



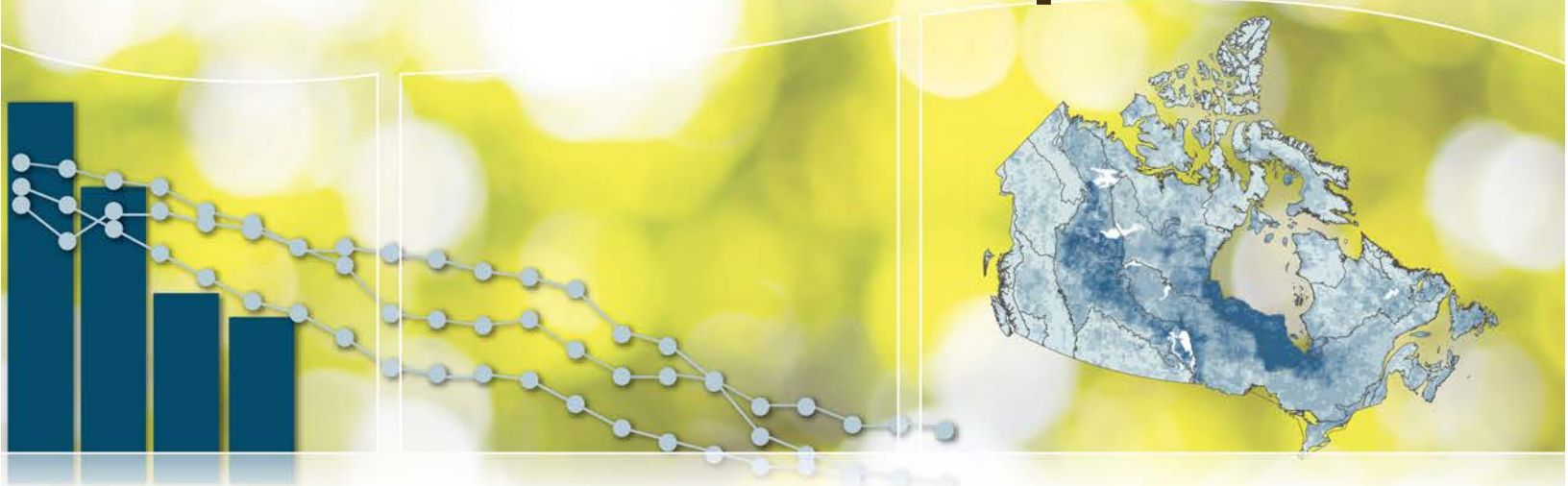
Environment and
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Canadian Environmental Sustainability Indicators

Carbon Dioxide Emissions from a Consumption Perspective



Suggested citation for this document: Environment and Climate Change Canada (2017) Canadian Environmental Sustainability Indicators: Carbon Dioxide Emissions from a Consumption Perspective. Consulted on *Month day, year*.

Available at: www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=7BA2C0DA-1

Cat. No.: En4-144/79-2016E-PDF

ISBN: 978-0-660-06700-1

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

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Canadian Environmental Sustainability Indicators

Carbon Dioxide Emissions from a Consumption Perspective

February 2017

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Part 1. Carbon Dioxide Emissions from a Consumption Perspective Indicator

This indicator provides a view of the emissions tied to the goods and services Canadians consume compared with those they produce.¹

Between 1995 and 2004, Canada's consumption-based carbon dioxide (CO₂) emissions were lower than its production-based emissions.² Canada was thus a net exporter of CO₂ emissions to other countries during that period.

