



Environment and
Climate Change Canada

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GREENHOUSE GAS EMISSIONS PROJECTIONS

CANADIAN ENVIRONMENTAL
SUSTAINABILITY INDICATORS



Canada 

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS GREENHOUSE GAS EMISSIONS PROJECTIONS

January 2023

Table of contents

Greenhouse gas emissions projections	5
Projections under Canada's Eighth National Communication and Fifth Biennial Report.....	5
Key results	5
About the indicator	6
What the indicator measures.....	7
Why this indicator is important	7
Related initiatives	7
Related indicators.....	8
Data sources and methods.....	8
Data sources	8
Methods	8
Recent changes.....	9
Caveats and limitations	9
Resources.....	10
References	10
Related information	10
Annex	12
Annex A. Data table for the figure presented in this document.....	12

List of Figures

Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2035	5
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List of Tables

Table A.1. Data for Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2035	12
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Greenhouse gas emissions projections

Climate change is caused by the increase in concentrations of greenhouse gases (GHGs) which trap heat in the Earth's atmosphere. These increases are primarily due to GHG emissions from human activities.

Canada's actions to address climate change at home and abroad are guided by the 2015 Paris Agreement goal of holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels, and pursuing efforts to limit the global temperature increase to 1.5 degrees Celsius. In 2021, Canada announced an enhanced target committing Canada to cut its GHG emissions by 40% to 45% below 2005 levels by 2030. Previously, Canada had committed to reducing its GHG emissions by 30% below 2005 levels by 2030.

To estimate future GHG emissions, Canada develops GHG projections on an annual basis, using the most up-to-date assumptions of the key drivers that influence Canada's emissions. The indicator uses the latest GHG emissions projections to present the forecast progress toward Canada's 2030 target.

Projections in Canada's Eighth National Communication and Fifth Biennial Report

Environment and Climate Change Canada publishes updated projections annually. In December 2022, the projections were updated and published as part of [Canada's Eighth National Communication and Fifth Biennial Report](#) to the United Nations Framework Convention on Climate Change (UNFCCC). While in previous Biennial Reports, projections were presented out to 2030, the Fifth Biennial Report includes projections out to 2035. For the December 2022 projections update, 2 scenarios were developed:

- the "with measures" scenario includes all policies and measures funded, legislated and implemented by federal, provincial and territorial governments up to November 2022 and contributions from the land use, land use change and forestry (LULUCF) sector
- the "with additional measures" scenario adds in policies and measures that are under development but have not yet been fully implemented, including contributions from nature-based-climate solutions (NBCS) and agriculture measures and credits purchased under the [Western Climate Initiative](#) (WCI)¹

These scenarios do not include modelling of further measures which could contribute to progress toward the 2030 target but have not yet been sufficiently developed, such as the cap on oil and gas emissions and elements of the Green Buildings Strategy.

