CANADA'S SECOND BIENNIAL REPORT ON CLIMATE CHANGE

Government of Canada
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Canada

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1.0 INTRODUCTION

Canada is pleased to present its Second Biennial Report submission to the United Nations Framework Convention on Climate Change (UNFCCC).

1.1 HIGHLIGHTS OF CANADA'S ACTION ON CLIMATE CHANGE

Canada recognizes the challenges in addressing climate change and the urgent need for action at all levels. Canada also recognizes that climate change presents an opportunity to innovate and to take a leadership position in the low-carbon economy. To this end, the Government of Canada will provide national leadership and partner with the provinces and territories to address climate change both domestically and internationally to make the transition towards a clean economy. Over the last year, Canada has seen a number of significant advancements in its approach to climate change.

- In December 2015 at the Paris Climate Conference, Parties under the UNFCCC agreed to a historic new agreement to address climate change. Collectively, the countries of the world agreed to strengthen the global response to limit global average temperature rise to well below 2 degrees Celsius, as well as to pursue efforts to limit the increase to 1.5 degrees. Canada was pleased to play a role in moving the negotiations forward.

- In November 2015 at the Commonwealth Heads of Government meeting, Canada announced a new climate finance commitment of CA$2.65 billion over five years. This is Canada's largest climate finance contribution to date and will support developing countries (particularly the poorest and most vulnerable) in their transition to low-carbon economies that are both sustainable and more resilient. In addition, funding of CA$30 million is directed to the Least Developed Countries Fund to help vulnerable countries address their adaptation needs, while funding of CA $10 million will support the improvement of early warning systems for meteorological hazards (e.g., tropical cyclones, floods, heat waves, forest fires) in developing countries. This climate finance contribution supports the commitment that Canada made under the 2009 Copenhagen Accord to work with partners to jointly mobilize climate finance from a wide variety of sources, to reach US $100 billion annually by 2020. It also supports the commitment made under the 2015 Paris Agreement to continue to mobilize climate finance from a variety of sources, instruments and channels, with a view to updating the collective finance goal by 2025.

- In October 2015, Canadians elected a new federal government. Canada's new federal government has made a number of commitments related to climate change. These include working with Canada's provinces and territories to establish a pan-Canadian framework for addressing climate change, including carbon pricing, as well as investments in clean energy technology, infrastructure, and innovation, and a Low-Carbon Economy Trust Fund to support provinces and territories in achieving emissions reductions and transforming their economies towards a low-carbon future.

- In July 2015, the Commission on Environmental Cooperation, including Canada, the United States and Mexico, met and announced its Strategic Plan for 2015–2020, identifying climate change mitigation and adaptation as the number one priority for North American collaboration.
- In mid-July 2015, the Canadian Energy Strategy was released by provinces and territories. The Strategy, agreed to by provincial and territorial premiers through collaborative efforts under the Council of the Federation, seeks to ensure efficient use of Canada's energy resources in a manner compatible with a low-carbon future. The Strategy is important for Canada as approximately 80% of Canada's total emissions are energy related.
- In early July 2015, the Government of Ontario hosted the Climate Summit of the Americas to facilitate continued dialogue and strengthen cooperation among subnational governments leading up to the 21st Conference of the Parties to the UNFCCC. The Summit presented an opportunity for subnational leaders, including several provincial premiers, to discuss common climate change initiatives, including carbon pricing, to reduce greenhouse gas (GHG) emissions.
- In June 2015, Ministers established a new climate change committee under the Canadian Council of Ministers of the Environment to facilitate ongoing engagement on climate change. The committee works on priorities identified by ministers in order to effectively address climate change, reviews the outcomes of UNFCCC meetings, and maintains a dialogue among the federal, provincial and territorial governments.
- In May 2015, Canada submitted its Intended Nationally Determined Contribution to the UNFCCC. Canada's submission included a 2030 target of 30% below 2005 levels and announced plans for further regulatory action, including addressing methane and hydrofluorocarbons.
- In April 2015, the Province of Quebec hosted a Climate Change Summit with all provincial and territorial premiers. The summit was convened to discuss mitigation opportunities and to enhance provincial cooperation on climate change; it resulted in a declaration supported by all 13 provinces and territories committing to a transition to a low-carbon economy.
- In April 2015, the Arctic Council Framework for Action on Black Carbon and Methane, which was established under Canada's Chairmanship of the Arctic Council, developed a common vision for Arctic Council nations to take enhanced action to reduce emissions of black carbon and methane. Canada's approach to this framework was done in cooperation with Canada's three territories. Canada submitted its first national report on black carbon and methane to the Arctic Council Secretariat in November 2015.

