PROGRESS TOWARDS CANADA'S GREENHOUSE GAS EMISSIONS REDUCTION TARGET

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

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# Progress towards Canada's greenhouse gas emissions reduction target

Greenhouse gases (GHGs) trap heat in the Earth's atmosphere, just as the glass of a greenhouse keeps warm air inside. Human activity increases the amount of GHG in the atmosphere. When more heat is trapped, the temperature of the planet increases. Canada is committed to implementing the Pan-Canadian Framework on Clean Growth and Climate Change; while strengthening existing and introducing new GHG reducing measures to exceed Canada's 2030 emissions reduction goal, and beginning work so that Canada can achieve net-zero emissions by 2050. This indicator tracks Canada's progress related to the 2030 target.[1]

Greenhouse gas emissions projections

Key results

- In the Second Biennial Report, GHG emissions in 2030 were projected to be 815 megatonnes of carbon dioxide equivalent (Mt CO_2 eq)
- Environment and Climate Change Canada publishes updated projections annually. Most recently, the projections were updated and published as part of Canada's Fourth Biennial Report. For the December 2019 projections update, 2 scenarios were developed:
  - the Reference Case scenario includes actions taken by governments, consumers and businesses put in place up to September 2019. Under this scenario emissions are projected to be 673 Mt CO_2 eq in 2030, or 8% below 2005 levels
  - the Additional Measures scenario adds in policies and measures that are under development but have not yet been fully implemented, credits through the Western Climate Initiative and the contribution from the land use, land use change and forestry (LULUCF) sector. In this case, emissions are projected to be 588 Mt CO_2 eq, or 19% below 2005 levels

Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2030

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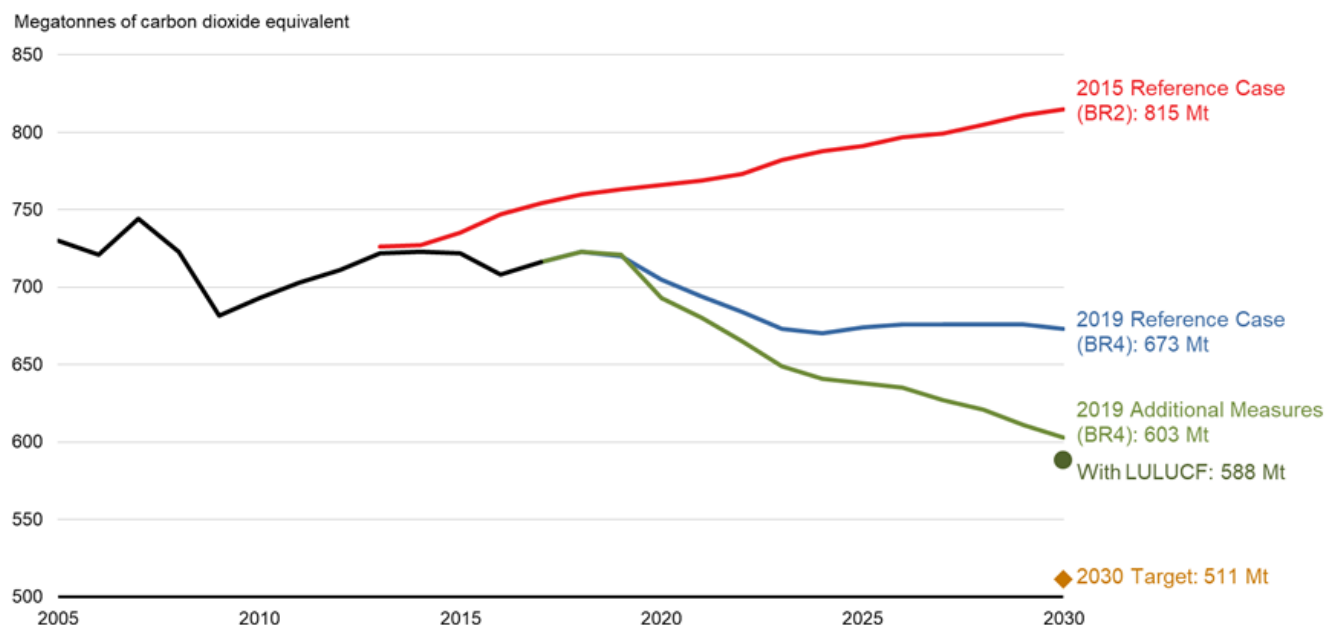
[1] Under the Paris Agreement, Canada committed to reducing its GHG emissions by 30% below 2005 levels by 2030. The Government of Canada has also recently announced that it will develop a plan to set Canada on a path to achieve a prosperous net-zero emissions future by 2050. This will have an impact on Canada's future emissions projections, including for 2030, as new measures associated with this plan are developed and implemented.