Key results

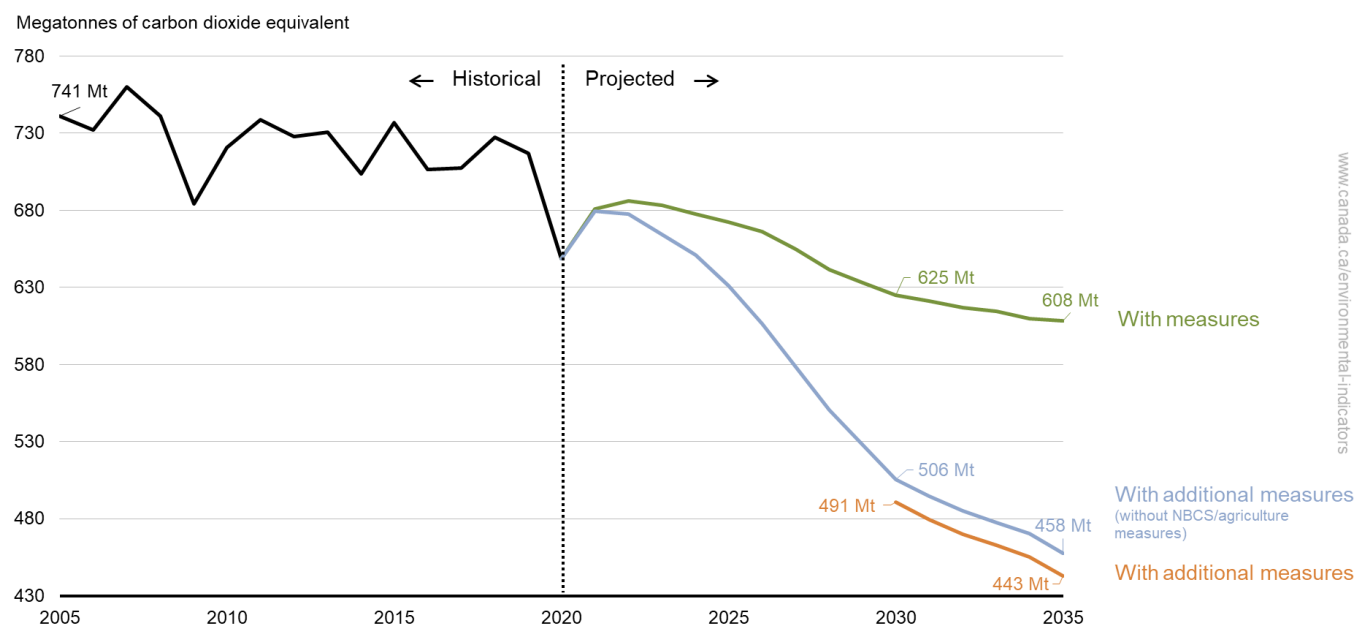
- Under the "with measures" scenario, emissions in Canada are projected to be 625 megatonnes of carbon dioxide equivalent (Mt CO₂ eq) in 2030² (or 16% below 2005 levels³)
- Under the "with additional measures" scenario, emissions are projected to decline to 491 Mt CO₂ eq in 2030 (or 34% below 2005 levels)
- 2035 emissions are projected to decline further, reaching 608 Mt CO₂ eq (18% below 2005 levels) under the "with measures" scenario and 443 Mt CO₂ eq (40% below 2005 levels) under the "with additional measures" scenario

¹ Nature-based climate solutions and agriculture measures represent avoided conversion and restoration of ecosystems such as wetlands, grasslands, and forest land, as well as the use of best management practices on agricultural land. The Western Climate Initiative supports greenhouse gas emissions trading programs and permits the purchase of GHG emissions credits from other participating jurisdictions.

² Through the sensitivity analysis of the "with measures" scenario, GHG emissions in 2030 are projected to range between 612 and 664 Mt CO₂ eq, excluding the LULUCF accounting contribution. The LULUCF sector is projected to reduce Canada's emissions by 12 Mt CO₂ eq in 2030.

³ Based on Canada's 2022 National Inventory Report, Canada's GHG emissions were 741 megatonnes of carbon dioxide equivalent in 2005. Note that the 2005 emission level is subject to change as recalculations are performed annually to reflect updates to source data and estimation methodology.

Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2035



[Data for Figure 1](#)

Note: NBCS = nature-based climate solutions. The "with additional measures" scenario assumes the 2030 estimate for NBCS and agriculture measures (reduction of 14 to 16 megatonnes of carbon dioxide equivalent) is constant out to 2035. Historical emissions data from 2005 to 2020 correspond to the emissions presented in the [National Inventory Report 1990-2020: Greenhouse gas sources and sinks in Canada](#) to which were added the accounting contribution from the land use, land use change and forestry sector. For more information on the projection scenarios, refer to the [Data sources and methods](#).

Source: Environment and Climate Change Canada (2022) [Canada's Eighth National Communication and Fifth Biennial Report](#). Environment and Climate Change Canada (2022) [National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada](#).

