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Highlights of Canada's Sixth National Communication and First Biennial Report on Climate Change

2014

ACTIONS TO MEET COMMITMENTS UNDER THE
UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE





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Highlights of Canada's Sixth National Communication and First Biennial Report on Climate Change

Introduction

Canada is pleased to present its Sixth National Communication and First Biennial Report on Climate Change for 2014 to meet its reporting requirements under the United Nations Framework Convention on Climate Change (UNFCCC).

Canada recognizes the importance of climate change and, as an arctic nation, is particularly affected by its impacts. To respond to this global challenge, Canada is implementing a comprehensive climate change plan, both domestically and internationally. This plan is underpinned by a strong scientific foundation and includes action on, and investments in mitigation and adaptation, as well as international engagement through a number of multilateral fora.

Since Canada's Fifth National Communication in 2010, progress has been made in implementing a sector-by-sector regulatory approach to address emissions. These actions are precedent-setting: for the first time, Canada has national regulations to reduce greenhouse gas (GHG) emissions.

The Government of Canada has started with the transportation and electricity sectors—two of the largest sources of emissions in Canada. The Government of Canada has implemented regulations setting progressively more stringent standards for passenger automobiles and light-duty trucks and has introduced proposed regulations to further improve fuel efficiency and reduce GHG emissions from model years 2017 and beyond. As a result of these regulations, model year 2025 passenger vehicles and light-duty trucks will emit about 50% less GHGs and consume up to 50% less fuel than 2008 models. The Government of Canada has also taken action to regulate heavy-duty vehicles. In March 2013, the Government of Canada released final regulations that establish progressively

more stringent emissions standards for heavy-duty vehicles such as full-size pick-ups, semi-trucks, garbage trucks and buses.

The Government of Canada's coal-fired electricity regulations further strengthen Canada's position as a world leader in clean electricity production. With these regulations, Canada became the first major coal user to ban the construction of traditional coal-fired electricity generation units. This approach will foster a permanent transition towards lower or non-emitting types of electricity generation such as high-efficiency natural gas and renewable energy. Over the first 21 years, these regulations are expected to result in a cumulative reduction of about 214 megatonnes (Mt) of GHGs, equivalent to removing some 2.6 million personal vehicles from the road per year over this period.

Building on this record, the Government of Canada is working with provinces to reduce emissions from the oil and gas sectors while ensuring Canadian companies remain competitive.

The Government of Canada has also made significant investments to begin Canada's transition to a clean energy economy and advance Canada's climate change objectives. Since 2006, the federal government has invested over \$10 billion in green infrastructure, energy efficiency, the development of clean energy technologies, and the production of cleaner energy and cleaner fuels.

At the same time, climate change is a shared responsibility in Canada. Provinces and territories have been taking action to address climate change according to their unique circumstances.

In combination, these actions have been generating significant results. As a result of collective action by governments, consumers and industry, Canada's 2020 emissions are projected to be 128 Mt lower than

they would have been under a no-action scenario. This is the equivalent of shutting down 37 coal-fired electricity generation plants. Moreover, Canada's per capita emissions are at a historic low of 20.4 tonnes of carbon dioxide equivalent (CO₂ eq) per person—their lowest level since tracking began in 1990. Canada has also demonstrated progress in decoupling emissions growth from economic growth. Since 2005, Canadian GHG emissions have decreased by 4.8%, even while the economy has grown by 8.4%.

Addressing short-lived climate pollutants (SLCPs) is also part of the Government of Canada's comprehensive climate change plan. Since the last National Communication, Canada became a founding member and large financial contributor to the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC). Since its beginning in 2012, the CCAC has grown to include over 70 partners. Canada is also demonstrating leadership in addressing short-lived climate pollutants through its chairmanship of the Arctic Council (2013–2015). One of Canada's priority initiatives in this context is to advance work on addressing black carbon and methane. As part of this effort, the Arctic Council ministers agreed to establish a task force, co-chaired by Canada and Sweden, to work towards actions to reduce emissions of these pollutants. These international efforts complement the strong action Canada has taken to address SLCPs domestically, including regulations for both on-road and off-road vehicle emissions and for sulphur content in gasoline and in diesel.

Beyond these efforts, Canada recognizes that the climate is changing and Canadians are experiencing its effects. Since Canada's last National Communication, Canadian governments have continued to take action to help Canadians adapt to a changing climate.

The Government of Canada is providing \$148.8 million in funding over 5 years (2011–2016) to support an improved understanding of climate change and to help Canadians plan for climate impacts, including in the North. Other levels of government are making progress on impacts and adaptation issues. For example, all provinces and

territories have either released adaptation strategies, or are in the process of developing them, or have integrated adaptation efforts into broader climate change action plans. Adaptation has also become an increasingly important risk management issue for the private sector. Shared adaptation priorities across jurisdictions and economic sectors include building community capacity, undertaking climate change research, and enhancing existing emergency preparedness initiatives. Continued support for adaptation decision-making by businesses, communities and Canadians contributes to effective climate risk management in Canada.

