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GLOBAL GREENHOUSE GAS EMISSIONS

CANADIAN ENVIRONMENTAL
SUSTAINABILITY INDICATORS



Canada 

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

GLOBAL GREENHOUSE GAS EMISSIONS

August 2024

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Global greenhouse gas emissions

The release of greenhouse gases (GHGs) and their increasing concentration in the atmosphere is causing climate change, one of the most important environmental issues of our time. This change has an impact on the environment, human health and the economy. The increase in GHG concentrations is primarily due to human activities, such as the use of fossil fuels. Greenhouse gases remain in the atmosphere for periods ranging from a few years to thousands of years. As such, they have a worldwide impact, no matter where they were first emitted. This indicator highlights GHG emissions caused by human activity around the world.

Total global greenhouse gas emissions are the amount of emissions by an entire country or region, while per capita global greenhouse gas emissions are the amount of emissions an individual person emits in a particular country or region on average.

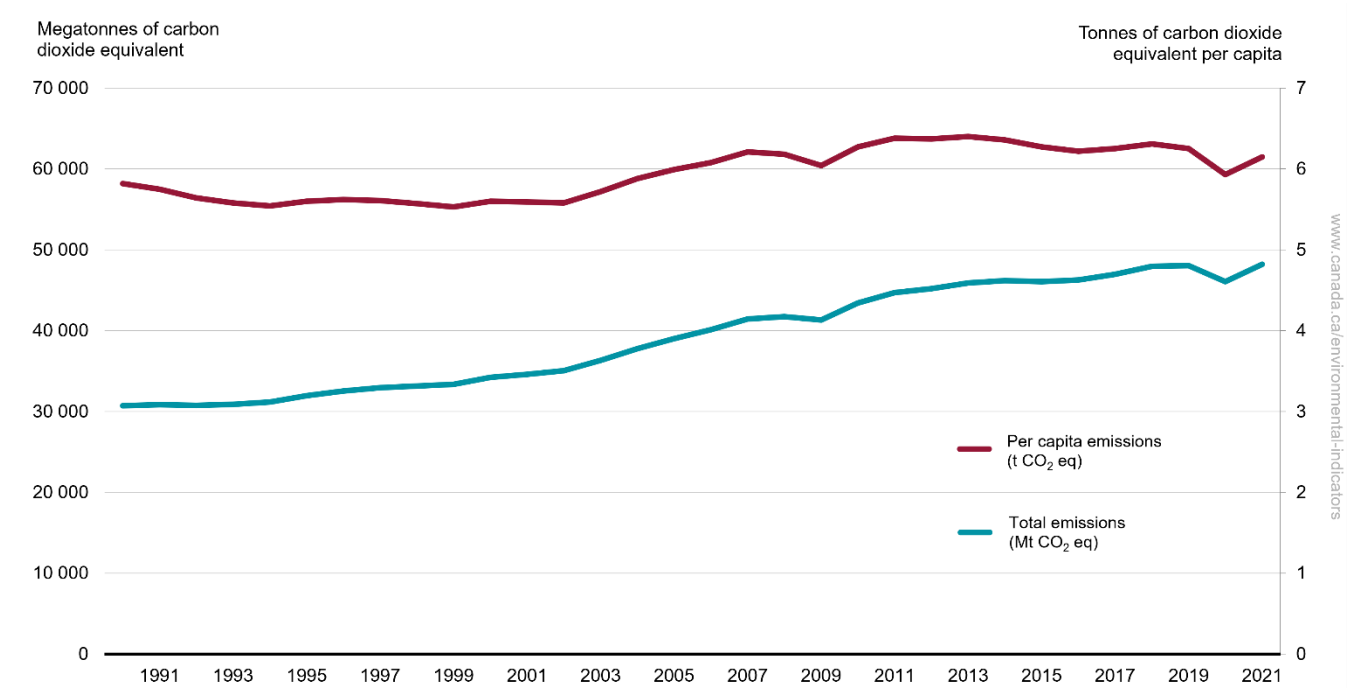
Global emissions

This indicator presents greenhouse gas emissions at the global level, both in terms of total emissions and per capita emissions.