The uncertainty inherent in projections is addressed via modelling and analysis of alternate cases that focus on variability in: future economic growth, population projections and oil and natural gas production and prices. The sensitivity analyses generated through these alternate cases are used to identify a range of possible emissions projections. Through the sensitivity analysis of the "with measures" scenario, GHG emissions in 2030 are projected to range between 612 and 664 Mt CO₂ eq, excluding LULUCF accounting contributions. The LULUCF Sector is projected to reduce Canada's emissions by 12 Mt CO₂ eq in 2030.

When all announced measures are taken into account ("with additional measures" scenario), GHG emissions for 2030 are projected to have decreased by 97 Mt CO₂ eq compared to [Canada's Fourth Biennial Report on Climate Change](#) published in December 2019. This change is primarily driven by new policies and measures that have been put in place or announced in the 2020 strengthened climate plan, [A Healthy Environment and a Healthy Economy](#) and in the [2030 Emissions Reduction Plan](#), released in March 2022, as well as updated macroeconomic assumptions such as population growth and oil and gas production forecasts.

The projections in the Fifth Biennial Report reflect the estimated impact of recent global events. These have had significant impacts on the projections, and include:

- Disruptions to global energy markets due to the war in Ukraine, which are leading countries previously relying on natural gas sourced from Russia to find other suppliers
- Global inflation, including in Canada, reaching highs not seen in decades, which has an impact on future prices (such as that for carbon), when those are set in nominal prices
- The COVID-19 pandemic, which disrupted economic activity across the globe and shifted consumption patterns

As new measures are announced in more detail and implemented, they will be included in the modelling to assess their impact on future projected emissions levels, including for 2030.

About the indicator

What the indicator measures

The indicator provides an overview of Canada's projected GHG emissions up to 2035. These modelled projections are based on:

- historical data from Canada's National Inventory Report
- expectations about future energy markets, population and economic growth from authoritative sources including the Canada Energy Regulator, Statistics Canada and Finance Canada
- policies and measures that were in place as of November 2022
- policies and measures that are under development but not yet fully implemented, including those from the 2030 Emissions Reductions Plan where there was sufficient information to include them in the sectoral projections

Why this indicator is important

In 2015, Canada and 194 other countries reached the Paris Agreement. This agreement aims to limit the global average temperature rise to well below 2 degrees Celsius and pursue efforts to limit the increase to 1.5 degrees Celsius. To achieve this long-term goal, the Paris Agreement requires countries to increase their ambition every 5 years. This is why, in July 2021, Canada committed to a GHG emissions reduction target of 40% to 45% below 2005 levels by 2030 and to achieve net-zero emissions by 2050.

The [Canadian Net-Zero Emissions Accountability Act](#) enshrines in legislation Canada's commitment to achieve net-zero greenhouse gas emissions by 2050. The Act establishes a legally-binding process to set 5-year national emissions-reduction targets and develop emissions-reduction plans to achieve each target. In March 2022, the Government of Canada introduced the [2030 Emissions Reduction Plan](#), the first plan issued under the Act. The plan provides a roadmap for the Canadian economy to achieve its emissions reduction target. The Government of Canada expects that the measures outlined in the 2030 Emissions Reduction Plan, together with complementary climate actions from the provinces and territories, municipalities, the financial community, Indigenous Peoples, innovators, and businesses – as well as with the acceleration of clean technology innovation and deployment – will lead to further emission reductions by 2030. Updates on progress to implement the measures outlined in the 2030 plan will be presented through progress reports in 2023, 2025 and 2027. Additional targets will be developed in 5-year intervals for 2035 through to 2045, as well as associated plans through to 2050.

The 2030 Emissions Reduction Plan continues to build upon the actions outlined in Canada's previous climate plans. Canada's first-ever national climate plan was released in 2016 – the [Pan-Canadian Framework on Clean Growth and Climate Change](#) – jointly developed by the federal, provincial and territorial governments and in consultation with Indigenous Peoples. In 2020, the Government of Canada announced its strengthened climate plan, [A Healthy Environment and a Healthy Economy](#).

The indicator allows the public and policy-makers to see Canada's modelled GHG emissions projections relative to the 2030 target and introduces for the first time projections up to 2035.

Further, this indicator is important because of the human health, environmental and economic impacts associated with GHG emissions. For more information on these impacts, consult [Greenhouse gas emissions: drivers and impacts](#).

