sources and estimation methods may differ from country to country. Canada and the United States include open sources such as dust from roads, prescribed forest burning and agriculture in their $PM_{2.5}$ emissions. These sources are not always reported by other OECD member countries. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Canada and Turkey experienced an increase in $PM_{2.5}$ emissions in 2019 from 2009 levels, by 273 and 8 kilotonnes respectively. Despite these increases in emissions, all the top 10 member countries experienced declines in their emissions intensity, which varied between 3% and 42%, from 2009 to 2019.

Canada and the United States include open sources[1] such as dust from roads, prescribed forest burning and agriculture in their $PM_{2.5}$ emissions. These sources are not always reported by other OECD member countries.

Note that, in 2009, Chile was the third highest in $PM_{2.5}$ emissions among OECD member countries with 381 kilotonnes. Since no data was available for 2019, Chile is not represented in the comparison as the top 10 emitting countries are based on 2019 emissions.

[1] Canada's Air Pollutant Emission Inventory reported that, in 2019, national emissions from dust, agriculture and controlled fires accounted for 1 349 kilotonnes (87%) of Canada's total of $PM_{2.5}$.

About the indicators

What the indicators measure

These indicators present total emissions and emissions intensity for member countries of the Organisation for Economic Co-operation and Development (OECD). The emissions of 5 pollutants are reported: sulphur oxides (SO_X), nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOCs), and fine particulate matter ($PM_{2.5}$). The indicators focus on the top 10 emitting member countries of the OECD.

Why these indicators are important

These indicators help to inform Canadians about how Canada's emissions compare to those of other countries. The indicators report on key air pollutants that contribute to smog and acid rain and help the government to identify priorities, track progress, and develop strategies and policies for reducing or controlling air pollution.

Exposure to air pollutants on a daily basis can cause adverse health and environmental effects. Fine particulate matter is a key component of smog along with ground-level ozone (O_3) and has been associated with pulmonary and cardiovascular health issues. 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. NO_X, SO_X (such as sulphur dioxide [SO_2]), and VOCs also lead to the formation of $PM_{2.5}$ in the air. This is in addition to the $PM_{2.5}$ that is emitted directly from sources such as road dust and prescribed forest burning. SO_X and NO_X can also lead to the formation of acid rain that can harm the environment, materials, living organisms and humans.

Irrespective of downward trends observed in emissions, localized air quality issues may still arise when emission sources are spatially concentrated.

Consult Air pollution: drivers and impacts for more information on the human health, environmental and economic impacts of air pollution.

Related indicators

The 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. For each air pollutant, data are provided at the national, provincial/territorial and facility level and by major source.

The Air quality indicators track ambient concentrations of fine particulate matter ($PM_{2.5}$), ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and volatile organic compounds (VOCs) at the national and regional levels and at local monitoring stations.

The International comparison of urban air quality indicators present and compare the air quality in selected Canadian urban areas with a population greater than 1 million to the air quality in selected international urban areas having comparable data.

Data sources and methods

Data sources

Air pollutant emissions data for the indicators come from the Organisation for Economic Co-operation and Development OECD.Stat database, specifically the Air emissions by source table under the Environment (Air and Climate) grouping.

The gross domestic product data were obtained from the Main aggregate tables of the National accounts (Annual national accounts) in the same database.

More information

At the time of this update the OECD.Stat database contained emissions data up to the end of 2019, reflecting delays in the collection and aggregation of international data. Data are collected for each member country from the following sources:

- the Centre on Emission Inventories and Projections database (as of August 2021) of the Convention on Long-Range Transboundary Air Pollution
- the National Inventory Submissions 2021 (as of August 2021) of the United Nations Framework Convention on Climate Change
- the replies to the OECD Questionnaire on the State of the Environment and comments from member countries received before late August 2021
- national data from specific countries

The OECD.Stat database indicates the source used to report emissions for each country, pollutant and year.