Note: BR2 = Second Biennial Report. BR4 = Fourth Biennial Report. LULUCF = land use, land use change and forestry. The Reference Case scenarios are the "with measures" scenarios as defined by the United Nations Framework Convention on Climate Change. For more information on the projection scenarios, refer to the Data sources and methods.
Source: Environment and Climate Change Canada (2019) National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Environment and Climate Change Canada (2020) Canada's Fourth Biennial Report on Climate Change.

Under the Paris Agreement, Canada committed to reducing its GHG emissions by 30% below 2005 levels by 2030. In 2019, the 2005 level was estimated at 730 Mt CO_2 eq.

Under the 2019 Reference Case scenario, it is projected that Canada's emissions in 2030 would be 673 Mt CO_2 eq, or 142 Mt CO_2 eq below the projections published in the Second Biennial Report.

Taking into consideration climate change policies and measures that have been announced in Canada and for which enough information is available, an Additional Measures scenario was also developed. Under this scenario and accounting for 13 Mt CO_2 eq of credits through the Western Climate Initiative and a 15 Mt CO_2 eq reduction from the LULUCF sector, emissions in 2030 would be 588 Mt CO_2 eq, or 227 Mt CO_2 eq below the projections published in the Second Biennial Report. This decline, equivalent to approximately a third of Canada's emissions in 2005, is widespread across all economic sectors, reflecting the breadth and depth of the Pan-Canadian Framework on Clean Growth and Climate Change.

Projected greenhouse gas emissions reductions

This section shows the contribution of each sector to projected emissions reductions in 2030.

Key results

- Canada's 2030 GHG emissions target is 511 Mt CO_2 eq
- To reach the target, Canada would need a 304 Mt CO_2 eq reduction in projected 2030 emissions from the starting point in the Second Biennial Report (2015)

Figure 2. Contributions to emissions reductions in 2030

Megatonnes of carbon dioxide equivalent

Future Reductions:
- Efforts to increase clean electricity, greener buildings and communities, electrification of transportation and nature-based climate solutions.
- Greater than anticipated clean technology adoption; one possible scenario is highlighted in the Technology Case, as set out in Canada's Fourth Biennial Report on Climate Change.
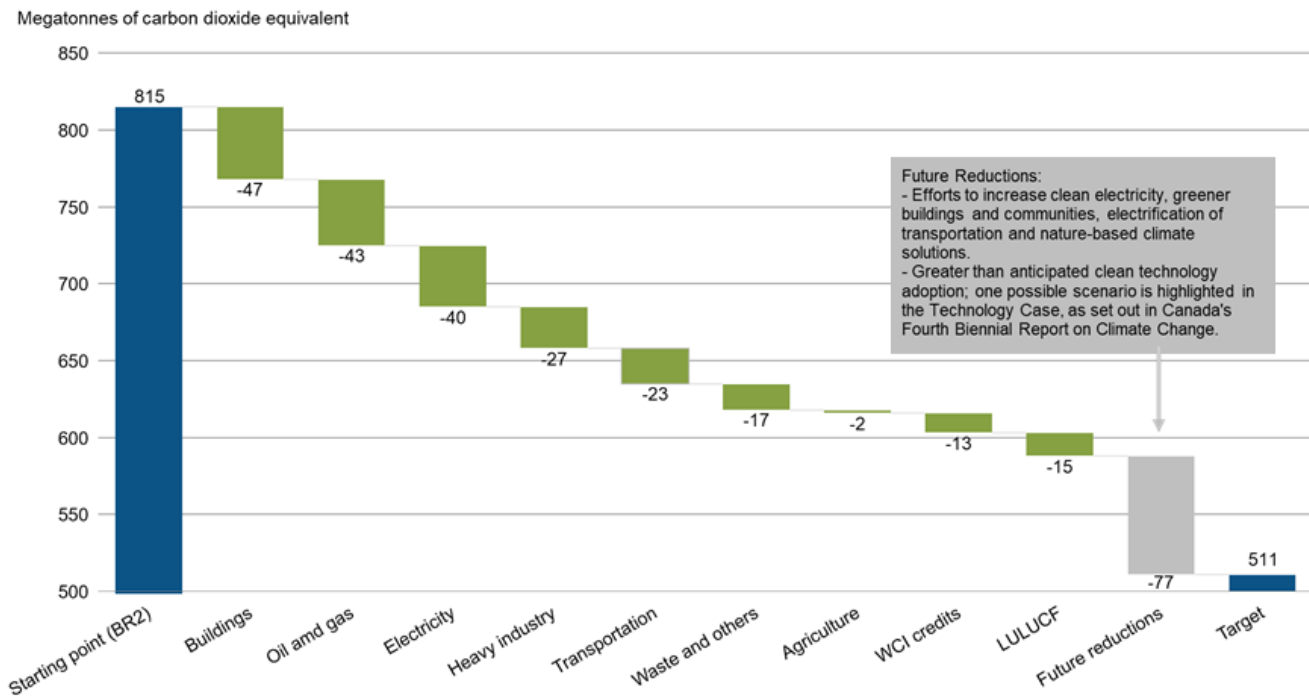
Note: BR2 = Second Biennial Report. LULUCF = land use, land use change and forestry. WCI = Western Climate Initiative. The starting point projections are reported in Canada's Second Biennial Report on Climate Change. For more information on the projected emissions in 2030,