Canada's climate science is an integral part of the global effort to understand climate system behaviour, human influence on climate, and future climate change scenarios. Canada's science contributes to domestic climate change policies and decisions, and informs international bodies such as the Intergovernmental Panel on Climate Change, the Arctic Council, and the Global Methane Initiative. In May 2013, the Government of Canada provided funds for arctic research through the Natural Sciences and Engineering Research Council's Climate Change and Atmospheric Research initiative. This program supports collaborative climate change and atmospheric research, and will provide funding of more than \$32 million over 5 years to 7 university-based research networks.

On the international stage, Canada is an active participant in discussions under the UNFCCC towards a new post-2020 international climate change agreement. At the 19th Conference of the Parties in Warsaw, Canada played a constructive role to help create momentum under these negotiations. Canada's leadership was also instrumental in achieving a breakthrough on an important initiative to help developing countries reduce deforestation and forest degradation, which account for nearly 15% of global GHG emissions.

Canada is also committed to working with developing countries to help them respond to the challenge of climate change. The Government of Canada fulfilled its commitment to deliver \$1.2 billion of the \$30 billion

fast-start funding pledge made by developed countries. Issued over fiscal years 2010–2011 to 2012–2013, Canada's funding supports climate change mitigation and adaptation in developing countries. This funding is helping advance a range of climate change projects in over 60 developing countries, with a specific focus on adaptation, clean energy technology and transfer, and sustainable forests and agriculture.

In addition to Canada's engagement in the UNFCCC, the Government of Canada continues to pursue a number of collaborative international initiatives to address global climate change, including the phase-down of hydrofluorocarbons (HFCs) under the Montreal Protocol on Substances that Deplete the Ozone Layer.

Canada recognizes that climate change is a serious challenge that requires collective action by businesses, consumers and governments. The Government of Canada is focused on a pragmatic approach to addressing climate change that will reduce emissions while continuing to create jobs and encouraging the growth of the Canadian economy.

The following provides highlights of Canada's Sixth National Communication and First Biennial Report submission to the UNFCCC. For the full report, please visit the Annex I Party National Reporting page of the UNFCCC website.

National Circumstances

Canada's unique geographic, demographic and economic circumstances influence its GHG emissions profile. Canada has an extreme, highly variable climate that contributes to higher energy use for space heating and cooling in both the commercial and residential sectors. Canada also has a large landmass that contributes to longer travel times and a higher demand for freight transportation.

The Canadian population remains the smallest among G8 countries but is also the fastest growing, with an annual population growth rate of just over 1%. Canada's

low population density contributes to a higher energy demand (and GHG emissions) for the transportation of people and goods as compared with smaller, more densely populated countries.

In addition to its faster-than-average population growth relative to other developed countries, Canada has experienced sustained economic growth. As a natural resource-rich economy, Canada is a net exporter of agricultural products, energy (electricity and oil and gas) and many resource-based commodities such as mined metals, aluminum and pulp and paper. Over the past decade, Canada's exports of energy, extracted resources and agricultural commodities as a share of GDP have increased by almost 40%.

Canada relies on transportation for trade in the global economy. Since 1990, there has been a 33% growth in transportation emissions in Canada, an increase that was mainly driven by an increase in cross-border trade, on-road freight transportation activity and a shift in personal vehicle ownership from cars to light-duty trucks.

Canada's Greenhouse Gas Inventory

UNFCCC Annex I Parties, including Canada, are required to report annual inventories of GHG emissions and removals. Canada's National Inventory Report is prepared and submitted annually to the UNFCCC and includes estimates of CO₂ equivalent in the following six sectors: Energy, Industrial Processes, Solvent and Other Product Use, Agriculture, Waste, and Land Use, Land-Use Change and Forestry (LULUCF). The most recent report is entitled *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990–2011*; the report's Executive Summary is available online at <http://www.ec.gc.ca/ges-ghg>

In 2011, Canada emitted 702 Megatonnes of carbon dioxide equivalent (Mt CO₂ eq)¹ of GHGs to the atmosphere, excluding LULUCF estimates. The Energy Sector (comprising stationary combustion, transport and fugitive emission sources) produced the majority of Canada's GHG total emissions in 2011, at 81% or 572 Mt.