Key results

- Between 2005 and 2021, global GHG emissions increased by 24%, from 39 001 to 48 210 megatonnes of carbon dioxide equivalent (Mt CO₂ eq)
- Between 2005 and 2021, per capita global GHG emissions increased by 2.67%, from 5.99 to 6.15 tonnes of carbon dioxide equivalent (t CO₂ eq)

Figure 1. Global total greenhouse gas emissions and per capita greenhouse gas emissions, 1990 to 2021



[Data for Figure 1](#)
Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

Global per capita emissions saw a notable low period (as low as 5.53 and a maximum of 5.64 t CO₂ eq per person) between 1992 and 2002. The fall of the USSR contributed to this decrease because of its ensuing economic slowdowns in Eastern Europe and Central Asia.¹

Both total and per capita global GHG emissions saw a sharp increase from 2003 to 2007 (by 18.3% and 11.3%, respectively). This increase was partially driven by China's fossil-fuel powered economic growth and increased manufacturing during this period.² The global financial crisis in 2008 led to an economic slowdown, reductions in manufacturing and lower demand for electricity. This crisis influenced the decline of total and per capita emissions (by 1.03% and 2.27%, respectively) from 2008 to 2009.³

The confinement measures introduced in many countries in 2020 due to the COVID-19 pandemic created an industrial slowdown and reductions in trade and travel by air and land. These impacts contributed to a 4.12% decrease in total GHG emissions and a 5.12% decrease in per capita global GHG emissions from 2019 to 2020. Following the relaxation of confinement measures in 2021, total global emissions climbed above pre-pandemic levels (4.65% increase from 2020 to 2021) and per capita global emissions were almost as high as in 2019 (3.71% increase from 2020 to 2021).

In 2015, Canada and 194 other countries reached the [Paris Agreement](#) to limit the global average temperature rise to well below 2°C and pursue efforts to limit the increase to 1.5°C. Under the Agreement, Canada committed to reduce its GHG emissions by 30% below 2005 levels by 2030. In 2021, Canada announced a commitment to cut its GHG emissions by 40% to 45% below 2005 levels by 2030.

According to the Intergovernmental Panel on Climate Change, reaching this goal implies large-scale changes in energy systems and potentially land use across the world. In addition, the efforts and associated costs needed to reach this goal will vary between countries, with the distribution of costs across countries potentially being different from the distribution of the actions themselves.⁴

Canada is committed to implementing its strengthened climate plan ([2030 Emissions Reduction Plan](#)) to ensure Canada not only meets, but exceeds its 2030 emissions reduction goal, and beginning work so that Canada can achieve net-zero emissions by 2050.

Greenhouse gas emissions by country

This indicator presents total greenhouse gas emissions and per capita greenhouse gas emissions from Canada and the top 10 emitting countries and regions.

Key results

- In 2021, total emissions:
 - were highest in China with 13 438 megatonnes of carbon dioxide equivalent (Mt CO₂ eq), corresponding to 27.9% of global GHG emissions, up from 18.4% in 2005. Since 2005, emissions from China increased by 86.9%
 - in Canada reached 676 Mt CO₂ eq, which made up 1.4% of total global GHG emissions. This places Canada as the 12th largest emitter in the world
- In 2021, Canada's per capita emissions:
 - were the second highest among the top 10 emitting countries and regions and Canada with 17.7 tonnes of carbon dioxide equivalent per person (t CO₂ eq)

¹ Schierhorn F et al (2019) [Large greenhouse gas savings due to changes in the post-Soviet food systems](#). Environmental Research Letters, 14(6). Retrieved on June 17, 2024.