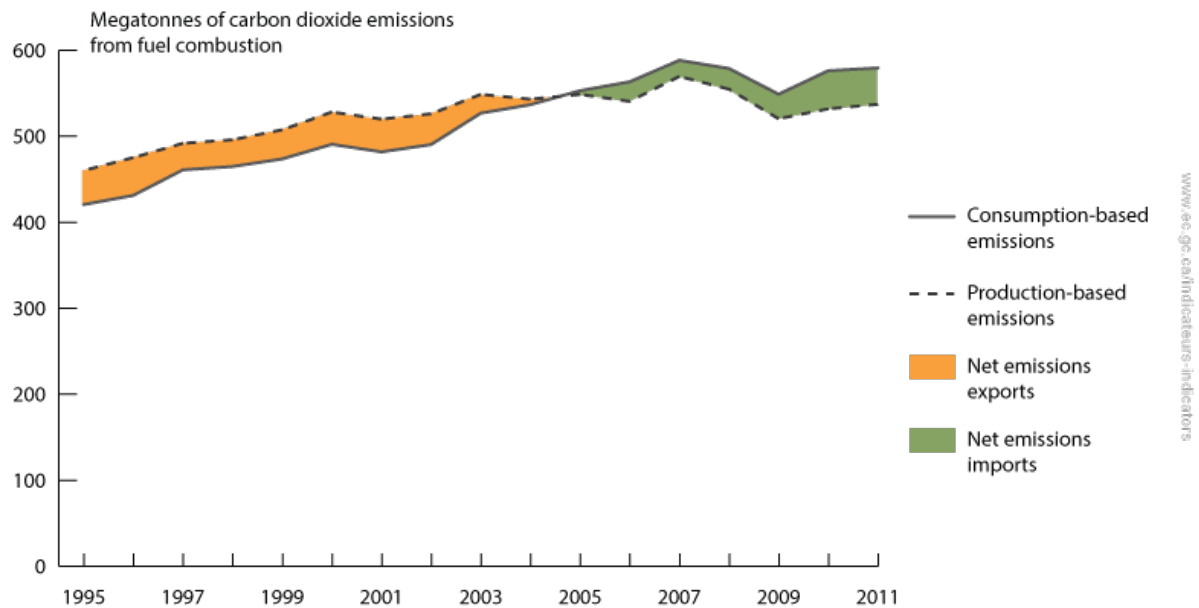
Since 2005, Canada's consumption-based CO₂ emissions have been higher than those from production, making the country a net importer of CO₂ emissions. This change can be partly attributed to an increase in imports from developing countries, such as China, that produce goods using a mix of energy sources that are more emissions-intensive than Canada's.

In 2011, the latest year with available data, Canada's consumption-based emissions were 579 megatonnes, or 8% above its production-based emissions.

¹ Values reported by this indicator differ from the [Greenhouse Gas Emissions](#) indicator. The Greenhouse Gas Emissions indicator includes all greenhouse gases, is production-based and is calculated from Canada's official inventory of domestic greenhouse gas emissions, which can be found in the [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#). Production-based emissions presented in this indicator are derived from the International Energy Agency's [CO₂ Emissions from Fuel Combustion](#), and differ slightly from the corresponding values reported in the National Inventory Report.

² Production-based emissions account for emissions physically occurring in Canada. They do not take into account the emissions associated with products imported and consumed in Canada, but include emissions associated with the production of products and services exported from Canada responding to a demand abroad. Consumption-based emissions account for emissions associated with products and services consumed in Canada and produced either domestically or abroad.

Figure 1. Production- and consumption-based carbon dioxide emissions from fuel combustion, Canada, 1995 to 2011



[Data for Figure 1](#)

Note: Values for production- and consumption-based emissions presented in this indicator differ from Canada's official accounting of production-based greenhouse gas emissions. Canada's official accounting of greenhouse gas emissions can be found in the [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#).
Source: Organisation for Economic Co-operation and Development (2015) [OECD production- and consumption-based CO₂ emissions estimates](#).

Comparison of Carbon Dioxide Emissions Embodied in International Trade

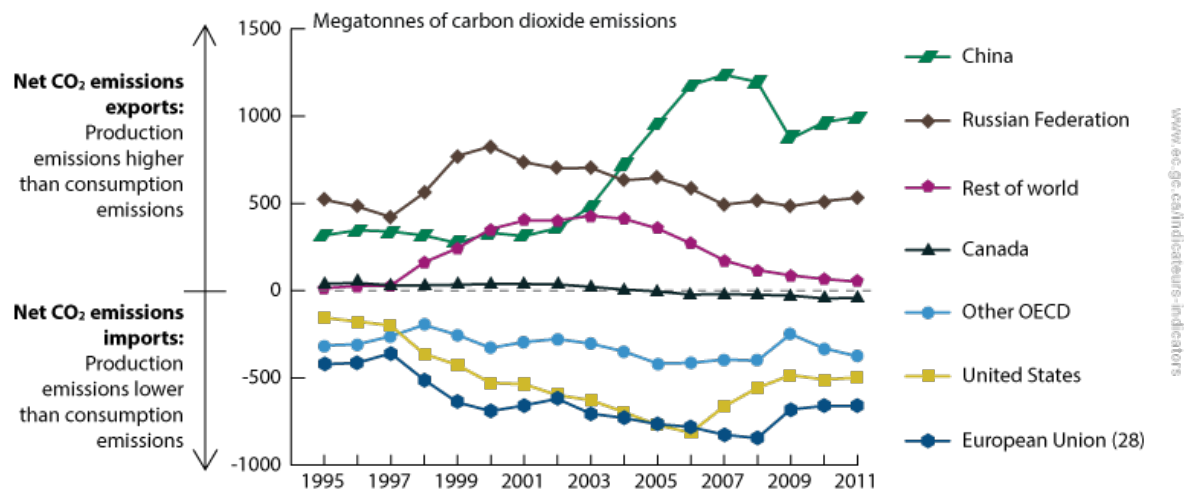
A country can be considered a net exporter of CO₂ emissions when its production-based CO₂ emissions are higher than its consumption-based emissions. When the reverse is true, the country is a net importer of CO₂ emissions. The worldwide sums of net exports and net imports of CO₂ emissions are equal.