Related initiatives

This indicator supports the measurement of progress towards the following [2022 to 2026 Federal Sustainable Development Strategy](#) Goal 13: Take action on climate change and its impacts.

In addition, the indicator contributes to the [Sustainable Development Goals of the 2030 Agenda for Sustainable Development](#). They are linked to Goal 13, Take urgent action to combat climate change and its impacts and Target 13.2, "Integrate climate change measures into national policies, strategies and planning."

Related indicators

The [Greenhouse gas emissions](#) indicators report 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 [Global greenhouse gas emissions](#) indicator provides a global perspective on Canada's share of global GHG emissions.

The [Greenhouse gas concentrations](#) indicators present atmospheric concentrations as measured from sites in Canada and at a global scale for 2 greenhouse gases: carbon dioxide and methane.

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 data for this indicator come from Environment and Climate Change Canada's GHG emissions projections as reported in [Canada's Eighth National Communication and Fifth Biennial Report](#). The indicator reflects the latest GHG emissions projections modelling published by the department at the time of production.

The latest projections (December 2022) use historical GHG emissions data from the 2022 [National Inventory Report](#) for the years 2005 to 2020. The projections cover the period from 2021 to 2035.

Methods

No changes or additional calculations are performed on the data.

More information

The indicator is based on analysis that incorporates the most up-to-date information on GHG emissions, economic and population growth and energy price and production projections available at the time the technical modelling was completed. Data and information on policies and measures modelled under each scenario were included in [Canada's Eighth National Communication and Fifth Biennial Report](#).

Emissions projections

The emissions projections have been developed in line with generally recognized best practices. This includes:

- incorporating Intergovernmental Panel on Climate Change standards for estimating GHG emissions across different fuels and processes
- relying on outside expert views and the most up-to-date assumptions of the key drivers that influence Canada's overall GHG emissions, such as economic and population growth, energy prices, and energy demand and supply
- applying an internationally recognized energy and macroeconomic modelling framework for estimating emissions and economic interactions
- using a methodology to develop the projections and underlying assumptions that has been subject to peer review by leading external experts on economic modelling and GHG emissions projections, and reviewed by key stakeholders

The approach to developing Canada's GHG emissions projections involves:

- using the most up-to-date statistics on GHG emissions and energy use, and sourcing key assumptions from the best available public and private expert sources

- developing emissions projection scenarios using the detailed and proven Energy, Emissions and Economy Model for Canada, that combines a detailed bottom-up simulation with a top-down macroeconomic model

The methodology for developing the emissions scenarios is described in Chapter 5 - Annex 7 of [Canada's Eighth National Communication and Fifth Biennial Report](#).

Scenarios

The indicator presents the 2 different scenarios from [Canada's Eighth National Communication and Fifth Biennial Report](#):

- the "with measures" scenario includes policies and measures in place as of November 2022 and contributions from the land use, land use change and forestry (LULUCF) sector
- the "with additional measures" scenario adds in policies and measures that are under development but have not yet been fully implemented, including contributions from nature-based climate solutions (NBCS) and agriculture measures and credits purchased under the [Western Climate Initiative](#) (WCI)

Recent changes

The calculation of this indicator reflects methodological revisions that were applied to the 2022 [National Inventory Report](#), as well as revisions to the Energy, Emissions and Economy Model for Canada. For a list of the modelling and methodological changes, refer to Sections 5.2.2, 5.2.3 and Chapter 5 – Annex 4 of [Canada's Eighth National Communication and Fifth Biennial Report](#).

Caveats and limitations

Emissions projections are subject to uncertainty, and are most appropriately viewed as a range of plausible outcomes. Many of the events that shape emissions and energy markets cannot be anticipated. In addition, future developments in technologies, demographics and resources cannot be foreseen with certainty.

More information

Scenarios' description

The projection scenarios derive from a series of plausible assumptions regarding, among others, population and economic growth, prices, demand and supply of energy, and the evolution of energy efficiency technologies. The "with measures" scenario assumes no further government actions to address GHG emissions beyond those already in place as of November 2022.