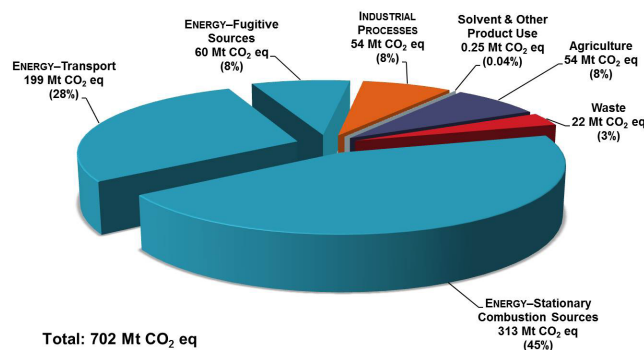


Figure 1 Canada's Emissions Breakdown by Sector (2011) (all sectors are consistent with the definitions provided in the Intergovernmental Panel on Climate Change 1996 Guidelines for National GHG Inventories)

In 2011, Canada emitted 702 Megatonnes of carbon dioxide equivalent (Mt CO₂ eq)¹ of GHGs to the atmosphere, excluding LULUCF estimates. The Energy Sector (comprising stationary combustion, transport and fugitive emission sources) produced the majority of Canada's GHG total emissions in 2011, at 81% or 572 Mt

The remaining 19% of total emissions was largely generated by source within the Agriculture Sector (8% of total emissions) and Industrial Processes Sector (8%), with minor contributions from the Waste Sector (3%) and Solvent and Other Product Use Sector. Greenhouse gases in the LULUCF Sector are not included in the inventory totals, due to large annual fluctuations heavily influenced by the impact of natural disturbances on managed forest land, notably fires. In 2011, total emissions for the LULUCF Sector are estimated at about 87 Mt.

In 2011, CO₂ contributed 79% of Canada's total GHG emissions. The majority of these emissions are produced by the combustion of fossil fuels. Methane (CH₄) accounted for 13% of Canada's total emissions, largely from fugitive emissions from oil and natural gas systems, as well as activities in the Agriculture and Waste Sectors. Nitrous oxide (N₂O) emissions from activities such as agriculture soil management and transport accounted for 7% of the emissions, while perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and HFCs constituted the remainder of the emissions (slightly more than 1%).

Canada's emissions in 2011 were 111 Mt (19%) above the 1990 total of 591 Mt (Figure 2). Steady increases in annual emissions characterized the first 15 years of this period, followed by fluctuating emission levels between 2005 and 2008, a steep drop in 2009 and more stable values thereafter. Between 2005 and 2011, emissions decreased

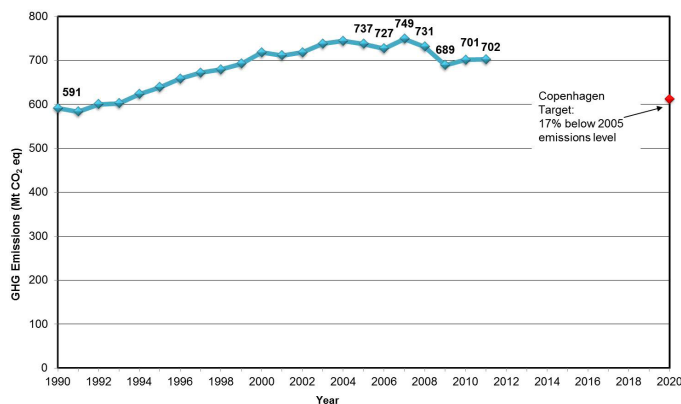


Figure 2 Canadian GHG Emissions Trend (1990–2011) and Copenhagen Target

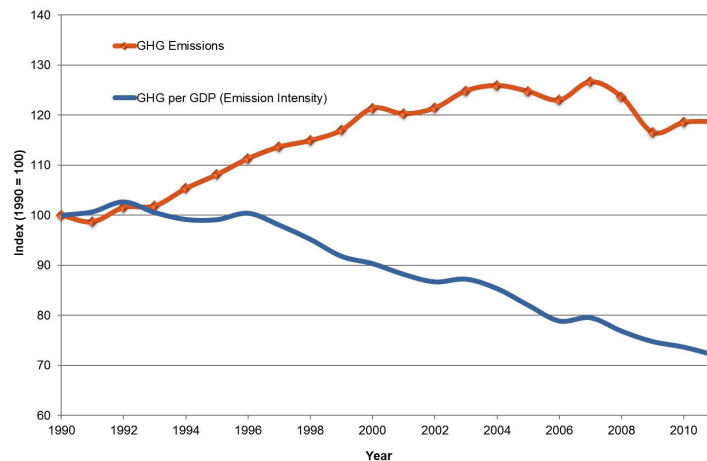


Figure 3 Indexed Trend in GHG Emissions and GHG Emissions Intensity (1990–2011)

by 36 Mt (4.8%), primarily due to decreases from electricity generation and manufacturing industries.

Though GHG emissions have risen by 19% since 1990, Canada's economy has grown much more rapidly, with its gross domestic product (GDP) rising by 65%. As a result, the emission intensity for the whole economy (GHG per GDP) has improved considerably, dropping by 28% (Figure 3).

Canada has established a national system to ensure the integrity of its annual inventory. Canada's national system for the estimation of anthropogenic (i.e., human-induced) emissions from sources and removals by sinks of GHGs encompasses the institutional, legal and procedural arrangements necessary to ensure that Canada meets its reporting obligations.