1.2 SUB-NATIONAL ACTION ON CLIMATE CHANGE

In Canada, provinces and territories have taken strong action on climate change. Recently, a number of provinces have announced significant new climate change strategies, which will expand the coverage and stringency of carbon pricing systems across Canada. These new initiatives reflect the ongoing commitment by provinces and territories in Canada to reduce GHG emissions.

- In January 2016, Alberta and Manitoba signed a bilateral Memorandum of Understanding on Renewable Energy and Climate Change Initiatives. The two provinces plan to prioritize improving electrical grid integration to facilitate the sale of hydroelectricity from east to west.
- In December 2015, at the 21st Conference of the Parties, Ontario, Manitoba and Quebec signed a Memorandum of Understanding signaling their intentions to link their cap and trade programs. This effort will strengthen and expand the coverage of the Western Climate Initiative. Quebec and California are currently the only two members of the WCI that have implemented cap-and-trade systems and linked them to create North America's

largest carbon market. At the Paris Conference the Memorandum of Understanding was recognized as an important initiative by the Secretary-General of the Organisation for Economic Co-operation and Development. It should be noted that carbon market revenues for Quebec have been estimated at CA$3.3 billion for the 2013 to 2020 period and that these revenues are entirely reinvested in mitigation and adaptation measures in the province.

- In addition, in December 2015, British Columbia (BC) and Quebec joined the International Zero Emission Vehicle Alliance and announced they will strive to make all new passenger vehicles in their jurisdictions zero-emissions vehicles by no later than 2050.

- In December 2015, the Government of Yukon released its Climate Change Action Plan Progress Report, which includes updates on existing commitments, provides information on actions taken beyond the original commitments, and details new actions and initiatives moving forward to help achieve the government's existing goals.

- In November 2015, Quebec adopted a 2030 target of a 37.5% reduction below 1990 levels, based on the outcomes of a public consultation process on climate change targets.

- In late November 2015, Manitoba released its Climate Change and Green Economy Plan establishing new GHG emission reduction targets, and signalled its intent to develop a new cap-and-trade program for large emitters. Manitoba has also indicated that it will link its system with the cap-and-trade systems of Ontario, Quebec and California as part of the Western Climate Initiative.

- In mid-November 2015, Saskatchewan announced that it would aim to generate 50% of its electricity using renewable energy by 2030, primarily through new solar, wind and geothermal projects.

- In November 2015, Alberta government released its new Climate Leadership Plan based on the Advisory Panel's recommendations. The Climate Leadership Plan includes a CA$20/tonne carbon price starting in 2017 that will rise to CA$30/tonne the following year and increase in real terms each year thereafter. The province also plans to legislate an emissions limit for the oil sands sector of 100 Megatonnes (Mt) in any year (with provisions for cogeneration and new crude oil upgrading capacity) and plans to reduce methane emissions under Alberta's Joint Initiative on Methane Reduction and Verification.

- In August, at the 39th annual conference of New England Governors and Eastern Canadian Premiers, Canada's Atlantic provinces (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador) and Quebec adopted a resolution with six US states to reduce regional GHG emissions by 35-45% below 1990 levels by 2030.

- In May 2015, British Columbia formed a Climate Leadership Team to provide advice and recommendations to aid in the development of a new climate plan for the province. In late November, Climate Leadership Team's report was released, which includes 32 recommendations for consideration by the BC government. BC has committed to reviewing these recommendations and continuing its public consultations in the development of its new plan. The province plans to update its 2008 Climate Action Plan by spring 2016.

