



## INDICATOR: Changes in greenhouse gas emissions

**Strategic Direction:** Reduce Threats

**Target:** 6. By 2030, the release of ecologically damaging pollutants is reduced to a level that is not harmful to biodiversity and ecosystem services.

**Theme:** Pressures on Ontario's Biodiversity — Climate Change

**Previous versions:**

- [Changes in greenhouse gas emissions - 2015](#)
- [Changes in greenhouse gas emissions - 2021](#)

### Background Information

Pollution is one of the five largest direct drivers of global biodiversity loss. There is clear evidence that specific pollutants have impacts on biodiversity, including greenhouse gas emissions, untreated urban and rural waste, and pollutants from industrial, mining, and agricultural activities, etc. (IPBES, 2023). Greenhouse gases (GHG) are gases in the atmosphere such as carbon dioxide, methane, and nitrous oxide, that trap heat in the air, causing a rise in global temperatures. Human activities, such as burning fuel for energy, industrial processes, certain farming practices, and deforestation, release these gases into the atmosphere. These activities are a main source of GHG emissions and observed climate change (IPCC 2022). In a recent assessment of the impacts of climate change to Ontario, the Climate Risk Institute (CRI) examined the risks to Ontario through various 'areas of focus' including infrastructure, food and agriculture, people and communities, natural environment, and business/economy. The study found that nearly all species and ecosystems are at a high risk of loss or significant degradation by 2050. Climate change presents direct stressors to species, influences the timing of life stages and population dynamics, species distribution and abundance, as well as water quantity and quality, and frequencies and intensities of disturbances (e.g., wildfires and pest outbreaks). In turn, these changes influence each other causing cascading effects that can reduce or magnify the initial response. Climate change impacts exacerbate threats to biodiversity and ecosystem health caused by human-created stressors, such as habitat loss and fragmentation and pollution (IPPCA 2023).

While climate change is a primary driver of biodiversity loss, it depends on biodiversity as part of the solution (UN CBD 2022). Greenhouse gas emissions can be removed from the atmosphere by trees and other plants. Nature-based climate solutions such as large-scale protection and restoration of ecosystems, can reduce atmospheric GHG through sequestration and can enhance ecosystem resilience to the residual effects of climate change while providing co-benefits to society.

The Ontario Biodiversity Strategy (OBS) recognizes the threat of GHG emissions and the pressure of climate change on Ontario's biodiversity. In 2011, the OBS established a target to develop and implement climate change mitigation plans and reduce Ontario's greenhouse gas emissions by 6 per cent below 1990 levels. This target was achieved in 2015, Ontario's total GHG emissions were 164 million tons (Mt) compared to the 178 Mt in 1990 (SOBR 2021). Additionally, in 2018 Ontario released the Made-in-Ontario Environment Plan, committing to a revised GHG target for 2030 to reduce emissions by 30 per cent below 2005 levels (OMECP 2018). Today, the province and the OBS continue progress toward mitigating impacts of climate change and GHG emissions.



This indicator assists with reporting on progress in achieving the Ontario Biodiversity Strategy 2023-2030 target 6 to reduce the release of ecologically damaging pollutants to a level that is not harmful to biodiversity and ecosystem services. The Changes in Greenhouse Gas Emissions indicator tracks Ontario’s GHG emissions over time. The indicator report includes Ontario’s yearly GHG emissions and provides insights on the relative contribution of various sectors (e.g., Industry, Agriculture, Waste, Transportation, etc.) to Ontario’s GHG emissions.

**Data Analysis**

Information about GHG emissions in Ontario can be found in Environment and Climate Change Canada’s National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada (NIR 2024). Canada’s National Inventory Report is prepared and submitted annually to the United Nations Framework Convention on Climate Change (UNFCCC). The inventory emission estimates are reported by totals aggregated at the provincial and sectoral levels. Some of the GHGs reported on include: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulphur hexafluoride (SF6), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and nitrogen trifluoride (NF3).

Environment and Climate Change Canada is responsible for the preparation and submission of the National Inventory Report to UNFCCC. Data for GHG emissions have been calculated annually since 1990. Emissions data for Ontario were categorized into the following eight Canadian economic sectors: oil and gas, electricity, transport, heavy industry, buildings, agriculture, waste and other (i.e., light manufacturing, construction and forest resources) (Table 1). Ontario’s annual GHG emissions were plotted from 1990 to 2022 (Figure 1). The annual GHG emissions by sector from 1990 to 2022, as well as the percent change in GHG emissions by sector between 1990 and 2022 are presented in Figures 2 and 3.