The national system consists of institutional arrangements for the preparation of the greenhouse gas inventory, including formal agreements supporting data collection and estimates development; a quality assurance/quality control plan; the ability to identify key categories and generate quantitative uncertainty analysis; a process for performing recalculations for improvement of the inventory; procedures for official

approval; and a working archives system to facilitate third-party review.

Policies and Measures

All levels of government in Canada are taking action to address climate change. The Government of Canada is implementing a sector-by-sector regulatory approach to reduce greenhouse gas emissions. The Government of Canada has already begun to implement this plan starting with the transportation and electricity sectors, and is now moving to address other sectors of the economy. The Government of Canada's regulatory approach is complemented by investments in clean energy technology and other non-regulatory measures that will help reduce emissions over the longer term. Provinces and territories are also taking meaningful action on climate change, and they are playing a role in several international and regional climate action plans and partnerships.

Federal Policy Making Process

While several federal departments are involved in the development and implementation of climate change programming, the Minister of the Environment is the lead minister for domestic and international climate

change policies and measures within the Government of Canada. The Government of Canada uses bilateral and multilateral fora (e.g., process working groups) to develop its sector-by-sector regulatory approach, working closely with provinces and territories, given the shared jurisdiction for the environment in the country. Federal climate change policies and measures are underpinned by key legislative instruments, the most important of which is the *Canadian Environmental Protection Act, 1999* (CEPA 1999). This act includes authorities to regulate various aspects of GHG releases, including setting the quantity or concentration of a GHG that may be released from various types of facilities, or from vehicles, engines and equipment.

Government of Canada's Sector-by-Sector Regulatory Approach

The Government of Canada's sector-by-sector regulatory approach allows Canada to maximize progress on reducing emissions while maintaining economic competitiveness by making it possible to tailor regulations to accommodate individual sector circumstances. Regulations are being designed to drive real reductions over the long term, provide regulatory certainty, spur innovation, and leverage capital stock turnover to avoid the lock-in of long-lived high-emitting infrastructure. This approach has already been implemented in the transportation and electricity sectors and the federal government is working on regulations for other sectors.

In the transportation sector, the Government of Canada has implemented GHG emission standards under CEPA 1999 for passenger automobiles and light-duty trucks for 2011–2016 model year vehicles. In 2012, proposed amendments were published to include standards for 2017 model years and beyond. With these regulations, model year 2025 passenger vehicles and light-duty trucks will emit about half as many GHGs and consume up to 50% less fuel than 2008 model year vehicles.

Canada has also taken action to regulate heavy-duty vehicles. In March 2013, the Government of Canada released regulations that establish progressively more stringent emissions standards for heavy-duty vehicles, such as full-size pick-ups, semi-trucks, garbage trucks and buses. With these tough new regulations in place, GHG emissions from 2018 model year heavy-duty vehicles will be reduced by up to 23%. Both the light- and heavy-duty standards are aligned with regulations in the United States. Other regulatory actions in the transportation sector include renewable fuels regulations, which require an average of 5% renewable fuel content for gasoline and 2% for most diesel fuels.

In the electricity sector, the federal government has introduced a performance standard for coal-fired electricity generation. The performance standard comes into force in 2015 and applies an emissions intensity limit to new coal-fired electricity generation units and to old units that have reached the end of their useful life. Over the first 21 years, these regulations are expected to result in a cumulative reduction of about 214 Mt of GHGs, equivalent to removing some 2.6 million personal vehicles from the road per year over this period.

Addressing short-lived climate pollutants is also part of the Government of Canada's comprehensive approach to addressing climate change. The federal government completed an assessment that concluded that many of Canada's measures to address greenhouse gases and air pollutants have led to reductions in emissions of short-lived climate pollutants. These include Canada's regulations to address carbon dioxide emissions from coal-fired electricity (which will reduce ozone precursor emissions and particulate matter/black carbon), as well as a suite of vehicle and fuel regulations (which have, and will continue to significantly reduce black carbon and ozone precursor emissions). Forthcoming measures to address emissions from the oil and gas sector, as well as industrial emissions requirements under Canada's new Air Quality Management System, will produce further reductions.

Cross-sectoral, Clean Energy Investments and Other Complementary Measures

The Government of Canada has also established regulations under the *Energy Efficiency Act, 1992*, to strengthen the minimum energy performance requirements for more than 40 consumer products to date. These regulations include requirements for mandatory EnerGuide labels on major electrical household appliances and room air conditioners. The labels show how much energy a product uses compared with the range of products in its category.

The Government of Canada also recognizes the importance of clean technologies in combatting climate change. Since 2006, the federal government has invested over \$10 billion in green infrastructure, energy efficiency, the development of clean energy technologies, and the production of cleaner energy and fossil fuels. This includes funds allocated to Sustainable Development Technology Canada, an arm's-length, not-for-profit foundation that finances and supports the development and demonstration of clean technologies. The federal government's investments in clean energy also include investments through the ecoENERGY Innovation Initiative to support energy technology innovation, and investments through a number of programs to support the research, development and demonstration of carbon capture and storage technologies.