- In April 2015, Ontario announced its intention to implement a cap-and-trade system as a key component of a new climate change strategy. The following month, the province announced a new 2030 GHG emission reduction target of 37% below 1990 levels and reiterated its commitment to the existing 2020 and 2050 targets. In late November 2015, Ontario released its Climate Change Strategy, which outlined key actions including climate legislation that would establish a long-term framework for action, implement its cap-and-trade system, and expand its capacity for renewable energy.

2.0 CANADA'S GREENHOUSE GAS EMISSIONS PROFILE

Canada's National Inventory Report (NIR) is prepared and submitted annually to the UNFCCC using methodologies that are consistent with the inventory guidelines prepared by the Intergovernmental Panel on Climate Change (IPCC). The most recent inventory report is entitled *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2013*; the full report and the Executive Summary are available online at http://www.ec.gc.ca/ges-ghg/.

The NIR includes estimates of GHGs in the following five sectors defined by the IPCC[1]: Energy; Industrial Processes and Other Product Use; Agriculture; Waste; and Land Use, Land-Use Change and Forestry (LULUCF). In 2013, Canada's total GHG emissions were estimated to be 726 Mt of carbon dioxide equivalent (Mt CO_2 eq)[2], excluding LULUCF estimates[3]. The Energy sector (comprising stationary combustion, transport and fugitive emission sources) produced the majority of Canada's total GHG emissions in 2013, at 81% or 588 Mt. The remaining emissions were largely generated by sources within the Agriculture sector (8% of total emissions) and Industrial Processes and Product Use sector (7%), with minor contributions from the Waste sector (3%). The emissions breakdown by IPCC sector is shown below in Figure 2-1.

For the purposes of analyzing trends and policies, it is also useful to allocate emissions to the economic sector from which they originate, as these categories are more identifiable in Canada than the IPCC activity-based sectoral categories. This report also presents emissions by the following economic sectors: Electricity; Transportation; Oil and Gas; Buildings; Emissions-Intensive and Trade-Exposed (EITE) Industries; Agriculture; and Waste and Others. Canada's 2015 NIR provides a detailed cross-walk of emissions in 2013 by IPCC and economic sector and further explanation of how adjustments are made between the two sectoral breakdowns. The emissions breakdown by economic sector is shown below in Figure 2-2.

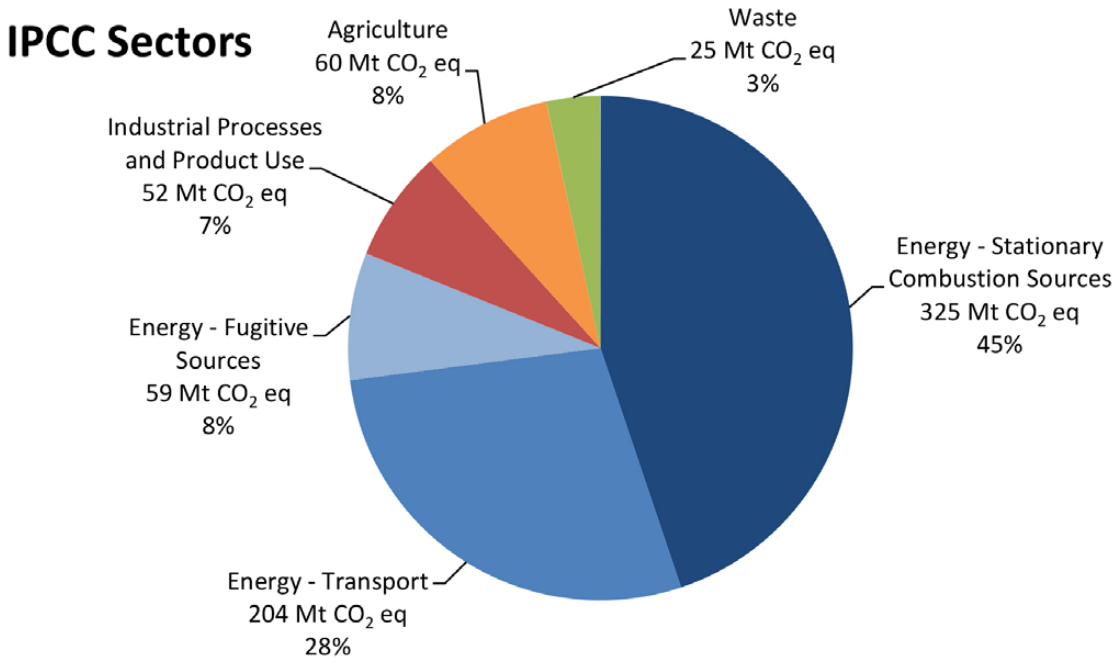
Canada's emissions in 2013 were 23 Mt (3%) below the 2005 level (Figure 2-3). Emission levels fluctuated between 2005 and 2008, followed by a steep drop in 2009 and a slight increase thereafter. Between 2005 and 2013, the decline in emissions was primarily due to lower emissions in the electricity sector and a shift away from coal-fired power production, including through Ontario's phase-out of coal-fired power plants.