Production- and consumption-based emissions data is available for the 1995 to 2011 period. During that time, China and the Russian Federation were net exporters of CO₂ emissions with China's CO₂ exports more than tripling. The United States, the European Union and other member countries of the Organisation for Economic Co-operation and Development,³ were major net CO₂ importers for the whole period, except Canada which became a net importer in 2005. The European Union and the United States' increased their imports.

Canada's economy represents 2% to 3% of the world economy and less than 2% of the world's greenhouse gas emissions. As a result, and as seen in the graph, Canada represents a relatively small portion of CO₂ emissions embodied in global trade.

³ Please note that while Latvia is a member of the Organisation for Economic Co-operation and Development, it is not represented individually in the source data. Latvia is therefore not included in the estimate for other members of the Organisation for Economic Co-operation and Development.

Figure 2. Difference between production- and consumption-based emissions, selected countries and regions, 1995 to 2011



[Data for Figure 2](#)

Note: OECD = Organisation for Economic Co-operation and Development. Values for production- and consumption-based emissions presented in this indicator differ from Canada's official accounting of production-based greenhouse gas emissions. Canada's official accounting of greenhouse gas emissions can be found in the [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#). (28) refers to the 28 member states of the European Union as of May 2016. Countries in the "Other OECD" group include Australia, Chile, Iceland, Israel, Japan, Korea, Mexico, New Zealand, Norway, Switzerland and Turkey. Please note that while Latvia is a member of the Organisation for Economic Co-operation and Development, it is not represented individually in the source data. Latvia is therefore included in the estimate for the rest of the world.

Source: Organisation for Economic Co-operation and Development (2015). [OECD production- and consumption-based CO₂ emissions estimates](#).

Part 2. Data Sources and Methods for the Carbon Dioxide Emissions from a Consumption Perspective Indicator

Introduction

The [Carbon Dioxide Emissions from a Consumption Perspective](#) indicator is part of the [Canadian Environmental Sustainability Indicators](#) (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

Description and rationale of the Carbon Dioxide Emissions from a Consumption Perspective indicator

Description

The Carbon Dioxide Emissions from a Consumption Perspective indicator provides a view of the impact of Canada's consumption of goods and services, regardless of where they are produced, on the levels of carbon dioxide (CO₂) released into the atmosphere. It is accounting for emissions associated with products and services consumed in Canada and produced either domestically or abroad. The indicator also reports on Canada's CO₂ emissions resulting from the production of goods and services that are consumed in Canada, as well as emissions produced in Canada and exported to other countries.

Rationale

The most common method of accounting for greenhouse gas (GHG) emissions is to assign responsibility for the emissions to the emitting entity, sector or region. This approach (often referred to as production-based emissions accounting) is used by Canada and other countries to report their national GHG emissions inventory to the United Nations Framework Convention on Climate Change. It is also the approach underlying the [national](#) and [global](#) GHG indicators in the [Canadian Environmental Sustainability Indicators](#) program, which are based on Canada's official [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#).

Production-based emissions account for emissions physically occurring in Canada. They do not take into account the emissions associated with products imported and consumed in Canada, but include emissions associated with the production of products and services exported from Canada responding to a demand abroad.

The location where GHG emissions originate has little or no impact on the resulting influence on climate change. For example, reducing production in a country and purchasing more products abroad may reduce emissions domestically, but the effect on worldwide emissions depends on whether the production taking place in other countries is more or less carbon-intensive than the domestic production. Focusing on consumption- or demand-based emissions accounting can support climate change policy by calling attention to the influence of household, business, and government choices on emissions.

Data

Data source

The data were retrieved in April 2016 from the October 2015 version of the Organisation for Economic Co-operation and Development's [production- and consumption-based CO₂ emissions estimates](#).