refer to Chapter 5 of Canada's Fourth Biennial Report.
Source: Environment and Climate Change Canada (2020) Canada's Fourth Biennial Report on Climate Change.

Collectively, Canada's economic sectors[2] are projected to reduce their emissions by 199 Mt CO_2 eq in 2030 relative to what was projected in 2015.

- Buildings (47 Mt CO_2 eq)
- Oil and gas (43 Mt CO_2 eq)
- Electricity (40 Mt CO_2 eq)
- Heavy industry (27 Mt CO_2 eq)
- Transportation (23 Mt CO_2 eq)
- Waste and others (17 Mt CO_2 eq)
- Agriculture (2 Mt CO_2 eq)

Additional projected emissions reductions will come from:

- credits through the Western Climate Initiative (13 Mt CO_2 eq)
- land sector contributions (15 Mt CO_2 eq)
- future reductions (for example, clean electricity, greener buildings and communities, electrification of transportation) (77 Mt CO_2 eq)

It is expected that GHG estimates will continue to decline in the medium term, especially as current estimates do not include the full reductions from investment in green infrastructure, clean technology and innovation. The current estimates do not include the potential impacts of a faster evolution of technological progress than that assumed in these projections, as noted in the Technology Case presented in Canada's Fourth Biennial Report on Climate Change.

In addition, the federal government has committed to develop a plan to set Canada on a path to achieve a prosperous net-zero emissions future by 2050, including setting legally-binding, 5-year emissions-reduction milestones based on the advice of experts and consultations with Canadians, and working to position Canada as a global leader in clean technology. Other key priorities, including support for clean electricity generation, greener buildings and communities, the electrification of transportation and nature-based climate solutions (including a commitment to plant 2 billion trees over the next 10 years) had not yet been formally announced at the time the projections were being completed. As new measures are announced in more detail and implemented, they will be included in the modelling and will have an 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 2030. These 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 National Energy Board, Statistics Canada and Finance Canada
- policies and measures that were in place as of September 2019 (for the Reference Case scenario of the December 2019 projections)
- policies and measures that are under development but not yet fully implemented (for the Additional Measures scenario)

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[2] Refer to the Greenhouse gas emissions indicators for more information on how the economic sectors contribute to GHG emissions in Canada.

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. Under the Agreement, Canada has committed to a target to reduce GHG emissions by 30% below 2005 levels by 2030. In addition, the Government of Canada is committed to implementing the Pan-Canadian Framework on Clean Growth and Climate Change, while strengthening existing and introducing new GHG reducing measures to exceed Canada's 2030 emissions reduction goal and beginning work so that Canada can achieve net-zero emissions by 2050.