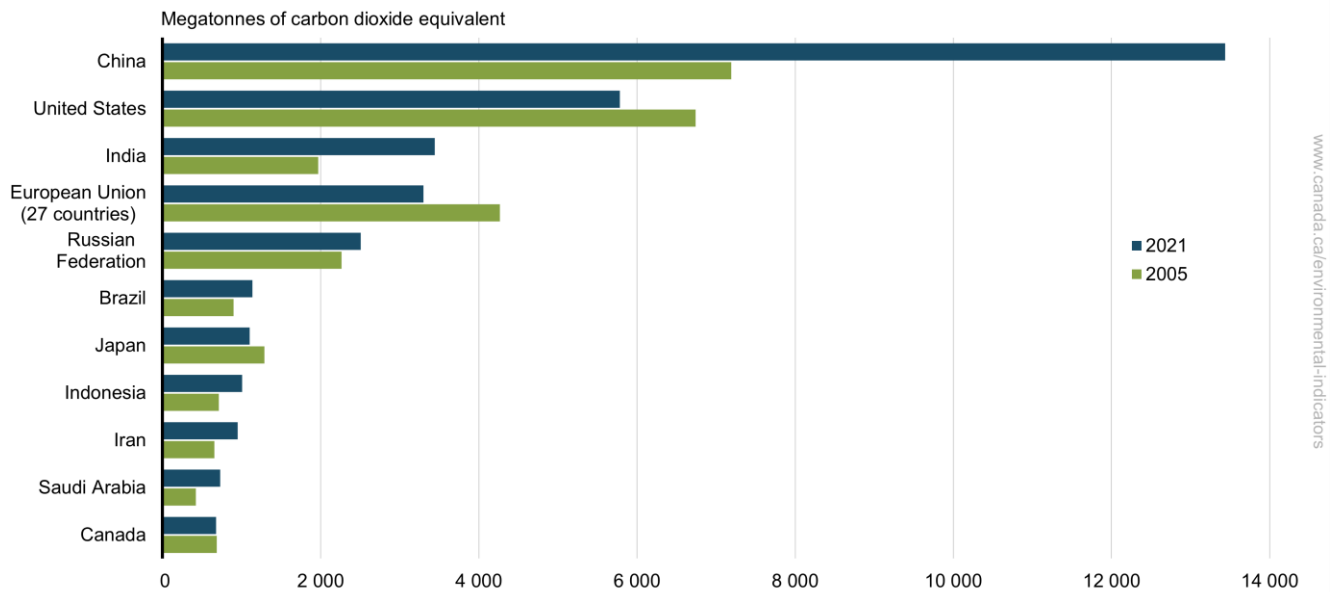
² Chong Wei (2022) [Historical trend and drivers of China's CO₂ emissions from 2000 to 2020](#). Retrieved on June 17, 2024.

³ Zhang et al. (2023) [What can we learn from the 2008 financial crisis for global power decarbonization after COVID-19?](#). Retrieved on June 17, 2024.

⁴ Intergovernmental Panel on Climate Change (2014) [Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change – Summary for Policy Makers](#) (PDF; 2.0 MB). Retrieved on June 17, 2024.

- decreased by 16.9% since 2005, from 21.28 to 17.69 t CO₂ eq per person

Figure 2. Total greenhouse gas emissions from Canada and the top 10 emitting countries and regions, 2005 and 2021