Methods

Two (2) years of data are used to compare the emissions from 38 member countries of the Organisation for Economic Co-operation and Development (OECD): 2019, which is the latest year with available information, and 2009, 10 years prior.

For each air pollutant, 2009 and 2019 emissions are compiled and ranked in relation to total emissions in 2019. While the focus is on the top 10 emitting OECD member countries, emissions for all 38 member countries are provided, when available.

The emission intensity indicators are calculated by dividing a country's emissions by its gross domestic product value for that year.

More information

Air pollutant emissions indicators

Emissions for each member country are estimated or measured using one or several of the following methods:

- continuous emission monitoring systems
- predictive emission monitoring
- source testing
- mass balance
- site-specific emission factors
- published emission factors
- engineering estimates
- special studies

Generally, each country compiles and estimates its air pollutant emissions combining facility-level emissions (aka point sources) with sector-level emissions (or area sources).

Canada's data are derived from the annual Convention on Long-Range Transboundary Air Pollution submission to the Centre on Emission Inventories and Projections database. The submitted air pollutant emission data are based on Canada's Air Pollutant Emission Inventory. This includes information reported by facilities to the National Pollutant Release Inventory as well as emission estimates compiled for non-reporting facilities, non-reporting sources such as motor vehicles or non-reported pollutants (in-house emissions estimates).

Air pollution emissions per unit of gross domestic product

The emissions intensity indicators are expressed in tonnes of pollutants emitted per million United States dollars using constant gross domestic product at purchasing power parity for the base year 2010. Purchasing power parity is a weighted average of the relative prices, quoted in national currency, of comparable items between countries. Using purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.

Countries included in the comparison

The indicators include all member countries of the OECD as of September 2021. The data presented in the indicator reflect data completeness in the OECD.Stat database at the time of reporting.

Caveats and limitations

Air pollutant emission inventories from different countries are estimated with the best data, measurements and methodologies available. While national emission inventories follow a common reporting structure, emissions estimation methodologies and coverage among countries may differ. Users should be cautious when comparing the data.

The indicators exclude non-anthropogenic (natural sources) emissions and emissions from international aviation and maritime transport.

Emissions from sources such as dust from roads, prescribed forest fires and agriculture are also included in Canada's values. These sources are not always reported by other countries.

Emissions reported for Canada in this indicator may be slightly different from the emissions reported in the Canadian Environmental Sustainability Indicators' Air pollutant emissions. Those indicators are based on data from Canada's Air Pollutant Emission Inventory.

Adjustments may be made to Canada's national totals after the final submission to the database OECD.Stat, which may result in slight differences in the values reported.

Resources

References

Centre on Emission Inventories and Projections, European Monitoring and Evaluation Programme (2021) Submissions 2021. Retrieved on September 16, 2021.

Environment and Climate Change Canada (2021) Canada's Air Pollutant Emissions Inventory Report (PDF; 4.14 MB). Retrieved on September 16, 2021.

Organisation for Economic Co-operation and Development (2021) OECD.Stat. Retrieved on September 16, 2021.

Related information

Air pollution: Drivers and impacts

Annex

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

Table A.1A. Data for Figure 1. Sulphur oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 sulphur oxides emissions (kilotonnes)	2019 sulphur oxides emissions (kilotonnes)	2009 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
Turkey	2 663	2 454	2.01	1.05
Australia	2 598	2 154	2.71	1.78
United States	8 182	1 820	0.51	0.09
Canada	1 393	701	1.00	0.41
Japan	803	577	0.17	0.11
Poland	745	427	0.88	0.35
Germany	396	263	0.12	0.06
United Kingdom	452	163	0.18	0.06
Spain	285	150	0.18	0.08
Italy	241	105	0.11	0.05

