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Data Sources and Methods for the International Comparison of Air Pollutant Emissions Indicators

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1. Introduction

The [International Comparison of Air Pollutant 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.

2. Description and rationale of the International Comparison of Air Pollutant Emissions indicators

2.1 Description

The International Comparison of Air Pollutant Emissions indicators track air pollutant emissions for Canada and other member countries of the Organisation for Economic Co-operation and Development (OECD) for which emissions data were available. Five pollutants were selected for these indicators: sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC) and fine particulate matter (PM_{2.5}). Emissions are reported in kilotonnes.

A country's air pollutant emissions intensity for the same five pollutants was also provided in terms of total tonnes of emissions per unit of gross domestic product (GDP). The GDP figures used are expressed in U.S. dollars (US\$), at constant prices, and constant purchasing power parity (PPP), for the base year of 2005. The use of PPP facilitates international comparison of GDP by creating an equivalent purchasing power basis for each country compared.

2.2 Rationale

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. The emissions data for Canada used for these indicators are also used to fulfill Canada's international and domestic commitments and reporting obligations.¹

2.3 Recent changes to the indicator

Previously, the indicators considered 10 selected industrialized countries (G7 countries + Australia, Russia and Sweden) for the comparison. To improve data consistency and enhance comparisons across countries, the current indicators compare the national emissions and emissions intensities across OECD member countries, with a focus on the top 10 largest emitters for each pollutant examined (see section 4.3). Furthermore, two pollutants were added (CO and PM_{2.5}) and one was removed (ammonia (NH₃)), since it is not reported by the new data source used for this indicator (see section 3.1). This new data source includes the same sources of information previously used for the indicators, with additional sources completing the pollutant emissions of OECD member countries.

3. Data

3.1 Data source

The air pollutant emissions data used to calculate the International Comparison of Air Pollutant Emissions indicators are directly retrieved from the "Emission of air pollutant" section of the "Environment (Air and Climate)" grouping of the OECD [StatExtracts](#) database.

¹ Convention on Long-Range Transboundary Air Pollution (CLRTAP)

This OECD database includes emissions data from:

- The [Centre on Emission Inventories and Projections database](#) of the Convention on Long-Range Transboundary Air Pollution (CLRTAP).
- The [National Inventory Submissions 2014](#) of the United Nations Framework Convention on Climate Change (UNFCCC).
- The replies to the 2014 OECD Questionnaire on the State of the Environment and comments from member countries received before August 2014.
- Country specific National data.

Appendix A includes the list of data sources for each OECD member country, pollutant and year. GDP statistics were obtained through the national accounts of the OECD [StatExtracts](#) database.

3.2 Spatial coverage

These indicators cover the OECD member countries. For the complete list of countries included, please consult the countries table in section 4.3.

3.3 Temporal coverage

Two years are used to compare these countries: 2012, which is the year with the latest available information at the release time of these indicators, and 2002 (10 years prior).

3.4 Data completeness

Only those countries that submitted emissions are found in the indicators. Some years or pollutants may be missing for certain countries due to the different reporting cycles or their year of accession to the OECD.

3.5 Data timeliness

The data is current up to the end of 2012. The International Comparison of Air Pollutant Emissions indicators are reported two to three years after data collection.

4. Methods

4.1 International comparison of air pollutant emissions indicators

Each country compiles and estimates its emissions, generally using a combination of top-down and bottom-up approaches. Top-down approaches involve the multiplication of sector activity levels by emissions factors. Bottom-up approaches are based on facility emissions. The emissions are collated, verified, validated and grouped into the format required by the international organizations (Centre on Emission Inventories and Projections [CEIP], United Nations Framework Convention on Climate Change [UNFCCC] and the Organisation for Economic Co-operation and Development [OECD] questionnaire) and reported.