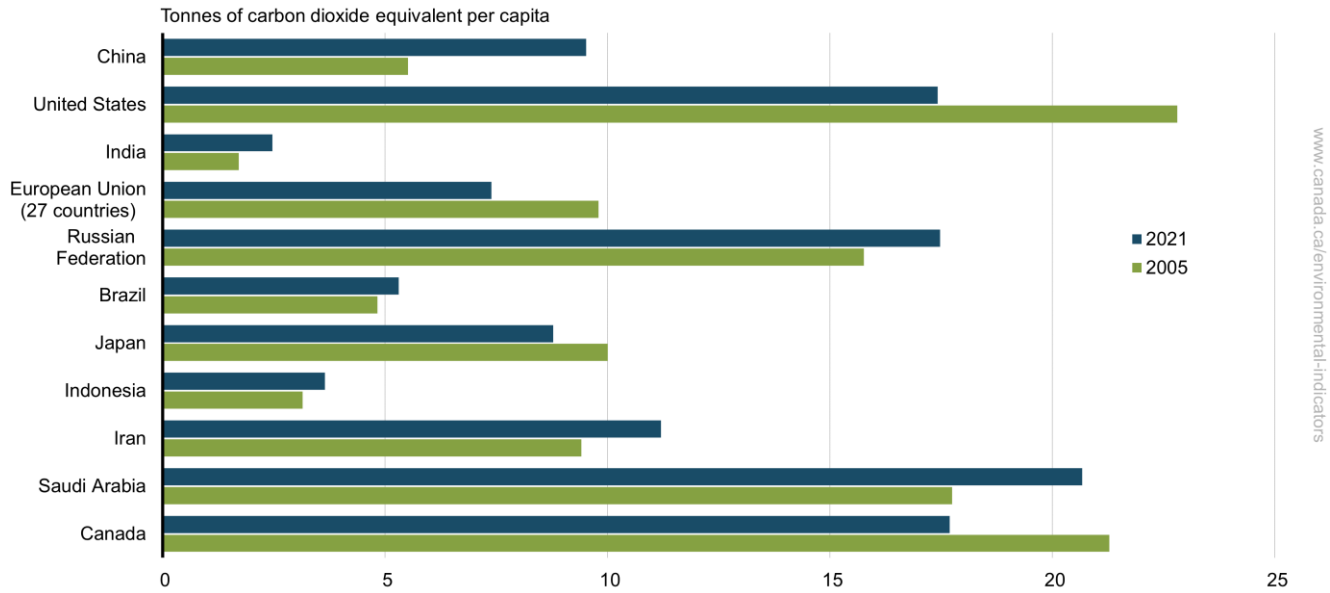


[Data for Figure 2](#)

Note: Greenhouse gas emissions for each country and region presented in this comparison were calculated by the World Resources Institute. For certain countries, including Canada, these values differ from the official estimates of greenhouse gas emissions submitted to the United Nations Framework Convention on Climate Change. For more information, please consult the [Caveats and limitations](#) section.

Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

Figure 3. Per capita greenhouse gas emissions for Canada and the top 10 emitting countries and regions, 2005 and 2021



[Data for Figure 3](#)

Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

In 2021, Canada ranked as the 12th largest GHG emitting country/region. Canada's share of global emissions decreased from 1.76% in 2005 to 1.40% in 2021. Like that of other economically developed countries, Canada's share is anticipated to continue to decline due to the expected rapid increase in emissions from economically developing and emerging countries, particularly China (+86.9% from 2005 to 2021), India (+75.1%), Brazil (+26.4%), and Indonesia (+41.3%).

Canada's total emissions decreased by 1.40% (from 686 to 677 Mt CO₂ eq) from 2005 to 2021. This is a smaller decrease than that of other western countries and regions, notably the United States' decrease by 14.2% (from 6 740 to 5 783 Mt CO₂ eq) and European Union's 22.6% decrease (from 4 267 to 3 301 Mt CO₂ eq).

Canada has the second-highest GHG emission per capita rate among the top 10 emitting countries and regions and Canada. If Canada's GHG emissions per year were shared equally by each person in Canada, each person would emit 17.7 t CO₂ eq per year, which is 3 times the global rate. That is the same amount of GHG emissions released as someone driving around the world in a gasoline-powered car twice per year (about 73 436 km total).⁵

Canada's per capita emissions have decreased by 16.9% since 2005, while the United States' have decreased by 23.6% and the European Union's by 24.6%. The 3 countries in the top 10 total emitters with the lowest GHG emissions per capita are India (2.47 t CO₂ eq), Indonesia (3.65 t CO₂ eq) and Brazil (5.31 t CO₂ eq).

About the indicator

What the indicator measures

The Global greenhouse gas emissions indicator reports global human emissions of GHGs from 1990 to 2021. The Greenhouse gas emissions by country indicator reports emissions coming from the top 10 total emitting countries and regions and Canada for 2005 and 2021. Both indicators measure total and per capita emissions. Emissions from energy and non-energy related sources are included in this indicator, while emissions from land use, land

⁵ Environmental Protection Agency (2024) [Greenhouse Gas Equivalencies Calculator](#). Retrieved June 17, 2024.

use change, and forestry are excluded. The emissions of GHGs include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

Why this indicator is important

The indicator provides a global perspective on the world's historical GHG emissions and Canada's part in global GHG emissions, both in total and per capita.

Related indicators

The [Greenhouse gas emissions](#) indicator reports trends in total anthropogenic (human-made) GHG emissions at the national level, per person and per unit gross domestic product, by province and territory, and 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).