It should be noted that Statistics Canada also publishes estimates of greenhouse gas emissions by final demand category in its [physical flow accounts](#) data. There are differences between those two data sets, the most significant being that in developing its estimates Statistics Canada makes the assumption that the resource requirements to produce goods and services abroad are the same as if they were produced in Canada. The source selected for this indicator takes into consideration that those resource requirements do vary across countries.

Spatial coverage

The indicator provides global coverage. The database from the Organisation for Economic Co-operation and Development covers 61 countries, while the rest of the world is comprised in a single entry.

Industry coverage

The industry classification used in the Organisation for Economic Co-operation and Development database is based on the [International Standard Industrial Classification of All Economic Activities, Revision 3](#).

Temporal coverage

The indicator provides information annually from 1995 to 2011.

Data completeness

The analysis covers only combustion-based emissions of carbon dioxide.

Data timeliness

The data are current up to 2011, the latest year for which the Organisation for Economic Co-operation and Development's [Inter-Country Input-Output Tables](#) were available at the time of production of this indicator.

Methods

The consumption-based carbon dioxide (CO₂) emissions presented in the indicator were developed by the Organisation for Economic Co-operation and Development. The Organisation for Economic Co-operation and Development used a Multi-Regional Input-Output model. This approach relies on input-output tables from national accounts coupled with national emissions data allocated to industries. The approach focuses on the emissions generated to supply and use a specific product or service (including those of all products and services used as intermediate inputs), but does not include emissions associated with disposal.

To develop its data set, the Organisation for Economic Co-operation and Development combined data from its [Inter-Country Input-Output Tables](#) with the International Energy Agency's CO₂ Emissions from Fuel Combustion – 2014 Edition.

Carbon dioxide emissions from fuel combustion by industry

The International Energy Agency's CO₂ Emissions from Fuel Combustion estimates are based on its energy data⁴ and the default methods and emission factors developed by the Intergovernmental Panel on Climate Change (IPCC) in its [Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories](#).

The International Energy Agency estimates include CO₂ emissions from fuel combustion in IPCC Source/Sink Category 1 A (fuel combustion activities) and those which may be reallocated to IPCC Source/Sink Category 2 (industrial processes and product use) under the Revised 1996 guidelines.⁵

It should be noted that the International Energy Agency's industry disaggregation does not fully comply with the [International Standard Industrial Classification of All Economic Activities, Revision 3](#), on which the Organisation for Economic Co-operation and Development's Inter-Country Input-Output Tables rely on. For this reason, the Organisation for Economic Co-operation and Development developed a procedure to allocate the CO₂ emissions from the International Energy Agency to the industry structure of the Inter-Country Input-Output Tables.⁶

Inter-Country Input-Output Tables

The Organisation for Economic Co-operation and Development's Inter-Country Input-Output Tables rely on data submissions from national statistical institutes. While the Organisation for Economic Co-operation and Development asks that data be provided in accordance with the International Standard Industrial Classification of All Economic Activities, Revision 3, in practice it accepts any relevant data (input-output and/or supply-use tables) at the most detailed and practicable level in any detailed format and then converts it on a harmonized basis. In the harmonization process, the Organisation for Economic Co-operation and Development ensures that data tables for all countries are:

- In an industry-by-industry format;
- Expressed in [basic prices](#);
- Aligned with the industry classifications used in the Organisation for Economic Co-operation and Development system; and
- Aligned in their treatment of concepts (most notably, the treatment of financial intermediation services indirectly measured, and differences in the treatment of other items, such as non-resident expenditures and resident expenditures abroad).

⁴ A summary of this data can be accessed through the International Energy Agency's [Key World Energy Statistics](#) report.

⁵ Further details about the similarities and differences between the International Energy Agency estimates and national estimates prepared using the Revised 1996 guidelines can be found in [CO₂ Emissions from Fuel Combustion \(2014 Edition\) – Documentation for Beyond 2020 Files](#) (PDF; 759 KB).

⁶ A description of the method used by the Organisation for Economic Co-operation and Development to allocate CO₂ emissions from fuel combustion to Inter-Country Input-Output industries can be found in [Estimating Consumption-Based CO₂ Emissions Using the OECD ICIO 2015](#) (PDF; 823 KB).