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.2B. Data for Figure 1. Sulphur oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 sulphur oxides emissions (kilotonnes)	2019 sulphur oxides emissions (kilotonnes)	2009 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
France	294	100	0.12	0.03
Greece	392	80	1.04	0.27
Czech Republic	169	80	0.53	0.20
New Zealand	74	79	0.51	0.40
Iceland	72	58	4.90	3.01
Portugal	72	44	0.23	0.13
Finland	60	30	0.27	0.12

Country	2009 sulphur oxides emissions (kilotonnes)	2019 sulphur oxides emissions (kilotonnes)	2009 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 sulphur oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
Belgium	73	29	0.16	0.05
Netherlands	39	23	0.05	0.02
Estonia	55	19	1.73	0.42
Hungary	30	17	0.13	0.06
Sweden	27	16	0.07	0.03
Norway	15	16	0.05	0.05
Slovak Republic	63	16	0.46	0.09
Lithuania	19	12	0.28	0.12
Austria	15	11	0.04	0.02
Ireland	33	11	0.14	0.03
Denmark	16	10	0.06	0.03
Switzerland	10	4	0.02	0.01
Slovenia	10	4	0.16	0.06
Latvia	7	4	0.15	0.07
Luxembourg	2	1	0.04	0.02
South Korea	388	n/a	0.25	n/a
Chile	330	n/a	1.04	n/a
Israel	154	n/a	0.66	n/a
Colombia	n/a	n/a	n/a	n/a
Costa Rica	n/a	n/a	n/a	n/a
Mexico	n/a	n/a	n/a	n/a

Note: n/a = not available. Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.3A. Data for Figure 2. Nitrogen oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 nitrogen oxides emissions (kilotonnes)	2019 nitrogen oxides emissions (kilotonnes)	2009 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
United States	14 221	7 762	0.89	0.39
Australia	2 250	2 715	2.35	2.25
Canada	1 949	1 649	1.40	0.95
Japan	1 559	1 228	0.33	0.23
Germany	1 455	1 133	0.42	0.27
United Kingdom	1 269	837	0.52	0.28
France	1 171	780	0.46	0.27
Turkey	1 029	779	0.78	0.33
Poland	862	680	1.01	0.56
Spain	977	648	0.60	0.36

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.4B. Data for Figure 2. Nitrogen oxides emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 nitrogen oxides emissions (kilotonnes)	2019 nitrogen oxides emissions (kilotonnes)	2009 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
Italy	971	629	0.43	0.27
Greece	435	249	1.16	0.83
Netherlands	340	220	0.42	0.24
New Zealand	154	177	1.05	0.89
Czech Republic	251	172	0.78	0.42
Belgium	238	156	0.50	0.28
Norway	207	153	0.73	0.46
Portugal	213	144	0.68	0.42
Austria	202	142	0.50	0.30
Sweden	165	128	0.40	0.24
Finland	170	114	0.76	0.45

Country	2009 nitrogen oxides emissions (kilotonnes)	2019 nitrogen oxides emissions (kilotonnes)	2009 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 nitrogen oxides emissions intensity (tonnes per million United States dollars of gross domestic product)
Hungary	151	114	0.64	0.37
Ireland	128	100	0.56	0.24
Denmark	154	98	0.60	0.32
Slovak Republic	88	60	0.65	0.33
Switzerland	84	59	0.17	0.10
Lithuania	52	51	0.76	0.52
Latvia	39	33	0.89	0.60
Slovenia	48	29	0.77	0.38
Estonia	36	25	1.14	0.55
Iceland	28	21	1.90	1.07
Luxembourg	38	18	0.77	0.28
South Korea	1 014	n/a	0.65	n/a
Chile	220	n/a	0.69	n/a
Israel	167	n/a	0.72	n/a
Colombia	n/a	n/a	n/a	n/a
Costa Rica	n/a	n/a	n/a	n/a
Mexico	n/a	n/a	n/a	n/a