The [Greenhouse gas emissions projections](#) indicator provides an overview of Canada's projected GHG emissions up to 2035.

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

The [Land-based greenhouse gas emissions and removals](#) indicator tracks exchanges of greenhouse gas emissions and removals between the atmosphere and Canada's managed lands.

Data sources and methods

Data sources

The emissions and emissions per capita data used to compile the Global greenhouse gas emissions indicator were retrieved from the [Climate Watch Country Historical Greenhouse Gas Emissions dataset](#) developed by the World Resources Institute. The dataset is accessible through the Climate Watch GHG Emissions platform which presents data from various sources. It was previously published through the World Resources Institute's Climate Analysis Indicator Tool (CAIT). The data are based on the May 2024 version of the dataset.

More information

The World Resources Institute's dataset uses information and emissions from different sources:

- Robbie M. Andrew for [global and country-level CO₂ emissions from cement production](#)
- Food and Agriculture Organization of the United Nations for [Land Use Change and Forestry Data](#)
- Global Carbon Project for their [Global Carbon Budget](#) reports
- International Energy Agency for their [Greenhouse Gas Emissions from Energy](#)
- United States Environmental Protection Agency for their [Global Non-CO₂ Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050](#)

It covers anthropogenic GHG emissions across the world, excluding emissions attributed to land use, land use change, and forestry. The data are reported by the World Resources Institute's 2 to 3 years after data collection. The latest year available at the time of the update was 2021.

The population data used by the World Resources Institute to calculate the GHG emissions per capita are retrieved from the World Bank's [World Development Indicators](#).

Methods

The indicator is composed of the total and per capita GHG emission totals for the world from 1990 to 2021, and total and per capita GHG emissions for Canada and the top 10 emitting countries/regions for 2005 and 2021, as retrieved from the World Resources Institute's Climate Watch Country Historical Greenhouse Gas Emissions dataset. The dataset is available on the [platform](#).

More information

The national GHG emission totals from the World Resources Institute's Climate Watch Country Historical Greenhouse Gas Emissions are compiled by using as many as 5 different GHG emissions data sources. The selection of these data sources is done using different completeness criteria like geographic coverage, temporal coverage, and accuracy. For more information on the data sources selection and the national and global emissions compilation consult the [Climate Watch Country Greenhouse Gas Emissions Data and Methodology](#).

Greenhouse gas emissions are reported in carbon dioxide equivalent (CO₂ eq), determined by multiplying the amount of emissions of a particular gas by its global warming potential. The Climate Watch Country Historical Greenhouse Gas Emissions dataset uses the 100-year [global warming potentials](#) from the Intergovernmental Panel on Climate Change's Fourth Assessment Report.

Greenhouse gas emissions per capita are determined by dividing a country/region's total greenhouse gas emissions by its population.

Recent changes

The time coverage of the indicator has been modified and now presents data for all years from 1990 to 2021. It previously presented data for 2005 and 2020.

The indicator has been reorganized to include 2 sections: Global emissions and Greenhouse gas emissions by country, each of which include data on total GHG emissions and per capita GHG emissions. Previously, the indicator divided information by total emissions and per capita emissions, with each section containing information for both the entire world, and by country.

Caveats and limitations

The latest 2 years reported (2020 and 2021) coincide with the first and second years of the COVID-19 pandemic which affected a wide range of economic sectors, including the energy and transport sectors. The trends presented must be interpreted in the context of the economic slowdown that influenced results from 2019 to 2020, and the economic rebound that influenced them from 2020 to 2021.

The emissions in the World Resources Institute's [Climate Watch Country Historical Greenhouse Gas Emissions](#) dataset as of May 2024 may reflect revisions of data previously published by that organization. The emissions reported by the World Resources Institute are also different from the emissions reported by member countries in their National Inventory Report to the United Nations Framework Convention on Climate Change.

More information

Due to the differences in data sources and methodologies used, Climate Watch estimated country GHG emissions may be different than official inventories prepared by countries. Caution is advised when comparing data released in different years and reports.