The Organisation for Economic Co-operation and Development also takes into account the fact that in some countries, some data are suppressed to preserve confidentiality and that there are also some rounding errors which need to be corrected. Finally, adjustments to country-specific data might also be required to deal with valuation differences in imports.⁷ In addition, the Organisation for Economic Co-operation and Development must develop estimates of trade flows between countries, using available information on import use or making assumptions when that information is not available.⁸

Estimates of consumption-based carbon dioxide emissions using the Multi-Regional Input-Output approach

The Organisation for Economic Co-operation and Development estimates consumption-based CO₂ emissions by developing CO₂ emissions intensities for all outputs produced by all industries for all countries included in the database. To do this, total output for each industry (from the Inter-Country Input-Output Tables) is divided by the total emissions by industry estimated by the Organisation for Economic Co-operation and Development from the International Energy Agency's data (see [Carbon dioxide emissions from fuel combustion by industry](#)).

As a second step, symmetrical industry-by-industry input-output tables are used to develop a Leontief inverse matrix⁹ and the final demand matrix.¹⁰

The final step in estimating consumption-based CO₂ emissions involves multiplying the emissions intensity matrix by the Leontief inverse and the final demand matrix. The result of this final multiplication is a matrix which represents consumption-based emissions in country *s* that are emitted in industry *i* located in country *r*.¹¹

Caveats and limitations

Carbon dioxide emissions from fuel combustion by industry

The carbon dioxide (CO₂) emissions estimates presented in the indicator are based on CO₂ emissions from fuel combustion estimates calculated by the International Energy Agency. As such, they vary from those of other indicators presented in the current set of [national](#) and [global](#) greenhouse gas (GHG) indicators from the Canadian Environmental Sustainability Indicators program, which are based on Canada's official [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#).

The International Energy Agency's CO₂ Emissions from Fuel Combustion estimates include emissions from energy transformation (e.g., from oil refineries) which are normally included in Category 1 B in the National Inventory Report. As a result, the closest comparison between production-based CO₂ emissions estimates presented in this indicator and those

⁷ A discussion of the process and assumptions made in order to convert country-submitted data is available in [The OECD Input-Output Database: 2006 edition](#).

⁸ A description of the process and assumptions made in order to convert country-submitted data can be found in [Trade in Value-Added: Concepts, Methodologies and Challenges](#) (PDF; 973 KB) and [Estimating Consumption-Based CO₂ Emissions Using the OECD ICIO 2015](#) (PDF; 823 KB).

⁹ Also known as the total requirements matrix, the Leontief inverse is a representation of all the direct and indirect inter-industry inputs required to provide one unit of output to final demand.

¹⁰ Final demand is the sum of household final consumption, general government final consumption, changes in inventories and gross fixed-capital formation.

¹¹ Country *s* is the country where the final consumption of the output from industry *i* occurs. Country *r* is the country where production of output from industry *i* occurs. In cases where *s* is the same as *r*, production-based and consumption-based emissions are the same.

used in other Canadian Environmental Sustainability Indicators is the National Inventory Report's CO₂ emissions from the energy sector (including stationary combustion sources, transport, fugitive sources and CO₂ transport and storage). However, further differences persist between the data prepared by the International Energy Agency and the data presented in the National Inventory Report.

A key cause of the remaining differences is that the International Energy Agency estimates used for the indicator were calculated using the Intergovernmental Panel on Climate Change's (IPCC) [Revised 1996 Guidelines for National Greenhouse Gas Inventories](#), while Canada's most recent National Inventory Report was prepared using the [2006 IPCC Guidelines for National Greenhouse Gas Inventories](#). Other factors listed by the International Energy Agency might also lead to differences between its estimates and those from the National Inventory Report.¹² These differences include the following:

- The International Energy Agency uses a Tier 1 Sectoral Approach based on the 1996 IPCC Guidelines, while countries may be using a Tier 2 or Tier 3 method that takes into account different technologies. In addition, as mentioned above, Canada is now using the 2006 IPCC guidelines.
- Energy data based on the International Energy Agency energy balances may differ from those used to prepare the National Inventory Report. In addition to different sources, the methodology used to develop national inventories may differ from that used by the International Energy Agency.
- The International Energy Agency uses average net calorific values for fuels to transform fuel consumption data from physical units to energy units. Country experts may have more detailed data on calorific values available when calculating the energy content of the fuels. This, in turn, could produce different values from those of the International Energy Agency.
- The International Energy Agency uses the default emission factors which are given in the 1996 IPCC Guidelines. Country experts may have better information available.
- The International Energy Agency cannot allocate emissions from auto producers to the end-use sectors, while country experts may be doing so, according to recommendations from the IPCC.
- Military emissions may be treated differently than in national inventories

Finally, it should be noted that the International Energy Agency CO₂ emissions estimates were not developed using the [International Standard Industrial Classification of All Economic Activities, Revision 3](#) industrial categories which are used by the Organisation for Economic Co-operation and Development to develop Inter-Country Input-Output Tables (further discussed in the section [Development of worldwide national accounts](#)). The Organisation for Economic Co-operation and Development thus developed a methodology to reallocate the International Energy Agency emissions estimates to these categories.¹³

¹² Further details about the similarities and differences between the International Energy Agency estimates and national estimates prepared using the Revised 1996 guidelines can be found in [CO₂ Emissions from Fuel Combustion \(2014 Edition\) – Documentation for Beyond 2020 Files](#) (PDF; 759 KB).