The emissions are estimated or measured using one of the following methods:

- Continuous emission monitoring systems (CEMS)
- Predictive emission monitoring (PEM)
- Source testing
- Mass balance
- Site-specific emission factors
- Published emission factors
- Engineering estimates
- Special studies

Canada's data are derived from the annual Convention on Long-Range Transboundary Air Pollution (CLRTAP) submission to the CEIP database. The submitted_{air} pollutant emission data is based on Canada's [Air Pollutant Emission Inventory](#). This includes information reported by

facilities to the National Pollutant Release Inventory (NPRI) as well as emission estimates that are compiled for other sources such as motor vehicles.

4.2 International air pollutant emissions per unit of gross domestic product (GDP)

This indicator is obtained by dividing the emissions from the international comparison of air pollutant emissions indicators by the GDP data from the OECD. The emission intensities are expressed in tonnes/million U.S. dollars (US\$) using constant GDP at purchasing power parity (PPP) and the 2005 base year. PPPs are weighted averages of the relative prices, quoted in national currency, of comparable items between countries. The use of PPPs facilitates international comparison of GDP by creating an equivalent purchasing power basis for each country compared.

4.3 Countries included in the comparison

OECD member countries included in the indicators

Country	Sulphur oxides (SO _x), Nitrogen oxides (NO _x), Carbon monoxide (CO) and Volatile organic compounds (VOC)	Fine particulate matter (PM _{2.5})
Australia	x	n/a
Austria	x	x
Belgium	x	x
Canada	x	x
Chile	A	n/a
Czech Republic	x	B
Denmark	x	x
Estonia	x	x
Finland	x	x
France	x	x
Germany	x	x
Greece	x	n/a
Hungary	x	x
Iceland	x	x
Ireland	x	x
Italy	x	x
Japan	x	n/a
Korea	A	n/a
Luxembourg	x	x
Netherlands	x	x
New Zealand	x	n/a
Norway	x	x
Poland	x	x
Portugal	x	x
Slovak Republic	x	x
Slovenia	x	x
Spain	x	x
Sweden	x	x
Switzerland	x	x
Turkey	x	n/a
United Kingdom	x	x

Country	Sulphur oxides (SO _x), Nitrogen oxides (NO _x), Carbon monoxide (CO) and Volatile organic compounds (VOC)	Fine particulate matter (PM _{2.5})
United States	x	x

Note: x means data available for 2002 and 2012. A means data for 2002 only and B means data for 2012 only. Israel and Mexico did not have data for the two comparing years for all pollutants. Australia, Chile, Greece, Japan, Korea, New Zealand and Turkey did not have data for the two comparing years for PM_{2.5}.

4.4 Emissions not included in the comparison

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

In general, for the emissions data retrieved from the CLRTAP submission to the CEIP database, the OECD used the national total line (line 134 of the [Nomenclature For Reporting](#) (NFR) tables from the national submission) and added the civil aviation (domestic, cruise) emissions [1 A 3 a ii (ii) line 140]. It then subtracted the emissions from international aviation (landing and take-off (LTO)) [1 A 3 a i (i) line 36] and shipping international inland waterways [1 A 3 d i (ii) line 45] to obtain its emission values.

For Canada, the data from the CLRTAP submission to the CEIP database were used. However, Canada's values include international emissions from aviation and marine since the estimation methodologies used by Canada cannot permit the separation of the international components from the domestic values.

5. Caveats and limitations

Air pollutant emissions inventories from different countries are being estimated with the best data, measurements and methodologies available. Although the national emissions inventories used for these comparisons follow a reporting structure such as the [Centre on Emission Inventories and Projections \(CEIP\) database](#), users should be cautious when comparing the data as emissions estimation methodologies and coverage among countries may differ.

Emissions reported for Canada in the OECD data set are slightly different than the emissions reported in the CESI National Indicators. They do not include emissions from international aviation and maritime transport.

6. References and further reading

6.1 References

Centre on Emission Inventories and Projections European Monitoring and Evaluation Programme (2014) [Centre on Emission Inventories and Projections 2014 submissions](#). Retrieved in January, 2015.

Organisation for Economic Co-operation and Development (2014) [OECD StatExtracts – GDP](#). Retrieved in January, 2015.

United Nations Framework Convention on Climate Change (2014) [GHG Emissions Inventory – National Inventory Submissions 2014](#). Retrieved in January, 2015.