Note: n/a = not available. Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.5A. Data for Figure 3. Carbon monoxide emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 carbon monoxide emissions (kilotonnes)	2019 carbon monoxide emissions (kilotonnes)	2009 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)
United States	54 933	40 553	3.45	2.03
Canada	6 311	5 161	4.54	2.98
Japan	2 662	3 157	0.56	0.59
Germany	3 298	2 881	0.96	0.69
Australia	3 154	2 396	3.29	1.98
France	3 731	2 374	1.47	0.81
Poland	2 877	2 116	3.38	1.74
Italy	3 112	2 061	1.37	0.88
Turkey	3 543	1 662	2.67	0.71
Spain	1 632	1 601	1.01	0.89

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.6B. Data for Figure 3. Carbon monoxide emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 carbon monoxide emissions (kilotonnes)	2019 carbon monoxide emissions (kilotonnes)	2009 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)
United Kingdom	2 163	1 579	0.88	0.54
Czech Republic	906	819	2.82	2.00
New Zealand	711	730	4.84	3.67
Netherlands	652	619	0.81	0.66
Austria	563	497	1.40	1.06
Greece	696	464	1.85	1.54
Norway	458	401	1.61	1.21
Belgium	424	367	0.89	0.66
Hungary	540	354	2.30	1.14
Finland	423	344	1.88	1.36
Sweden	469	337	1.15	0.64

Country	2009 carbon monoxide emissions (kilotonnes)	2019 carbon monoxide emissions (kilotonnes)	2009 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 carbon monoxide emissions intensity (tonnes per million United States dollars of gross domestic product)
Portugal	399	289	1.27	0.85
Slovak Republic	414	279	3.07	1.54
Denmark	361	208	1.41	0.68
Switzerland	254	160	0.52	0.27
Estonia	156	131	4.90	2.88
Latvia	212	119	4.89	2.16
Iceland	120	117	8.15	6.03
Lithuania	170	115	2.48	1.19
Slovenia	143	97	2.26	1.27
Ireland	158	67	0.69	0.16
Luxembourg	30	21	0.61	0.31
Chile	4 718	n/a	14.82	n/a
South Korea	810	n/a	0.52	n/a
Israel	198	n/a	0.85	n/a
Colombia	n/a	n/a	n/a	n/a
Costa Rica	n/a	n/a	n/a	n/a
Mexico	n/a	n/a	n/a	n/a

Note: n/a = not available. Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.7A. Data for Figure 4. Volatile organic compounds emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 volatile organic compounds emissions (kilotonnes)	2019 volatile organic compounds emissions (kilotonnes)	2009 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)
United States	13 378	11 091	0.84	0.56
Canada	1 972	1 676	1.42	0.97
Australia	1 236	1 194	1.29	0.99
Germany	1 245	1 121	0.36	0.27
Turkey	1 092	1 120	0.82	0.48
France	1 198	956	0.47	0.33
Italy	1 184	894	0.52	0.38
Japan	1 067	881	0.23	0.16
United Kingdom	922	813	0.38	0.28
Poland	774	647	0.91	0.53

Note: Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.8A. Data for Figure 4. Volatile organic compounds emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 volatile organic compounds emissions (kilotonnes)	2019 volatile organic compounds emissions (kilotonnes)	2009 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)
Spain	618	608	0.38	0.34
Netherlands	257	236	0.32	0.25
Czech Republic	258	215	0.80	0.52
New Zealand	178	190	1.21	0.96
Portugal	161	160	0.51	0.47
Norway	166	153	0.58	0.47
Greece	250	144	0.66	0.48
Sweden	181	134	0.44	0.26
Hungary	137	119	0.58	0.39