Under the strengthened climate plan, [A Healthy Environment and a Healthy Economy](#), and the [2030 Emissions Reduction Plan: Canada's Next Steps for Clean Air and a Strong Economy](#), a number of policies and measures have been announced. As the policy development process is not yet complete, some policies were not included in the "with measures" scenario, but they were in "with additional measures" scenario. For a complete list of included policies and measures, refer to Table 5A-49 in Chapter 5 – Annex 3 of [Canada's Eighth National Communication and Fifth Biennial Report](#). The "with measures" scenario does not take into account the impact of broader strategies or future measures within existing plans where significant details are still under development. Policies still under development will be included in subsequent scenarios as their details become finalized. For a list of key assumptions found in the "with additional measures" scenario, refer to Table 5A-52 in Chapter 5 – Annex 3 of [Canada's Eighth National Communication and Fifth Biennial Report](#).

Uncertainty and sensitivity

The projections are conservative relative to the significant investments and economic transformation likely to unfold over the coming decade. Certain investments, such as those in clean technology or public transit, are difficult to quantify in advance but can be expected to have a material impact on emissions. These projections also do not account for the reality that Canada is just starting along the innovation curves associated with promising decarbonization technologies.

The projections presented in the indicator are based on a series of assumptions, including that the current planned policy context will continue into the future. The projections do not attempt to account for unknown changes in government policy; energy supply, demand and technology; or domestic and international economic and political events.

The future level of GHG emissions in Canada depends on a number of factors, including changes in future energy markets and economic assumptions, technological change, consumer behaviour, and introduction of additional policies aimed at emissions reductions. A sensitivity analysis was conducted to address the uncertainty regarding the key drivers of GHG emissions and identify a range of possible emissions projections. The analysis focuses on variability in 2 key factors: future economic and population growth, and the evolution of world fossil fuel prices. For more details about the sensitivity analysis, please consult Section 5.3 and Chapter 5 – Annex 5 of [Canada's Eighth National Communication and Fifth Biennial Report](#).

Modelling

While the Energy, Emissions and Economy Model for Canada is a sophisticated analytical tool, no model can fully capture the complicated interactions between policy measures, markets, firms and consumers.

The Energy, Emissions and Economy Model for Canada has a broad model boundary that captures the complex interactions that occur between producers, consumers and the environment across all energy sectors in the Canadian context. In addition, the Energy, Emissions and Economy Model for Canada has an explicit causal structure that can be used to understand the origins of the patterns of behavior observed and also captures capital stock dynamics. Combined with the fact that it is calibrated to the Canadian experience, these provide considerable flexibility for the modelling of energy and environmental policies.

Unlike computable general equilibrium models, the Energy, Emissions and Economy Model for Canada does not fully equilibrate government budgets and the markets for employment and investment. That is, the modeling results reflect rigidities such as unemployment and government surpluses and deficits. The model, as used by Environment and Climate Change Canada, also does not generate changes in nominal interest rates and exchange rates, as would occur under a monetary policy response to a major economic event. Consequently, the model is not designed to undertake welfare analysis.

Finally, the model lacks endogenous technological change for the industrial and transportation sectors. As a result, the Energy, Emissions and Economy Model for Canada is not well-suited to modelling disruptive technological changes.

Resources

References

Environment and Climate Change Canada (2016) [Pan-Canadian Framework on Clean Growth and Climate Change](#). Retrieved on December 20, 2022.

Environment and Climate Change Canada (2019) [Canada's Fourth Biennial Report on Climate Change](#). Retrieved on December 20, 2022.

Environment and Climate Change Canada (2020) [A Healthy Environment and a Healthy Economy](#). Retrieved on December 20, 2022.

Environment and Climate Change Canada (2022) [National Inventory Report 1990-2020: Greenhouse gas sources and sinks in Canada](#). Retrieved on December 20, 2022.

Environment and Climate Change Canada (2022) [2030 Emissions Reduction Plan: Canada's Next Steps for Clean Air and a Strong Economy](#). Retrieved on December 20, 2022.

