



Environment
Canada

Environnement
Canada

www.ec.gc.ca



Data Sources and Methods for the National Greenhouse Gas Emissions Indicators

April 2012

Cat.#: En4-144/18-2012E-PDF
ISBN: 978-1-100-20561-8

Canada

1 Introduction

The national greenhouse gas (GHG) emissions indicators are part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

The GHG emissions indicators are used to track the progress of Canada's efforts to lower emissions and reach environmental performance objectives. Use of the GHG indicators in conjunction with economic performance indicators such as the gross domestic product (GDP) will help to support national-level decision making on sustainable development.

2 Description and rationale of the national greenhouse gas emissions indicators

2.1 Description

The GHG emissions indicators report trends in anthropogenic (human-made) GHG emissions at the national level (total emissions, emissions per person and emissions per unit of GDP), and at the provincial/territorial and economic sector level for the six main GHGs in Canada: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons and hydrofluorocarbons.

Emissions from natural unmanaged sources (material decay, plant and animal respiration, volcanic and thermal venting, etc.), and absorption of emissions by natural sinks (forests, oceans), are not captured by these indicators.

2.2 Rationale

As an Annex I Party (Annex 1 Parties include industrialized countries and economies in transition) to the United Nations Framework Convention on Climate Change (UNFCCC), Canada is required to prepare and submit a national inventory of anthropogenic sources and sinks of GHGs on an annual basis.

Since direct measurement of emissions from all sources is not practical, the UNFCCC requires that countries develop, update, publish and maintain national inventories using comparable emissions estimation methods.

Canada's inventory follows the internationally approved methods developed by the Intergovernmental Panel on Climate Change (IPCC) to estimate emissions for the six GHGs.

The IPCC guidelines (<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>) are approved and developed through an international process that includes comments from national experts, testing of methods through preliminary inventory development, country studies, technical and regional workshops, and informal expert groups.

2.3 Changes since last report

Changes to the data and methodologies used to develop the indicator are recorded in the caveats and limitations section of this report and in Chapter 9 of Environment Canada's National Inventory Report 1990-2010: Greenhouse Gas Sources and Sinks in Canada (<http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1>). In addition,

provincial/territorial and sector emissions indicators have been added to the reporting suite as well a summary of emissions by economic sectors.

3 Data

3.1 Data source

The GHG emissions indicators are based on GHG emissions data taken from Environment Canada's National Inventory Report 1990-2010: Greenhouse Gas Sources and Sinks in Canada (<http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1>). Data used to develop the National Inventory Report (NIR) are drawn from published and unpublished sources from various government departments, industry sources and scientific papers. The methods are consistent with internationally accepted Intergovernmental Panel on Climate Change (IPCC) reference documents. Figure 1-4 of the NIR illustrates the inventory preparation process and shows the main partners involved in preparing the annual inventory. A comprehensive list detailing all data sources (disaggregated by sector and sub-sector) can be found in chapters 3 through 8 of the NIR.

3.2 Spatial coverage

GHG emission estimates for the indicators are provided at the national, provincial/territorial and economic sector level.

3.3 Temporal coverage

GHG emissions are compiled annually and reported for the period 1990 to 2010. NIR data used to develop the indicators are almost completely compiled by the end of December of each reporting year by Environment Canada's Pollutant Inventories and Reporting Division. In the period from November through March, draft estimates of the NIR, along with accompanying data tables, are prepared, reviewed by external experts and internal Environment Canada staff, and finally submitted electronically to the UNFCCC by April 15.

A comprehensive detailing of the temporal coverage for each data source used for the indicators can be found in chapter 1 (section 1.3) and in chapters 3 through 8 of the NIR.

3.4 Data completeness

Although the GHG emissions indicators are comprehensive, some emission sources have not been included due to exclusions within the NIR. Owing to their relatively small contributions to the total emissions, these exclusions do not significantly affect the overall completeness of the inventory. A detailed discussion of the emission sources not included can be found in Annex 5 of the NIR.

3.5 Data timeliness

The data are current up to 2010. The GHG emissions indicators have less than a two-year time lag due to the time needed to collect, validate, calculate and interpret the data for reporting.