Table 1. Sector descriptions for sources of greenhouse gas emissions (Adapted from OMOECC 2014, Environment and Climate Change Canada 2023 NIR report).

Sector	Sources of Greenhouse gas emissions
Oil and gas	Emissions resulting from natural gas production and processing, oil sands (mining), conventional oil production, petroleum refining and natural gas distribution.
Transportation	The combustion of fossil fuels such as diesel, gasoline and propane by passenger and commercial vehicles on and off roads, as well as rail and Ontario’s share of domestic marine and air travel.
Industry	Some industrial processes and stationary combustion of fossil fuels such as coke, natural gas and coal used in mining; pipelines; construction; greenhouses; production of cement, iron and steel, chemicals, paper and wood products; and other manufacturing.
Buildings	The combustion of fossil fuels such as natural gas in residential, commercial and institutional buildings for space and water heating.
Electricity	Generating electricity and heat by electric utilities using fossil fuels such as natural gas.
Agriculture	Enteric fermentation, manure management and fertilizer application.
Waste	Solid waste disposal on land, wastewater handling and waste incineration.
Other	Light manufacturing, construction (e.g., the construction of buildings, highways, etc.) and forest resources such as forestry and logging service industry.

**Results**

Trend: Improvement

Data Confidence: High

Geographic Extent: Provincial

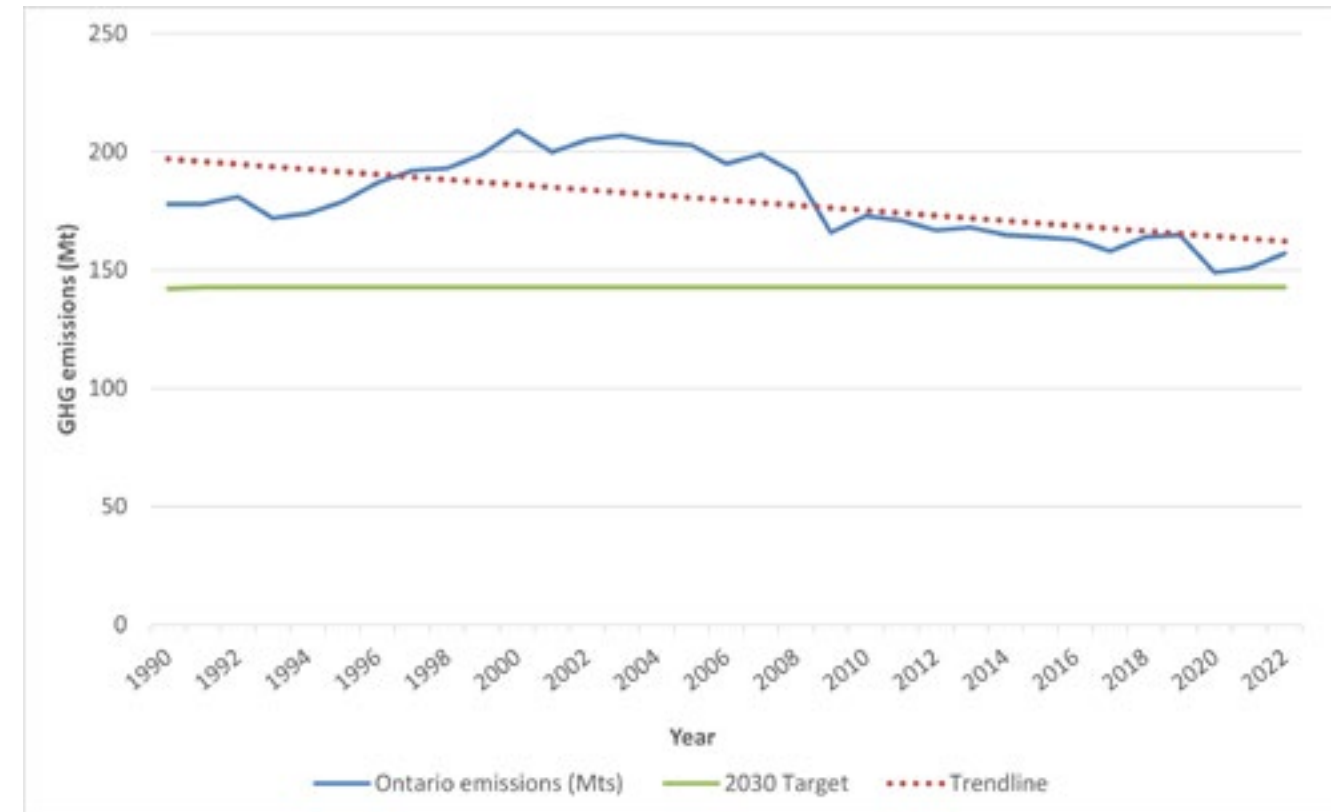


Figure 1. Ontario’s annual greenhouse gas emissions 1990–2022. Regression line (red) indicates a decrease in emissions over time. (Data source: Environment and Climate Change Canada NIR reports).

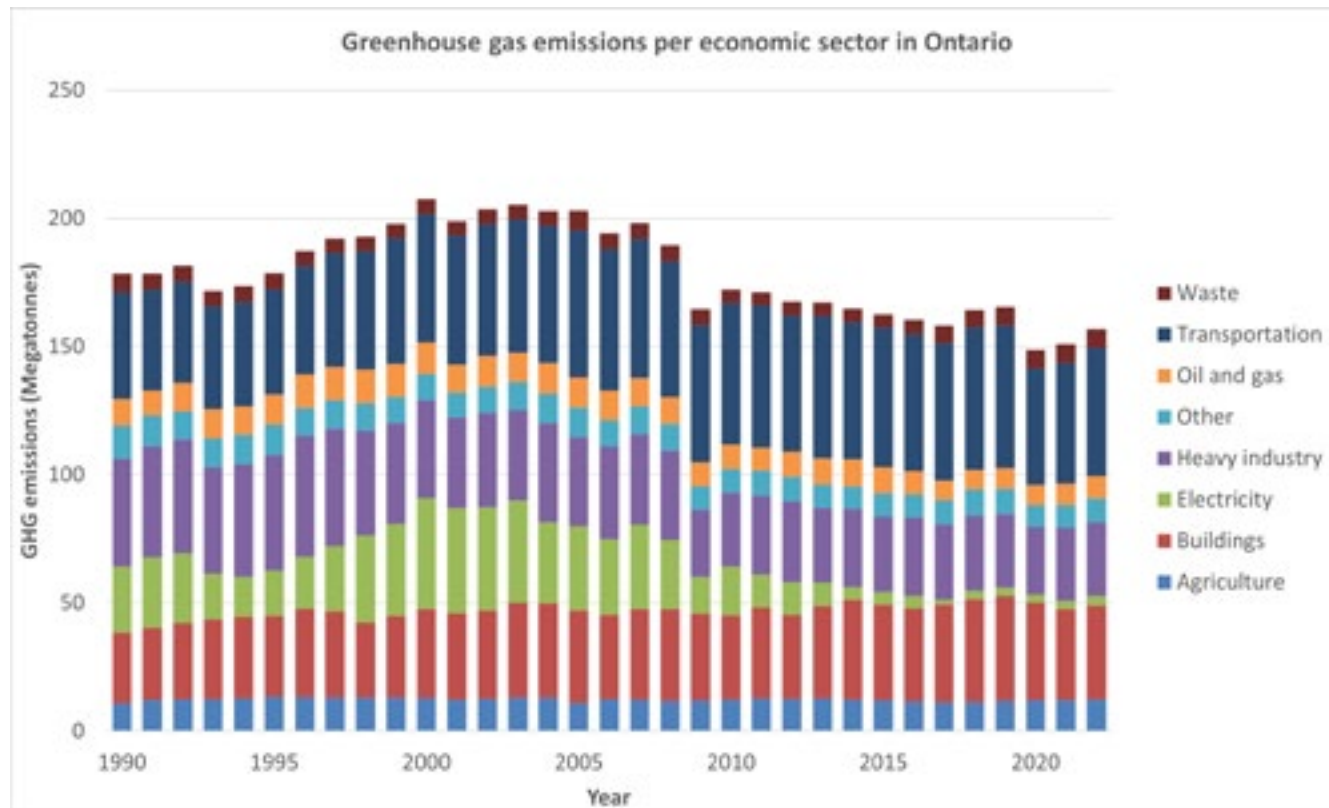


Figure 2. Greenhouse gas emissions in Ontario by sector from 1990-2022. (Data source: Environment and Climate Change Canada NIR reports)