¹³ This reallocation is discussed in [Estimating Consumption-Based CO₂ Emissions Using the OECD ICIO 2015](#) (PDF; 823 KB).

Development of worldwide national accounts

In developing the Inter-Country Input-Output Tables, the Organisation for Economic Co-operation and Development converts data it receives from national agencies on a harmonized basis (a process discussed in the section [Inter-Country Input-Output Tables](#)). As a result national data presented in the Inter-Country Input-Output Tables might differ from those presented by national statistical agencies such as Statistics Canada's [National Symmetric Input-Output Tables](#).

The level of aggregation found in the Organisation for Economic Co-operation and Development's Inter-Country Input-Output Tables (35 industries) means that the scope of potential analysis of specific products is limited. In addition, cross-country variations in data definitions mean that a specific product might not always fall under the same International Standard Industrial Classification category across all countries.

Consumption-based carbon dioxide emissions

The multi-regional input-output approach used by the Organisation for Economic Co-operation and Development to estimate consumption- and production-based CO₂ emissions by country and industry combines CO₂ emissions estimates by industry with Inter-Country Input-Output Tables. As a result, the accuracy of the results of the Multi-Regional Input-Output analysis is subject to the same caveats as those mentioned above in this section. In addition, the Multi-Regional Input-Output analysis does not include the impact of product disposal, and is thus a "cradle-to-gate" rather than "cradle-to-grave" analysis.¹⁴ Furthermore, as the data from the Inter-Country Input-Output Tables are in nominal terms, emissions intensity improvements may be partly explained by changes in price levels over time.

It should also be noted that there can be a time disconnect between the Organisation for Economic Co-operation and Development's consumption-based CO₂ emissions data and its production-based emissions data and other similar CO₂ emissions data sources, such as Canada's National Inventory Report. This is due to the fact that the Organisation for Economic Co-operation and Development's CO₂ emissions estimates are tied to Inter-Country Input-Output Tables, which include inventory movements that, by definition, can create a disconnect between the time a product is made and when it is consumed. In the National Inventory Report, the emissions are accounted for immediately when the product is made, while in the case of the consumption-based CO₂ emissions estimates, changes in inventories could influence when consumption-based emissions are reported.

Data gaps

At this time, the Organisation for Economic Co-operation and Development excludes GHGs other than CO₂ from its analysis due to problems with data availability and difficulties in matching non-CO₂ GHG emissions with the International Standard Industrial Classification categories. In addition, all GHG emissions from international bunker (aviation and marine) fuels are excluded from the analysis (as they also are in Canada's official [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#)), which underestimates the amount of emissions embedded in the consumption of imported products and services.

¹⁴ Norman J et al. (2007) [Economic Input-Output Life Cycle Assessment of Trade Between Canada and the United States](#). Environmental Science and Technology 41(5):1523-1532.

Part 3. Annexes

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

Table A.1. Data for Figure 1. Production- and consumption-based carbon dioxide emissions from fuel combustion, Canada, 1995 to 2011

Year	Production-based emissions (megatonnes of carbon dioxide)	Consumption-based emissions (megatonnes of carbon dioxide)	Net emissions exports (megatonnes of carbon dioxide)	Net emissions imports (megatonnes of carbon dioxide)
1995	460.1	420.6	39.5	n/a
1996	475.2	431.3	43.9	n/a
1997	491.8	461.0	30.8	n/a
1998	495.9	464.9	31.0	n/a
1999	507.5	473.7	33.8	n/a
2000	528.2	490.7	37.6	n/a
2001	519.9	481.9	38.1	n/a
2002	526.1	490.4	35.7	n/a
2003	548.7	526.9	21.8	n/a
2004	543.1	536.8	6.3	n/a
2005	548.7	553.0	n/a	4.3
2006	540.6	563.3	n/a	22.7
2007	569.6	588.3	n/a	18.7
2008	554.8	578.8	n/a	24.0
2009	520.4	548.9	n/a	28.5
2010	531.9	576.2	n/a	44.2
2011	537.2	579.4	n/a	42.2

Note: n/a = not applicable. Values for production- and consumption-based emissions presented in this indicator differ from Canada's official accounting of production-based greenhouse gas emissions. Canada's official accounting of greenhouse gas emissions can be found in the [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#).