Emissions from international bunker fuels (which are estimated based on the location of marine and aviation refueling) are not reflected in reported countries and regions emissions totals. However, they are included in the total world emissions.

Greenhouse gas data in the Climate Analysis Indicators Tool have uncertainties since they are using many different data sources. Despite the uncertainties, the World Resources Institute has chosen to err on the side of inclusiveness, by capturing the widest possible range of GHG sources and sinks that contribute to global climate change. For more information on uncertainties please consult the [Climate Watch Country Greenhouse Gas Emission Data and Methodology Technical Note](#).

Resources

References

International Energy Agency (2019) [Fuel Economy in Major Car Markets: Technology and Policy Drivers, 2005-2017](#) (PDF; 6.5 MB). Retrieved June 17, 2024.

United States Environmental Protection Agency (2021) [Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2019](#) (PDF; 3 MB). Retrieved June 17, 2024.

World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#). Retrieved on June 17, 2024.

Related information

[Canada's action on climate change](#)

[Climate change](#)

[Greenhouse gas emissions](#)

Annex

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

Table A.1. Data for Figure 1. Global emissions and per capita greenhouse gas emissions, 1990 to 2021

Year	Global emissions (megatonnes of carbon dioxide equivalent)	Per capita global emissions (tonnes of carbon dioxide equivalent per person)
1990	30 708.31	5.82
1991	30 854.08	5.75
1992	30 760.80	5.64
1993	30 896.88	5.58
1994	31 164.96	5.54
1995	31 949.87	5.60
1996	32 545.41	5.62
1997	32 942.62	5.61
1998	33 152.61	5.57
1999	33 346.20	5.53
2000	34 225.00	5.60
2001	34 604.52	5.59
2002	35 027.24	5.58
2003	36 318.41	5.72
2004	37 785.32	5.88
2005	39 001.40	5.99
2006	40 115.67	6.08
2007	41 424.75	6.21
2008	41 725.46	6.18
2009	41 297.04	6.04
2010	43 420.56	6.27
2011	44 688.81	6.38
2012	45 190.00	6.37
2013	45 892.25	6.40
2014	46 184.25	6.36
2015	46 073.06	6.27
2016	46 264.29	6.22
2017	46 981.68	6.25
2018	47 960.07	6.31
2019	48 046.60	6.25
2020	46 066.32	5.93
2021	48 209.50	6.15

Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

Table A. 2. Data for Figure 2. Total greenhouse gas emissions from Canada and the top 10 emitting countries and regions, 2005 and 2021

Country or region	2005 total greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2021 total greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
China	7 192.18	13 438.97
United States	6 740.01	5 782.55
India	1 966.93	3 444.46
European Union (27) ^[A]	4 266.99	3 301.27
Russian Federation	2 262.35	2 507.34
Brazil	898.79	1 136.45
Japan	1 289.90	1 103.39
Indonesia	713.43	1 007.81
Iran	656.79	952.17
Saudi Arabia	422.65	730.64
Canada	686.29	676.50

Note: Greenhouse gas emissions for each country and region presented in this comparison were calculated by the World Resources Institute. For certain countries, including Canada, these values differ from the official estimates of greenhouse gas emissions submitted to the United Nations Framework Convention on Climate Change. For more information, please consult the [Caveats and limitations](#) section.

^[A] European Union (27) includes: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

Table A.3. Data for Figure 3. Per capita greenhouse gas emissions for Canada and the top 10 emitting countries and regions, 2005 and 2021

Country or region	2005 greenhouse gas emissions per capita (tonnes of carbon dioxide equivalent)	2021 greenhouse gas emissions per capita (tonnes of carbon dioxide equivalent)
China	5.52	9.52
United States	22.81	17.42
India	1.71	2.47
European Union (27) ^[A]	9.80	7.39
Russian Federation	15.76	17.48
Brazil	4.83	5.31
Japan	10.01	8.78
Indonesia	3.15	3.65
Iran	9.41	11.20
Saudi Arabia	17.75	20.67
Canada	21.28	17.69

Note: ^[A] European Union (27) includes: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

Source : World Resources Institute (2024) [Climate Watch Country Historical Greenhouse Gas Emissions](#).

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