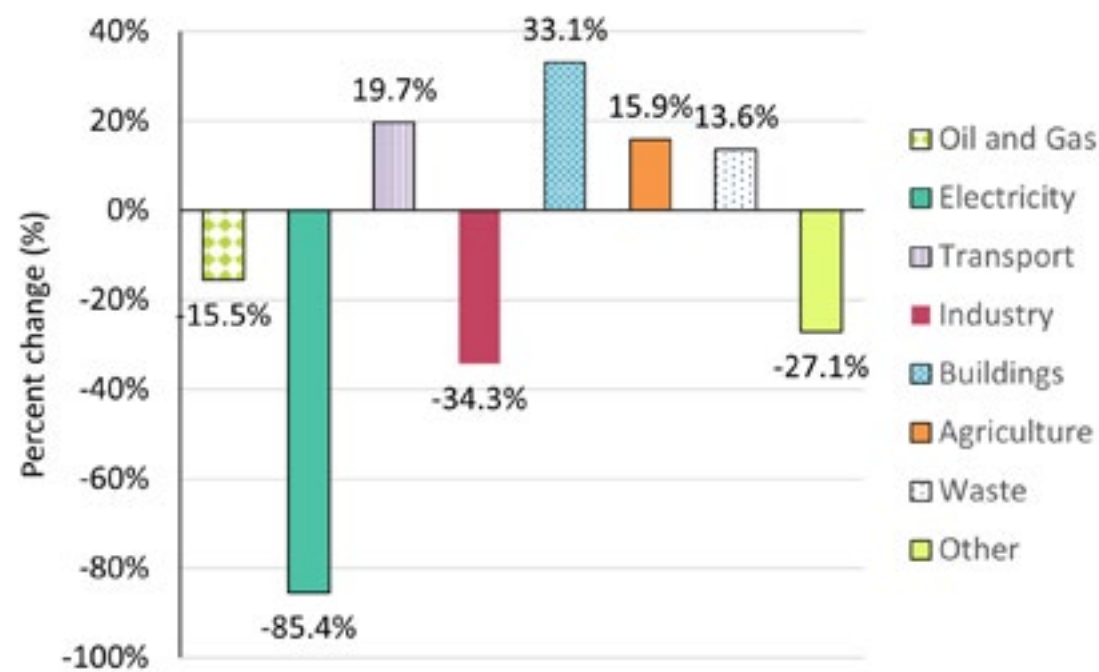


Figure 3. Percent of change in Ontario's greenhouse gas emissions by Sector from 1990 to 2022 (data source: Environment and Climate Change Canada 2024 NIR report).

**Status**

- GHG emissions in Ontario grew from 1990 to the early 2000s, then stabilized and declined in recent years. Since 1990, total annual emissions in Ontario have declined by approximately 12%, or 21 million tons (Mt). The greatest reductions in emissions during that period were in the electricity (22.2 Mt or 85% decrease since 1990) and industry (14.9 Mt or 34%) sectors. The large reduction in GHG emissions from the electricity sector is attributable to the phasing out of coal-fired electricity generation in the province, while the reduction in the industrial sector is attributable to improvements in efficiency and structural changes in the sector.
- The 2015 emissions target was achieved, and emissions have continued to be below that threshold ever since. The 2030 target is set at approximately 142Mt, which means another 14Mt will need to be reduced in the next 5 years.
- In 2003, coal represented approximately 25% of Ontario's supply mix, in 2014, it represented 0%, while the grid reliability and domestic supply improved (OMECP, 2017) a reduction of 17%.
- Since 2015, total GHG emissions have continued to decline in Ontario; however, emissions in 2018 and 2019 increased in part due to a colder winter, manufacturing, road traffic etc. Emissions from certain sectors, including the transportation and building sectors continue to increase.
- Since the OBS 2015 target was established, the province has iteratively developed and implemented policies and programs to directly or indirectly reduce GHG emissions. Some of the policies and programs include: The Big Move Transportation Plan (2008); Building Code Amendments (2020); Ontario's suite of progressive climate change action plans and strategies (2007, 2015, 2016, 2018); as well as a number of supporting plans at the provincial, regional and municipal levels.
- In 2018 the province introduced A Made-in-Ontario Environment Plan to help lower greenhouse gas emissions, and ensure a safe, healthy, and clean environment. Since its establishment, the province has implemented DriveON: Emissions and safety inspection program, an enhanced emissions testing program. Other emission reduction initiatives include Ontario cleaner transportation fuels regulation, investments in electric vehicle manufacturing and supply chains, large public transit investments, investments in electrifying heavy industry, and the low-carbon hydrogen strategy.
- In 2022, the Emissions Performance Standards Regulation came into full effect under the Environmental Protection Act to reduce industrial sector greenhouse gas emissions.