Source: Organisation for Economic Co-operation and Development (2015) [OECD production- and consumption-based CO₂ emissions estimates](#).

Table A.2. Data for Figure 2. Difference between production- and consumption-based emissions, selected countries and regions, 1995 to 2011

Year	China (mega- tonnes of carbon dioxide emissions)	Russian Federation (mega- tonnes of carbon dioxide emissions)	Rest of world (mega- tonnes of carbon dioxide emissions)	Canada (mega- tonnes of carbon dioxide emissions)	Other OECD (mega- tonnes of carbon dioxide emissions)	United States (mega- tonnes of carbon dioxide emissions)	European Union (28) (mega- tonnes of carbon dioxide emissions)
Data for Figure 2. Difference between production- and consumption-based emissions, selected countries and regions, 1995 to 2011							
1995	316.5	521.6	14.5	39.5	-314.8	-155.7	-421.8
1996	346.4	481.8	26.6	43.9	-307.5	-177.0	-414.3
1997	339.1	422.3	28.5	30.8	-261.7	-200.0	-358.9
1998	316.7	560.4	161.7	31.0	-196.6	-362.5	-510.7
1999	272.0	771.8	243.0	33.8	-254.1	-426.2	-640.3
2000	331.4	827.1	352.8	37.6	-328.7	-529.4	-690.7
2001	312.7	736.5	401.0	38.1	-294.5	-535.8	-658.0
2002	358.1	699.9	402.7	35.7	-277.2	-599.2	-619.9
2003	481.6	704.0	429.0	21.8	-303.6	-627.7	-705.0
2004	724.4	632.4	411.7	6.3	-349.0	-695.9	-729.8
2005	953.3	646.7	356.6	-4.3	-417.0	-770.1	-765.2
2006	1176.6	585.1	271.0	-22.7	-414.4	-814.0	-781.6
2007	1237.0	492.7	174.0	-18.7	-394.9	-664.2	-825.9
2008	1196.6	514.4	117.9	-24.0	-401.7	-557.7	-845.5
2009	871.0	484.4	87.6	-28.5	-248.9	-484.4	-681.1
2010	965.2	513.0	66.8	-44.2	-330.5	-509.5	-660.8
2011	995.7	531.8	51.1	-42.2	-376.6	-498.2	-661.5
Supplementary data for Figure 2. Production-based carbon dioxide emissions from fuel combustion, selected regions, 1995 to 2011							
1995	3021.6	1558.2	4666.6	460.1	2421.6	5130.3	3872.5
1996	3090.5	1525.9	4788.4	475.2	2511.7	5296.0	3990.0

Year	China (mega- tonnes of carbon dioxide emissions)	Russian Federation (mega- tonnes of carbon dioxide emissions)	Rest of world (mega- tonnes of carbon dioxide emissions)	Canada (mega- tonnes of carbon dioxide emissions)	Other OECD (mega- tonnes of carbon dioxide emissions)	United States (mega- tonnes of carbon dioxide emissions)	European Union (28) (mega- tonnes of carbon dioxide emissions)
1997	3062.9	1425.7	4966.9	491.8	2569.6	5474.3	3903.6
1998	3139.4	1415.9	5033.5	495.9	2524.9	5468.8	3908.2
1999	3040.4	1455.5	5146.0	507.5	2607.4	5496.9	3841.9
2000	3310.1	1496.4	5317.6	528.2	2714.5	5691.3	3857.6
2001	3396.2	1497.8	5440.5	519.9	2705.9	5670.6	3934.1
2002	3605.3	1487.0	5620.0	526.1	2759.6	5598.4	3907.6
2003	4176.8	1517.8	5849.1	548.7	2800.7	5673.3	4016.1
2004	4837.2	1509.2	6151.9	543.1	2854.7	5760.7	4015.0
2005	5403.0	1512.0	6390.9	548.7	2889.2	5770.6	3994.5
2006	5913.5	1567.0	6655.0	540.6	2922.0	5684.8	4003.1
2007	6316.9	1567.0	6996.1	569.6	3029.1	5763.1	3954.0
2008	6491.5	1586.4	7335.4	554.8	2954.4	5586.9	3870.5
2009	6795.1	1478.9	7481.3	520.4	2896.0	5181.1	3570.2
2010	7254.5	1580.8	7869.5	531.9	3026.1	5425.0	3683.0
2011	7956.3	1654.0	8092.2	537.2	3135.5	5286.1	3550.4
Supplementary data for Figure 2. Consumption-based carbon dioxide emissions from fuel combustion, selected regions, 1995 to 2011							
1995	2705.0	1036.6	4652.0	420.6	2736.4	5286.0	4294.3
1996	2744.1	1044.1	4761.8	431.3	2819.2	5472.9	4404.3
1997	2723.8	1003.5	4938.5	461.0	2831.3	5674.3	4262.5
1998	2822.7	855.5	4871.7	464.9	2721.6	5831.3	4419.0
1999	2768.3	683.7	4903.0	473.7	2861.5	5923.1	4482.2
2000	2978.7	669.3	4964.8	490.7	3043.2	6220.7	4548.4
2001	3083.5	761.3	5039.4	481.9	3000.4	6206.4	4592.2