The federal government's sector-by-sector approach and clean technology investments are complemented by a number of non-regulatory measures. Examples of these measures include the ecoENERGY for Aboriginal and Northern Communities program, the ecoTECHNOLOGY for vehicles program, and measures in the Land Use, Land Use Change and Forestry Sector.

Provinces and territories are also developing and implementing measures to address climate change and are playing roles on a number of international and regional climate action plans and partnerships. Table 3 of Canada's First Biennial Report provides details on major federal, provincial and territorial policies and measures.

Modifying Long-term Trends in GHG Emissions and Removals

Canada's GHG regulations and complementary measures by provinces and territories will reduce absolute emissions over the longer term. For example, the Government of Canada's coal-fired electricity regulations will implement a permanent shift to lower or non-emitting types of electricity generation. Along with action by provinces (e.g., Ontario coal phase-out), the regulations are expected to result in a net cumulative reduction in GHG emissions of about 214 Mt over the 2015–2035 period. Through regulatory actions in the transportation sector, GHGs from light-duty vehicles will be reduced by 92 Mt over the lifetime of 2011 to 2016 model year vehicles, and by 162 Mt over the lifetime of 2017 to 2025 model year vehicles.

Projections

The Government of Canada has developed projections of greenhouse gas emissions over the 2012 to 2030 time period. Projections are presented by greenhouse gas and by economic sector. For comparison purposes, the tables also depict historical emissions, including for 2005, which is Canada's base year for its Copenhagen target. In addition, Canada's emissions projections for selected subsectors provide significantly more detail than required by the UNFCCC. Projections for the "with current measures" scenario assume federal, provincial and territorial policies and measures announced or in place as of May 2013 and assume no further government action. Policies that are proposed or planned but not implemented are not included in these projections.

Canada associated with the Copenhagen Accord in January 2010 and committed to reduce its GHG emissions to 17% below 2005 levels by 2020. In light of strong economic growth, this could be challenging. Canada's economy is projected to be approximately 31% larger (in real terms) in 2020 compared with 2005 levels. Figure 4 demonstrates Canada's progress towards its 2020 target.

The difference between the two scenarios represents the total effect of policies and measures by both federal and provincial and territorial Canadian governments and actions by businesses and consumers to improve their energy efficiency and emission intensity. Under the “with current measures” scenario, Canada’s GHG emissions in 2020 are projected to be 734 Mt CO₂ eq. This is 128 Mt less than under a scenario where emissions would be in 2020 if consumers, businesses and governments had taken no action to reduce emissions since 2005, highlighting the significant progress that has been achieved in lowering emissions from a business-as-usual trajectory.

The LULUCF contribution of 28 Mt of emission removals has only been estimated up to Canada’s target year (2020). This is because, although business-as-usual data is available through 2030, the reference level used to measure progress in the managed forests was only constructed and negotiated to 2020. Since estimating the LULUCF contribution requires this reference level, the contribution cannot be estimated for years after 2020. It is anticipated that Canada will develop a post-2020 reference level as part of its participation in international negotiations on post-2020 treatment of the land sector in an international climate change regime under the UNFCCC. The Government of Canada’s sector-by-sector plan will continue to reduce emissions. Reducing GHG emissions, however, it is everyone’s responsibility and governments, businesses and consumers all have a role to play. Further actions by businesses, individuals and governments will allow Canada to address GHG emissions while keeping the Canadian economy strong.

In 2030, Canada’s emissions are projected to be 815 Mt CO₂ eq, or 11% above 2005 levels, with current measures in place. Additional actions by federal or provincial/territorial governments would lower this number. Emissions are decreasing relative to population and economic growth. Per capita emissions are projected to improve through 2030, from 22.9 tonnes of CO₂ eq in 2005 to 19.6 tonnes per capita in 2030— a 15% decrease from 2005 levels.

In addition, the link between growth in GDP and GHG emissions continues to weaken in Canada. There has been an average annual decline of approximately 1.5% in Canadian emissions intensity (emissions per dollar of GDP) since 1990. Emissions intensity is expected to continue to decrease through 2030, demonstrating the continued decoupling of economic and emissions growth in Canada.

GHG emission projections depend on a number of evolving economic and energy variables and are subject to significant uncertainty. In addition, future developments in technologies and resource-extraction will alter the future emissions pathway. In Canada, anticipated emissions growth is due in large part because Canada’s economy is more dependent on emissions-intensive resource extraction than most other developed countries. Canada is also a major energy exporter and its oil and gas sector emissions are projected to increase significantly between now and 2030.

The Government of Canada has also provided detailed emission projections by economic sector (and subsector) as summarized in Table 1 below. This table illustrates how the projected trends in GHG emissions vary by economic sector.