**Links**

**Related Targets:** N/A

**Related Themes:** N/A



### Web links

National inventory report: greenhouse gas sources and sinks in Canada. <https://publications.gc.ca/site/eng/9.506002/publication.html>

Ontario Ministry of the Environment, Conservation and Parks. <https://www.ontario.ca/page/ministry-environment-conservation-parks>

Ontario Ministry of the Environment Conservation and Parks, The end of Coal, 2017. <https://www.ontario.ca/page/end-coal#:~:text=Ontario%20enshrined%20its%20commitment%20in,to%20generate%20electricity%20in%20Ontario.>

Ontario Ministry of the Environment Conservation and Parks, Made in Ontario Plan, 2022. [A Made-in-Ontario Environment Plan | ontario.ca](https://www.ontario.ca/page/made-in-ontario-environment-plan)

Ontario Ministry of Natural Resources <https://www.ontario.ca/page/ministry-natural-resources>

United Nations Framework Convention on Climate Change <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/submissions/national-inventory-submissions-2019>

### References

Bellard, C., C. Bertelsmeier, P. Leadley, W. Thuiller, and F. Courchamp. 2012. Impacts of climate change on future biodiversity. *Ecology Letters* 15:365-367.

Climate Risk Institute. (2023). Ontario Provincial Climate Impact Assessment Technical Report. Report prepared by the Climate Risk Institute, Dillon Consulting, ESSA Technologies Ltd., Kennedy Consulting and Seton Stiebert for the Ontario Ministry of Environment, Conservation and Parks. Available at: <https://www.ontario.ca/files/2023-11/mecp-ontario-provincial-climate-change-impact-assessment-en-2023-11-21.pdf>

Environment and Climate Change Canada. (2024). National Inventory Report 1990–2022: Greenhouse gas sources and sinks in Canada. [Available at: [https://publications.gc.ca/collections/collection\\_2024/eccc/En81-4-2022-1-eng.pdf](https://publications.gc.ca/collections/collection_2024/eccc/En81-4-2022-1-eng.pdf)]

International Institute for Sustainable development (2015). The end of Coal: Ontario's coal phase-out <https://www.iisd.org/system/files/publications/end-of-coal-ontario-coal-phase-out.pdf>

IPCC. 2014. Summary for policymakers. pp. 1-32 In [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)] *Climate change 2014: impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, U.K.



IPCC. 2022. Summary for policymakers. Pathak, M., Slade, R., Pichs-Madruga, R., Ürge-Vorsatz, D., Shukla, R., & Skea, J. [https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC\\_AR6\\_WGIII\\_SummaryVolume.pdf](https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryVolume.pdf)

IPCC, 2023: Summary for Policymakers. In: *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

Ontario Biodiversity Council. 2011. Ontario's biodiversity strategy, 2011: renewing our commitment to protecting what sustains us. Ontario Biodiversity Council, Peterborough, ON.

Ontario Biodiversity Council. 2023. Ontario's Biodiversity Strategy 2023-2030. Ontario Biodiversity Council, Peterborough, ON.

Ontario Ministry of the Environment (OMOE). 2007. Go green: Ontario's action plan on climate change. Queen's Printer for Ontario, Toronto, ON.

Ontario Ministry of the Environment and Climate Change (OMOECC). 2014. Ontario's Climate Change Update 2014. Queen's Printer for Ontario, Toronto, ON.

Ontario Ministry of the Environment and Climate Change (OMOECC). 2016. Ontario's Five Year Climate Change Action Plan 2016-2020. Queen's Printer for Ontario, Toronto, ON.

Ontario Ministry of the Environment, Conservation and Parks (MECP). 2018. Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan. Queen's Printer for Ontario.

UN Convention on Biological Diversity. 2022. Biodiversity – our strongest natural defense against climate change.

### Citation

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