Year	China (mega- tonnes of carbon dioxide emissions)	Russian Federation (mega- tonnes of carbon dioxide emissions)	Rest of world (mega- tonnes of carbon dioxide emissions)	Canada (mega- tonnes of carbon dioxide emissions)	Other OECD (mega- tonnes of carbon dioxide emissions)	United States (mega- tonnes of carbon dioxide emissions)	European Union (28) (mega- tonnes of carbon dioxide emissions)
2002	3247.2	787.1	5217.3	490.4	3036.8	6197.7	4527.5
2003	3695.3	813.9	5420.1	526.9	3104.4	6301.1	4721.1
2004	4112.8	876.8	5740.2	536.8	3203.7	6456.6	4744.8
2005	4449.7	865.3	6034.3	553.0	3306.2	6540.7	4759.7
2006	4736.9	981.8	6384.1	563.3	3336.4	6498.8	4784.8
2007	5079.9	1074.3	6822.1	588.3	3424.0	6427.3	4779.9
2008	5294.9	1072.0	7217.5	578.8	3356.1	6144.6	4716.1
2009	5924.1	994.5	7393.7	548.9	3145.0	5665.5	4251.3
2010	6289.3	1067.8	7802.8	576.2	3356.5	5934.5	4343.8
2011	6960.6	1122.2	8041.2	579.4	3512.1	5784.4	4211.9

Note: OECD = Organisation for Economic Co-operation and Development. Totals may not add up due to rounding. Values for production- and consumption-based emissions presented in this indicator differ from Canada's official accounting of production-based greenhouse gas emissions. Canada's official accounting of greenhouse gas emissions can be found in the [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#). (28) refers to the 28 member states of the European Union as of May 2016. The OECD's inter-country input-output system includes discrepancies in the trade data. In this table, emissions allocated to these inter-country input-output system discrepancies are included in the "rest of the world" region. This ensures that global CO₂ production equals global CO₂ consumption. Countries in the "Other OECD" group include Australia, Chile, Iceland, Israel, Japan, Korea, Mexico, New Zealand, Norway, Switzerland and Turkey. Please note that while Latvia is a member of the Organisation for Economic Co-operation and Development, it is not represented individually in the source data. Latvia is therefore included in the estimate for the rest of the world.

Source: Organisation for Economic Co-operation and Development (2015). [OECD production- and consumption-based CO₂ emissions estimates](#).

Annex B. References and additional information

References and further reading

Environment and Climate Change Canada (2016) [National Inventory Report: Greenhouse Gas Sources and Sinks in Canada](#). Retrieved on April 18, 2016.

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Related information

[Canada's Action on Climate Change](#)

[Drivers and Impacts of Greenhouse Gas Emissions](#)

[Global Greenhouse Gas Emissions](#)

[Greenhouse Gas Emissions by Economic Sector](#)

[Greenhouse Gas Emissions by Province and Territory](#)

[Greenhouse Gas Emissions from Large Facilities](#)

[Greenhouse Gas Emissions per Person and per Unit Gross Domestic Product](#)

[Greenhouse Gas Emissions](#)

[Progress Toward Canada's Greenhouse Gas Emissions Reduction Target](#)

[United Nations Framework Convention on Climate Change reporting guidelines on annual inventories for Parties included in Annex I to the Convention](#)

www.ec.gc.ca

Additional information can be obtained at:

Environment and Climate Change Canada

Public Inquiries Centre

7th Floor, Fontaine Building

200 Sacré-Coeur boul.

Gatineau, QC K1A 0H3

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

Fax: 819-994-1412

TTY: 819-994-0736

Email: ec.enviroinfo.ec@canada.ca