Table 1 Change in GHG emissions by economic sector (Mt CO₂ eq)

	2005	2010	2011	2020	2030
Transportation	168	167	170	176	179
Oil and Gas	162	164	163	200	241
Electricity	121	99	90	82	59
Buildings	84	79	84	95	110
Emissions-Intensive Trade-Exposed Industries	87	75	78	90	101
Agriculture	68	69	68	69	70
Waste and Others	49	48	49	50	55
Subtotal	737	701	702	762	815
Expected LULUCF Contribution	NA	NA	NA	-28	NE
Total	737	701	702	734	815

Abbreviations: NA = not applicable, NE = not estimated.

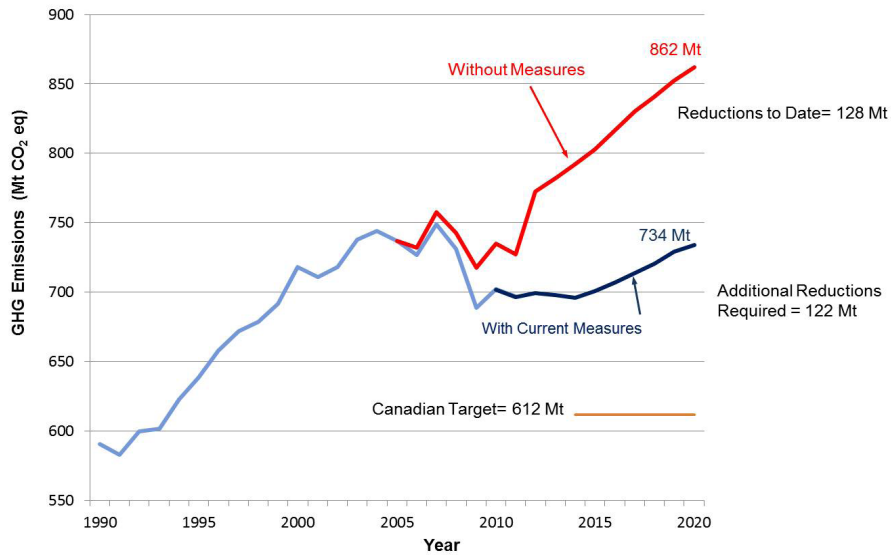


Figure 4 Scenarios of Canadian Emissions to 2020 (Mt CO₂ eq)*

* The "with current measures" line (post-2005) includes the compliance contribution of the LULUCF Sector towards the Copenhagen target, and therefore actual emissions trends (without LULUCF) will be 28 Mt higher in 2020.

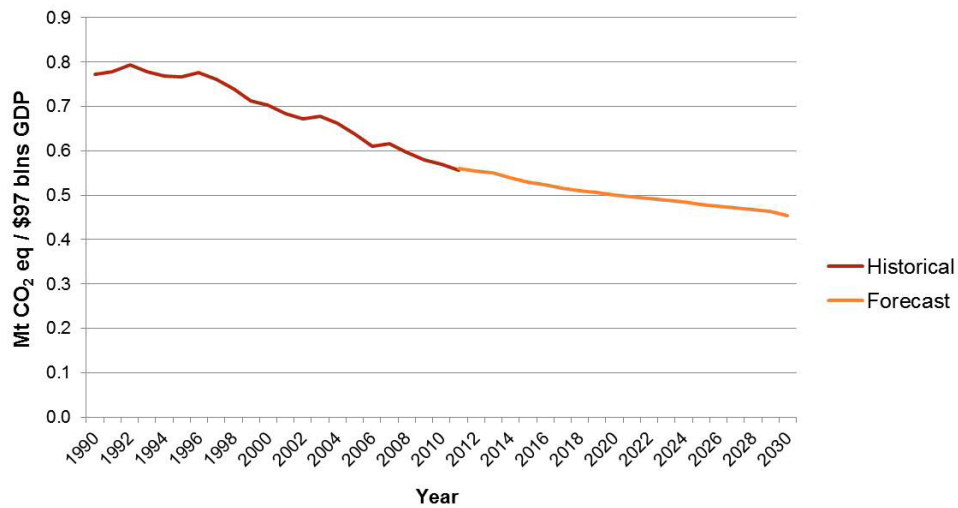


Figure 5 Canadian Emissions Intensity to 2030

Vulnerability Assessment, Climate Change Impacts and Adaptation Measures

Canada's climate is changing and impacts have been observed across the country. Adaptation is increasingly acknowledged as an important part of a broader response to climate change, and it is widely accepted that adaptation can help Canadians manage risks and take advantage of opportunities.

Between 1948 and 2012, the annual average surface air temperature over Canada's landmass warmed by about 1.7°C, approximately twice the global average. While warming trends are observed consistently across the country, stronger trends are found in the north and west, particularly during the winter and spring. Northern Canada (north of 60° latitude) has warmed at a rate approximately 2.5 times the global average since the late 1940s.

Although more difficult to assess, given the strong regional variability in precipitation trends and its various states (rain, freezing rain, snow, etc.), Canada has generally become wetter in recent years. Total annual precipitation in Canada has increased over the 1948–2012 period. In most of southern Canada (south of 60° latitude), there has been a decrease in snowfall and an increase in rainfall, a trend consistent with warmer temperatures.