Environment and Climate Change Canada (2022) [Canada's Eighth National Communication and Fifth Biennial Report](#). Retrieved on January 3, 2023.

Related information

[Canada's climate plan](#)

[Greenhouse gas emissions: drivers and impacts](#)

[Greenhouse gas emissions projections](#)

Annex

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

Table A.1. Data for Climate change is caused by the increase in concentrations of greenhouse gases (GHGs) which trap heat in the Earth's atmosphere. These increases are primarily due to GHG emissions from human activities.

Canada's actions to address climate change at home and abroad are guided by the 2015 Paris Agreement goal of holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels, and pursuing efforts to limit the global temperature increase to 1.5 degrees Celsius. In 2021, Canada announced an enhanced target committing Canada to cut its GHG emissions by 40% to 45% below 2005 levels by 2030. Previously, Canada had committed to reducing its GHG emissions by 30% below 2005 levels by 2030.

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These scenarios do not include modelling of further measures which could contribute to progress toward the 2030 target but have not yet been sufficiently developed, such as the cap on oil and gas emissions and elements of the Green Buildings Strategy.

Key results

- Under the "with measures" scenario, emissions in Canada are projected to be 625 megatonnes of carbon dioxide equivalent (Mt CO₂ eq) in 2030 (or 16% below 2005 levels)
- Under the "with additional measures" scenario, emissions are projected to decline to 491 Mt CO₂ eq in 2030 (or 34% below 2005 levels)
- 2035 emissions are projected to decline further, reaching 608 Mt CO₂ eq (18% below 2005 levels) under the "with measures" scenario and 443 Mt CO₂ eq (40% below 2005 levels) under the "with additional measures" scenario

Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2035

Year	Historical emissions ^[A] (megatonnes of carbon dioxide equivalent)	"With measures" scenario (megatonnes of carbon dioxide equivalent)	"With additional measures" scenario – no NBCS and agriculture measures (megatonnes of carbon dioxide equivalent)	"With additional measures" scenario ^[B] (megatonnes of carbon dioxide equivalent)
2005	741	n/a	n/a	n/a
2006	732	n/a	n/a	n/a
2007	760	n/a	n/a	n/a
2008	741	n/a	n/a	n/a
2009	684	n/a	n/a	n/a
2010	721	n/a	n/a	n/a
2011	739	n/a	n/a	n/a
2012	728	n/a	n/a	n/a
2013	731	n/a	n/a	n/a
2014	704	n/a	n/a	n/a
2015	737	n/a	n/a	n/a
2016	707	n/a	n/a	n/a
2017	708	n/a	n/a	n/a
2018	727	n/a	n/a	n/a
2019	717	n/a	n/a	n/a
2020	649	n/a	n/a	n/a
2021	n/a	681	679	n/a
2022	n/a	686	677	n/a
2023	n/a	683	664	n/a
2024	n/a	677	651	n/a
2025	n/a	672	631	n/a
2026	n/a	666	606	n/a
2027	n/a	655	578	n/a
2028	n/a	642	550	n/a
2029	n/a	633	528	n/a
2030	n/a	625	506	491
2031	n/a	621	494	479
2032	n/a	617	485	470
2033	n/a	614	478	463
2034	n/a	610	470	455
2035	n/a	608	458	443

Note: n/a = not applicable. NBCS = nature-based climate solutions. ^[A] Historical emissions data from 2005 to 2020 correspond to the emissions presented in the [National Inventory Report 1990-2020: Greenhouse gas sources and sinks in Canada](#) to which were added the accounting contribution from the land use, land use change and forestry sector. ^[B] NBCS and agriculture measures contribution was estimated for the year 2030 only. The scenario assumes the 2030 estimate (reduction of 14 to 16 megatonnes of carbon dioxide equivalent) is constant out to 2035. For more information on the projection scenarios, refer to the [Data sources and methods](#).

Source: Environment and Climate Change Canada (2022) [Canada's Eighth National Communication and Fifth Biennial Report](#). Environment and Climate Change Canada (2022) [National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada](#).

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