This indicator allows the public and policy-makers to see Canada's progress related to the 2030 target.

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.

Effective action on climate change

This indicator supports the measurement of progress towards the following 2019 to 2022 Federal Sustainable Development Strategy long-term goal: A low-carbon economy contributes to limiting global average temperature rise to well below 2 degrees Celsius and supports efforts to limit the increase to 1.5 degrees Celsius.

Greening government

This indicator supports the measurement of progress towards the following 2019 to 2022 Federal Sustainable Development Strategy long-term goal: The Government of Canada will transition to low-carbon, climate-resilient, and green operations.

In addition, the indicator contributes to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. It is linked to the 2030 Agenda's 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 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.

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 Fourth Biennial Report on Climate Change. The indicator reflects the latest GHG emissions projections published by the department at the time of production.

The latest projections (December 2019) use historical GHG emissions data from the 2019 National Inventory Report for the years 2005 to 2017. The projection scenarios cover the years 2018 to 2030.

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 Fourth Biennial Report on Climate Change.

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 data available for key drivers, 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 vetted 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 (E3MC)

The methodology for developing the emissions scenarios is described in Annex 2.7 of Canada's Fourth Biennial Report on Climate Change.

Scenarios

The indicator presents 3 different scenarios:

- the 2015 Reference Case scenario, shown from 2013 to 2030, was reported as the "with measures" scenario in Canada's Second Biennial Report on Climate Change. This scenario includes policies and measures in place as of September 2015
- the 2019 Reference Case scenario, shown from 2018 to 2030, was reported as the "with measures" scenario in Canada's Fourth Biennial Report on Climate Change. This scenario includes policies and measures in place as of September 2019
- the 2019 Additional Measures scenario is also shown from 2018 to 2030, and reported in Canada's Fourth Biennial Report on Climate Change. This scenario includes all of the actions, policies and measures of the 2019 Reference Case scenario as well as all climate change policies and measures that have been announced in Canada and for which enough information is available. This scenario accounts for those additional policies and measures

that are under development but have not yet been fully implemented, some of which were announced as part of the Pan-Canadian Framework on Clean Growth and Climate Change

Recent changes

The calculation of this indicator reflects methodological revisions that were applied to the 2019 National Inventory Report, as well as to the Energy, Emissions and Economy Model for Canada. For a list of the modelling and methodological changes, refer to Annex 2.4 of Canada's Fourth Biennial Report on Climate Change.

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

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 December 2019 Reference Case scenario assumes no further government actions to address GHG emissions beyond those already in place as of September 2019.

Under the Pan-Canadian Framework on Clean Growth and Climate Change, a number of policies and measures have been announced. As the policy development process is not yet finished, some policies were not included in the 2019 Reference Case scenario, but they were included in the 2019 Additional Measures scenario. For a complete list of included policies and measures modelled under each scenario, refer to Table A2.39 in Annex 2.3 of Canada's Fourth Biennial Report on Climate Change. Note that the modelled policies and measures do not match the full list of announced measures. This is because the economic modelling will only account for measures where sufficiently detailed data exist that makes it possible to add them to the modelling platform.

It is expected that GHG estimates will continue to decline in the near to medium term, especially as current estimates do not include the full reductions from investment in green infrastructure, clean technology and innovation. The current estimates do not include the potential impacts of a faster evolution of technological progress than that assumed in these projections, as noted in the Technology Case presented in Canada's Fourth Biennial Report on Climate Change. In addition, the federal government has committed to develop a plan to set Canada on a path to achieve a prosperous net-zero emissions future by 2050, including setting legally-binding, 5-year emissions-reduction milestones based on the advice of experts and consultations with Canadians, and working to position Canada as a global leader in clean technology. Other key priorities, including support for clean electricity generation, greener buildings and communities, the electrification of transportation and nature-based climate solutions (including a commitment to plant 2 billion trees over the next 10 years) had not yet been formally announced at the time the projections were being completed. As new measures are announced in more detail and implemented, they will be included in the modelling and will have an impact on future projected emissions levels.