Increases in temperature and changing precipitation patterns have led to a wide range of impacts, including reduced arctic ice cover, changes in timing and amount of surface water availability, increased evaporation contributing to lower levels in the Great Lakes, increased depth and extent of permafrost thaw, decreased quality and shorter seasons for northern ice roads, increased loss of forests due to pests and wildfires, more frequent droughts and flooding, and increased risks from food-borne diseases.

The Government of Canada renewed and expanded its focus on adaptation by investing \$148.8 million in

10 adaptation programs and adopting the 2011 Federal Adaptation Policy Framework to help bring climate change issues into the mainstream of federal decision making.

Adaptation has been incorporated into more strategies and plans at the provincial and territorial levels, so that most jurisdictions now have stand-alone plans that highlight the importance of adaptation and can help focus efforts. Since 2010, for example, Quebec, Ontario, Manitoba, British Columbia and the three territories (Yukon, Northwest Territories and Nunavut) have released stand-alone adaptation strategies or action plans. Other jurisdictions continue to build from previously announced plans, are in the process of developing adaptation strategies, or are integrating adaptation considerations into broader climate change efforts.

Municipalities have taken action to prepare for a changing climate, including the development of adaptation strategies, incorporating considerations of impacts and adaptation into official plans and planning policies, and adopting measures to reduce climate-related risks.

Progress at all levels has been encouraged by new mechanisms developed to facilitate collaboration, shared learning and priority setting on adaptation research and action. These include the Adaptation Platform and the Climate Change Adaptation Community of Practice.

Canada is actively engaged in the international community to strengthen and disseminate research and science related to the impacts of climate change to ensure that adaptation actions are informed by the best available knowledge.

Building from existing efforts and past successes, Canada will continue to play a leadership role through measures such as strategic investments in adaptation for priority areas. In addition, Canada's adaptation efforts will continue to take a risk management

approach, based on the principles of collaboration and mainstreaming. To date, this approach has enabled implementation of adaptation measures across jurisdictions and economic sectors in Canada.

Finance

Over the last four fiscal years (2009–2010 to 2012–2013), Canada has provided over \$1.53 billion to support climate change projects through a variety of channels and programs. This amount includes \$1.2 billion in fast-start financing delivered over the last three fiscal years (2010–2011 to 2012–2013), as well as \$339 million for other international assistance projects with a direct or a significant focus on climate change. Canada also provided over \$204 million to support the Global Environment Facility over the last four years (fiscal years 2009–2010 to 2012–2013), of which approximately one quarter came from Canada's fast-start financing.

Canada's financial support has been provided to contribute to efforts that address climate change in developing countries, and will be delivered through a wide range of multilateral, bilateral and partnership channels. Over 60 developing countries are benefiting directly from funding delivered through Canada's bilateral channels and Canadian facilities at multilateral institutions. This number will continue to grow as multilateral banks continue to start projects with

available fast-start funds from Canada. A much larger number of countries will also benefit from contributions made by Canada to multilateral trust funds such as the Global Environment Facility and the Least Developed Countries Fund.

As shown in Figure 6, from 2009 to 2013, the largest share of Canada's climate finance went to sub-Saharan Africa, followed by countries in Latin America and the Caribbean. Approximately 10% of financing went to global programs, for which it is not possible to estimate a geographic distribution at this time.

Canada's climate change finance is also targeting a range of climate change projects and initiatives. Canada made a \$200 million contribution to the Clean Technology Fund to support the demonstration, deployment and transfer of low-carbon technologies in developing countries. This and other clean energy projects and initiatives make up 52% of Canada's climate finance. About one third of Canada's finance supported adaptation measures in vulnerable countries such as Burkina Faso, Cameroon, Haiti and Ethiopia. The remaining funding is divided among projects that are related to forests and agriculture (9%) and cross-cutting programming (7%). These estimates could change slightly over time as multilateral institutions roll out Canada's fast-start financing contributions.

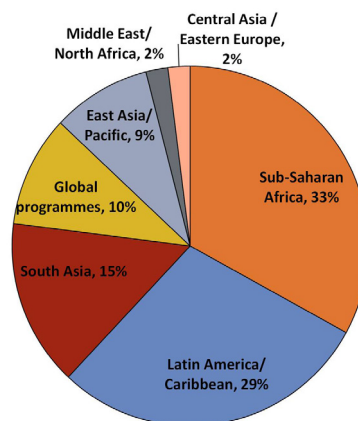


Figure 6 Canadian Climate Finance by Region

Technology and Capacity Building

Canada is committed to supporting the development and deployment of clean technologies to address the effects of climate change globally. Canada provides technology and capacity building support to developing country partners through bilateral and multilateral channels.