Country	2009 volatile organic compounds emissions (kilotonnes)	2019 volatile organic compounds emissions (kilotonnes)	2009 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 volatile organic compounds emissions intensity (tonnes per million United States dollars of gross domestic product)
Ireland	114	114	0.50	0.28
Belgium	145	113	0.31	0.20
Austria	137	108	0.34	0.23
Denmark	133	103	0.52	0.33
Slovak Republic	125	100	0.93	0.55
Finland	110	83	0.49	0.33
Switzerland	103	81	0.21	0.14
Lithuania	59	52	0.87	0.53
Latvia	48	41	1.10	0.73
Slovenia	41	31	0.64	0.41
Estonia	24	23	0.74	0.50
Luxembourg	12	11	0.25	0.17
Iceland	6	5	0.44	0.28
Chile	2 381	n/a	7.48	n/a
South Korea	817	n/a	0.53	n/a
Israel	263	n/a	1.13	n/a
Colombia	n/a	n/a	n/a	n/a
Costa Rica	n/a	n/a	n/a	n/a
Mexico	n/a	n/a	n/a	n/a

Note: n/a = not available. Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.

Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.9A. Data for Figure 5. Fine particulate matter emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 fine particulate matter emissions (kilotonnes)	2019 fine particulate matter emissions (kilotonnes)	2009 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)
United States	4 526	3 627	0.28	0.18
Canada	1 277	1 550	0.92	0.90
Turkey	195	202	0.15	0.09
Italy	201	139	0.09	0.06
Spain	141	135	0.09	0.08
Poland	143	122	0.17	0.10
France	185	121	0.07	0.04
United Kingdom	114	109	0.05	0.04
Germany	114	92	0.03	0.02
Portugal	55	49	0.17	0.14

Note: Definitions of pollution sources and estimation methods may differ from country to country. Canada and the United States include open sources such as dust from roads, prescribed forest burning and agriculture in their $PM_{2.5}$ emissions. These sources are not always reported by other OECD member countries. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.
Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Table A.10A. Data for Figure 5. Fine particulate matter emissions and emissions intensity of the top 10 emitting member countries of the Organisation for Economic Co-operation and Development, 2009 and

Country	2009 fine particulate matter emissions (kilotonnes)	2019 fine particulate matter emissions (kilotonnes)	2009 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)
Hungary	49	40	0.21	0.13
Greece	62	37	0.16	0.12
Czech Republic	42	36	0.13	0.09
Norway	32	24	0.11	0.07
Latvia	28	20	0.66	0.36
Belgium	29	18	0.06	0.03
Slovak Republic	23	18	0.17	0.10
Sweden	26	18	0.06	0.03
Finland	22	17	0.10	0.07

Country	2009 fine particulate matter emissions (kilotonnes)	2019 fine particulate matter emissions (kilotonnes)	2009 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)	2019 fine particulate matter emissions intensity (tonnes per million United States dollars of gross domestic product)
Netherlands	23	15	0.03	0.02
Austria	19	14	0.05	0.03
Denmark	21	13	0.08	0.04
Ireland	17	12	0.08	0.03
Slovenia	14	11	0.23	0.14
Switzerland	9	6	0.02	0.01
Estonia	10	6	0.30	0.13
Lithuania	8	5	0.12	0.06
Iceland	2	1	0.13	0.07
Luxembourg	2	1	0.04	0.02
Chile	381	n/a	1.20	n/a
Australia	n/a	n/a	n/a	n/a
Colombia	n/a	n/a	n/a	n/a
Costa Rica	n/a	n/a	n/a	n/a
Israel	n/a	n/a	n/a	n/a
Japan	n/a	n/a	n/a	n/a
Mexico	n/a	n/a	n/a	n/a
New Zealand	n/a	n/a	n/a	n/a
South Korea	n/a	n/a	n/a	n/a

Note: n/a = not available. Definitions of pollution sources and estimation methods may differ from country to country. Comparisons should be made with caution. Gross domestic product values are in millions of constant United States dollars, constant purchasing power parity, for the base year 2010. The use of purchasing power parity facilitates international comparison of gross domestic product by creating an equivalent purchasing power basis for each country compared.

Source: Organisation for Economic Co-operation and Development (2021) OECD.Stat.

Additional information can be obtained at:

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