4 Methods

In general, GHG emissions are estimated by multiplying activity data by specific emission factors.

$$\text{Emissions} = \text{activity data} \times \text{emission factor}$$

Activity data refer to the quantitative amount of human activity resulting in emissions during a given period of time. The annual activity data for fuel combustion sources, for example, are the total amounts of fuel burned.

Emission factors are based on samples of measurement data and are representative rates of emissions for a given activity level under a given set of operating conditions. They are the estimated average emission rate of a given pollutant for a given source, relative to units of activity.

Guidelines produced by the IPCC for countries reporting to the UNFCCC provide various methods for calculating a GHG emission from a given human activity. The methods for estimating the gases are divided into “tiers”, each encompassing different levels of activity and technological detail. The same general structure is used, but the level of detail at which the calculations are carried out can vary. Annexes 2 and 3 of the NIR describe the methods used to estimate Canada’s GHG emissions, and illustrate that the selection of IPCC method type is highly dependent on the importance of each category and the availability of data.

The GHG emissions are reported in carbon dioxide equivalents, determined by multiplying the amount of emissions of a particular gas by the global warming potential (GWP) of that gas. GHGs differ in their ability to absorb heat in the atmosphere due to their differing chemical properties and atmospheric lifetimes. For example, over a period of 100 years, methane’s potential to trap heat in the atmosphere is 21 times greater than carbon dioxide’s potential, and thus it is considered to have a GWP of 21. The IPCC publishes the GWPs and atmospheric lifetimes for each GHG which can be found in Table 1-1 of the NIR.

The GHG emissions by economic sector represent a different classification than the activity sector emissions prescribed by the IPCC methodology. Instead of reporting on Canada’s emissions by activity, GHG emissions have been allocated to the economic sector in which they are generated (e.g. transportation emissions directly supporting an industrial activity, like off-road trucks in mining activities, have been allocated to the economic sector in which they are generated rather than to the transportation “activity” sector). A comprehensive detailing of the emissions reported by economic sector can be found in chapter 2 of the NIR.

5 Caveats and limitations

Annex 7 of the NIR presents the uncertainty assessment for Canada’s GHG emissions. Further details on uncertainty related to specific sectors can be found in the uncertainty sections of chapters 3 through 8 of the NIR.

The sum of emissions from all provinces and territories do not add up to the national total because the emissions from some sources are estimated at the national level only. In particular, GHG estimates associated with the consumption of perfluorocarbons (PFCs) or sulfur hexafluoride (SF₆) from semi-conductor manufacturing are not included, only SF₆ emissions from electrical equipment have been included. Nevertheless, the trends in emissions from provinces and territories are considered representative of the actual emission trends in these jurisdictions.

The application of quality assurance and quality control (QA/QC) procedures is an essential requirement of the GHG inventory development and submission process. QA/QC procedures ensure and improve transparency, consistency, comparability, completeness and confidence in the national emissions for the purpose of meeting Canada’s reporting commitments under the UNFCCC. Annex 6 of the NIR provides a complete discussion of the QA/QC procedures.

Chapter 9 of the NIR provides a summary of the recalculations implemented in Canada's GHG inventory since the 2011 submission to the UNFCCC, and a description of planned improvements for future inventories.

6 References and further reading

6.1 References

Environment Canada (2011) National Inventory Report, 1990-2010: Greenhouse Gas Sources and Sinks in Canada. Available from: <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1>

6.2 Further reading

[IPCC] Intergovernmental Panel on Climate Change (2006) Guidelines for National Greenhouse Gas Inventories (not yet adopted for use by the UNFCCC). Retrieved on 4 April 2012. Available from: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>

[IPCC] Intergovernmental Panel on Climate Change (2003) Good Practice Guidance for Land Use, Land-Use Change and Forestry. Retrieved on 4 April 2012. Available from: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_contents.html

[IPCC] Intergovernmental Panel on Climate Change (2000) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Retrieved on 4 April 2012. Available from: <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>

[IPCC] Intergovernmental Panel on Climate Change (1996) Revised 1996 Guidelines for National Greenhouse Gas Inventories. Retrieved on 4 April 2012. Available from: <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>