Canada has led the way in developing some important tools to advance clean energy globally, including RETScreen clean energy project analysis software and the Carbon Budget Model of the Canadian Forest Sector. The Government of Canada is committed to sharing knowledge and resources, making tools like RETScreen and the Carbon Budget Model available to international partners and providing these partners with training. Canada is also a global leader in the research, development and demonstration of carbon capture and storage technologies.

Canada works with international partners to advance clean technologies through a number of fora, including the United States-led Clean Energy Ministerial, the International Partnership on Energy Efficiency Cooperation, the Climate and Clean Air Coalition, the International Energy Agency, and the Generation IV International Forum. Bilateral cooperation with key international partners is also central to Canada's efforts to advance clean technology. Canada works with international partners to share knowledge and undertake joint science and technology activities.

Research and Systematic Observation of Climate Change

In Canada, climate system research and observation is a joint effort implemented through core government programs, academic institutions and collaborative research networks. Collectively, these efforts improve Canada's understanding of the global climate system and the influence of natural forces and human activities on climate change and variability. This enables better

recognition of the potential impacts on ecosystems and society. Climate system research and monitoring in Canada provides the foundational scientific basis to guide Canadian decisions on climate change mitigation and adaptation.

Recognizing the broad and collaborative nature of climate research and monitoring in Canada, new integrated research networks involving government and university research teams were established in 2013 under the Climate Change and Atmospheric Research initiative. Seven network projects were awarded more than \$32 million over 5 years to understand Earth system processes; advance weather, climate, and environmental prediction; and understand recent changes in the Arctic and cold region environments.

Canada continued its extensive climate monitoring program, including land, air, oceans and fresh water, and space-based Earth observations. Monitoring capacity was enhanced in various areas—for example atmospheric monitoring in the Arctic—through both implementation of new sites and enhanced technology. Through Canada's involvement in international organizations, agreements and commitments, climate data is collected, quality-controlled and disseminated according to international standards.

Canada is a significant contributor to the Global Climate Observing System, the Global Ocean Observing System, and the Global Terrestrial Observing System. Canada is a member of the Group on Earth Observations (now the Federal Committee on Geomatics and Earth Observations), which seeks to coordinate international efforts to build the Global Earth Observation System of Systems. Canadian monitoring priorities encompass all of the major components of the climate system: land surface, forests, cryosphere, atmosphere and oceans. The Global Climate Observing System contributes to the climate component to the Global Earth Observation System of Systems. Canada is also a participant in the international Sustaining Arctic Observing Networks initiative.

Within Canada, research on the climate system and climate change involves different scientific disciplines from a range of government and academic institutions. Canadian scientists and research programs are often linked to larger international efforts. Canadian researchers play leading roles in many international climate research bodies under the World Meteorological Organization and the Arctic Council. Canadian science and scientists made significant contributions to the Intergovernmental Panel on Climate Change's Fifth Assessment Report, as well as other internationally coordinated climate science assessments.

Education and Public Awareness

The Government of Canada recognizes that addressing the challenge of climate change will require the collective effort of all levels of government, non-governmental organizations, businesses and individual Canadians. In Canada, federal, provincial and municipal governments, as well as non-governmental organizations, have undertaken a range of activities to broaden public awareness of climate change. This includes supporting training and education to build broad support for climate change policies and encourage collective action on the part of all Canadians.

Education in Canada is under provincial jurisdiction. Climate change is taught across a range of subjects and grades, but is traditionally part of senior science and geography studies. In terms of post-secondary education, most Canadian universities provide a range of courses of study in climate science and research at both the undergraduate and graduate levels. The Government of Canada provides funding to support post-secondary research networks on climate change, including climate science and impacts. Canadian government scientists also contribute to academia by holding adjunct professorships at Canadian universities and co-supervising students.

The Government of Canada communicates information about climate change and government programs, reports and initiatives using websites and social media, including Twitter, Facebook and Flickr. Canada also participates in conferences and trade shows that highlight Government of Canada climate change initiatives and promote national and international events.

Federal government departments, provincial and municipal governments, and nongovernmental organizations act as climate change resource or information centres for Canadians, governments and businesses. For example, the Office of Energy Efficiency at Natural Resources Canada partners with a variety of stakeholders to promote energy efficiency in Canada. The Office of Energy Efficiency also offers training for Canadian consumers and businesses on the skills they need to increase energy efficiency.

Many provincial and territorial climate change strategies feature public education and awareness, ranging from general information on climate change to specific issues and adaptation activities. Activities include promoting climate change through the education system, conducting outreach to businesses and industries, and providing tools to help Canadians reduce their carbon footprint.

Canada is an active participant in a number of collaborative international initiatives and provides funding to support climate change mitigation, clean energy technology transfer, sustainable forestry and agriculture, and adaptation to climate change by the world's most vulnerable countries. Many of these initiatives include an element of capacity building through the dissemination of information and knowledge tools.

Reference

- 1 Greenhouse gases (e.g., methane, nitrous oxide, hydrofluorocarbons) expressed as carbon dioxide equivalent.