Appendix A: Data sources by country, pollutants and years

Legend

UNFCCC: Data were retrieved from the [National Inventory Submissions 2014](#) of the United Nations Framework Convention on Climate Change (UNFCCC).

CLRTAP: Data were retrieved from the [2014 submission of the Centre on Emission Inventories and Projections database](#) of the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

CLRTAP^[A]: Expert estimates from the European Monitoring and Evaluation Programme (EMEP) under the CLRTAP.

National: Data from the specific country emissions compilation organization or from the 2014 Organisation for Economic Co-operation and Development (OECD) Questionnaire on the State of the Environment.

Countries	Sulphur oxides (SO _x) 2002	Sulphur oxides (SO _x) 2012	Nitrogen oxides (NO _x) 2002	Nitrogen oxides (NO _x) 2012	Carbon monoxide (CO) 2002	Carbon monoxide (CO) 2012
Australia	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Austria	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Belgium	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Canada	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Chile	National	n/a	National	n/a	National	n/a
Czech Republic	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]
Denmark	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Estonia	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Finland	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
France	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Germany	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Greece	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Hungary	National	CLRTAP	National	CLRTAP	National	CLRTAP
Iceland	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Ireland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	UNFCCC	UNFCCC
Italy	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Japan	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Korea	National	n/a	National	n/a	National	n/a
Luxembourg	National	National	National	National	National	National
Netherlands	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
New Zealand	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC	UNFCCC
Norway	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Poland	CLRTAP ^[A]	CLRTAP	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]	CLRTAP ^[A]
Portugal	UNFCCC	UNFCCC	National	National	National	National
Slovak Republic	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovenia	National	UNFCCC	National	UNFCCC	National	UNFCCC
Spain	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Sweden	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Switzerland	CLRTAP	CLRTAP	CLRTAP	CLRTAP	National	National
Turkey	National	National	National	National	National	National

Countries	Sulphur oxides (SO_x) 2002	Sulphur oxides (SO_x) 2012	Nitrogen oxides (NO_x) 2002	Nitrogen oxides (NO_x) 2012	Carbon monoxide (CO) 2002	Carbon monoxide (CO) 2012
United Kingdom	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP	CLRTAP
United States	National	National	National	National	National	National

Countries	Volatile organic compounds (VOC) 2002	Volatile organic compounds (VOC) 2012	Fine particulate matter (PM_{2.5}) 2002	Fine particulate matter (PM_{2.5}) 2012
Australia	UNFCCC	UNFCCC	n/a	n/a
Austria	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Belgium	UNFCCC	UNFCCC	CLRTAP	CLRTAP
Canada	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Chile	National	n/a	n/a	n/a
Czech Republic	CLRTAP ^[A]	CLRTAP ^[A]	n/a	CLRTAP
Denmark	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Estonia	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Finland	UNFCCC	UNFCCC	CLRTAP	CLRTAP
France	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Germany	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Greece	UNFCCC	UNFCCC	n/a	n/a
Hungary	National	CLRTAP	CLRTAP	CLRTAP
Iceland	UNFCCC	UNFCCC	n/a	n/a
Ireland	n/a	n/a	CLRTAP	CLRTAP
Italy	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Japan	UNFCCC	UNFCCC	n/a	n/a
Korea	National	n/a	n/a	n/a
Luxembourg	National	National	National	National
Netherlands	CLRTAP	CLRTAP	CLRTAP	CLRTAP
New Zealand	UNFCCC	UNFCCC	n/a	n/a
Norway	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Poland	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Portugal	National	National	CLRTAP	CLRTAP
Slovak Republic	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Slovenia	National	UNFCCC	National	CLRTAP
Spain	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Sweden	CLRTAP	CLRTAP	CLRTAP	CLRTAP
Switzerland	n/a	n/a	CLRTAP	CLRTAP
Turkey	National	National	National	National
United Kingdom	CLRTAP	CLRTAP	CLRTAP	CLRTAP
United States	National	National	National	National

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