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 the inevitable but as yet unknown changes that will occur 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. The analysis focuses on variability in 2 key factors: future economic growth and population projections, and the evolution of oil and natural gas prices and production. For more details about the sensitivity analysis, please consult Section 5.3 and Annex 2.5 of Canada's Fourth Biennial Report on Climate Change.

While the Energy, Emissions and Economy Model for Canada is a sophisticated analytical tool, no model can fully capture the complicated interactions associated with given policy measures between and within markets or between 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 modeling 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 modeling disruptive technological changes.

Resources

References

Environment and Climate Change Canada (2019) National Inventory Report 1990-2017: Greenhouse gas sources and sinks in Canada. Retrieved on December 3, 2019.

Environment and Climate Change Canada (2020) Canada's Fourth Biennial Report on Climate Change. Retrieved on January 3, 2020.

Related information

Greenhouse gas emissions: drivers and impacts

Greenhouse gas emissions projections

Annex

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

Table A.1. Data for Figure 1. Historical greenhouse gas emissions and projections, Canada, 2005 to 2030

Year	2015 Reference Case[A] (megatonnes of carbon dioxide equivalent)	2019 Reference Case[B] (megatonnes of carbon dioxide equivalent)	2019 Additional Measures[B] (megatonnes of carbon dioxide equivalent)	Canada's target (megatonnes of carbon dioxide equivalent)
2005	n/a	730	730	n/a
2006	n/a	721	721	n/a
2007	n/a	744	744	n/a
2008	n/a	723	723	n/a
2009	n/a	682	682	n/a
2010	n/a	693	693	n/a
2011	n/a	703	703	n/a
2012	n/a	711	711	n/a
2013	726	722	722	n/a
2014	727	723	723	n/a
2015	735	722	722	n/a
2016	747	708	708	n/a
2017	754	716	716	n/a
2018	760	723	723	n/a
2019	763	720	720	n/a
2020	766	705	693	n/a
2021	769	694	680	n/a
2022	773	684	665	n/a
2023	782	673	649	n/a
2024	788	670	641	n/a
2025	791	674	638	n/a
2026	797	676	635	n/a
2027	799	676	627	n/a
2028	805	676	621	n/a
2029	811	676	611	n/a
2030	815	673	588[C]	511

Note: n/a = not applicable. [A] Reported in Canada's Second Biennial Report on Climate Change. This scenario includes policies and measures in place as of September 2015. [B] These scenarios are reported in Canada's Fourth Biennial Report on Climate Change. Historical greenhouse gas emissions data from 2005 to 2017 were taken from the National Inventory Report 1990-2017: Greenhouse gas sources and sinks in Canada. The 2019 Reference Case scenario includes policies and measures in place as of September 2019. The Additional Measures scenario includes additional measures from Canada's clean growth and climate change plan that have been announced but are still under development. [C] This value includes 13 Mt CO_2 eq of credits through the Western Climate Initiative and the 15 Mt CO_2 eq contribution of the land use, land use change and forestry sector. The Reference Case scenarios are the "with measures" scenarios as defined by the United Nations Framework Convention on Climate Change. For more information on the projection scenarios, refer to the Data sources and methods.
Source: Environment and Climate Change Canada (2019) National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Environment and Climate Change Canada (2020) Canada's Fourth Biennial Report on Climate Change.

Table A.2. Data for Figure 2. Contributions to emissions reductions in 2030

Reduction measure	Projected emissions reductions in 2030 relative to 2015 (megatonnes of carbon dioxide equivalent)
Buildings	47
Oil and gas	43
Electricity	40
Heavy industry	27
Transportation	23
Waste and others	17
Agriculture	2
Western Climate Initiative credits	13
Land use, land use change and forestry	15
Future reductions	77

Note: Future reductions will come from efforts to increase clean electricity, greener buildings and communities, electrification of transportation and nature-based climate solutions. Reductions will also come from greater than anticipated clean technology adoption; one possible scenario is highlighted in the Technology Case, as set out in Canada's Fourth Biennial Report on Climate Change. For more information on the projected emissions in 2030, refer to Chapter 5 of Canada's Fourth Biennial Report.
Source: Environment and Climate Change Canada (2020) Canada's Fourth Biennial Report on Climate Change.

Additional information can be obtained at:

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