1 All sectors are consistent with definitions provided in the IPCC 2006 Guidelines for National GHG Inventories.

2 Greenhouse gases (i.e., methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride) are expressed as megatonnes of carbon dioxide equivalent.

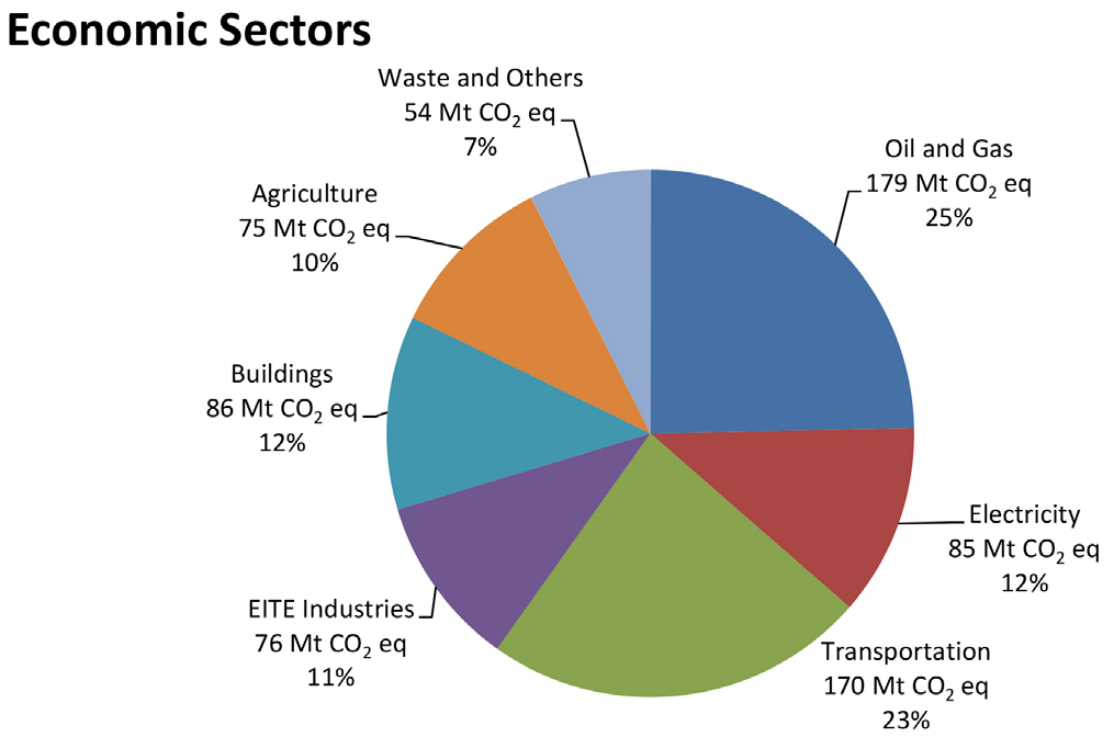
3 National totals based on both the IPCC and economic sectors exclude emissions and removals from LULUCF. This is because the LULUCF estimates include large highly variable annual fluctuations due to natural disturbances on managed forest land, notably fires. In 2013, the LULUCF sector represented a net removal of 15 Mt.

FIGURE 2-1: CANADA'S 2013 EMISSIONS BREAKDOWN BY IPCC SECTOR



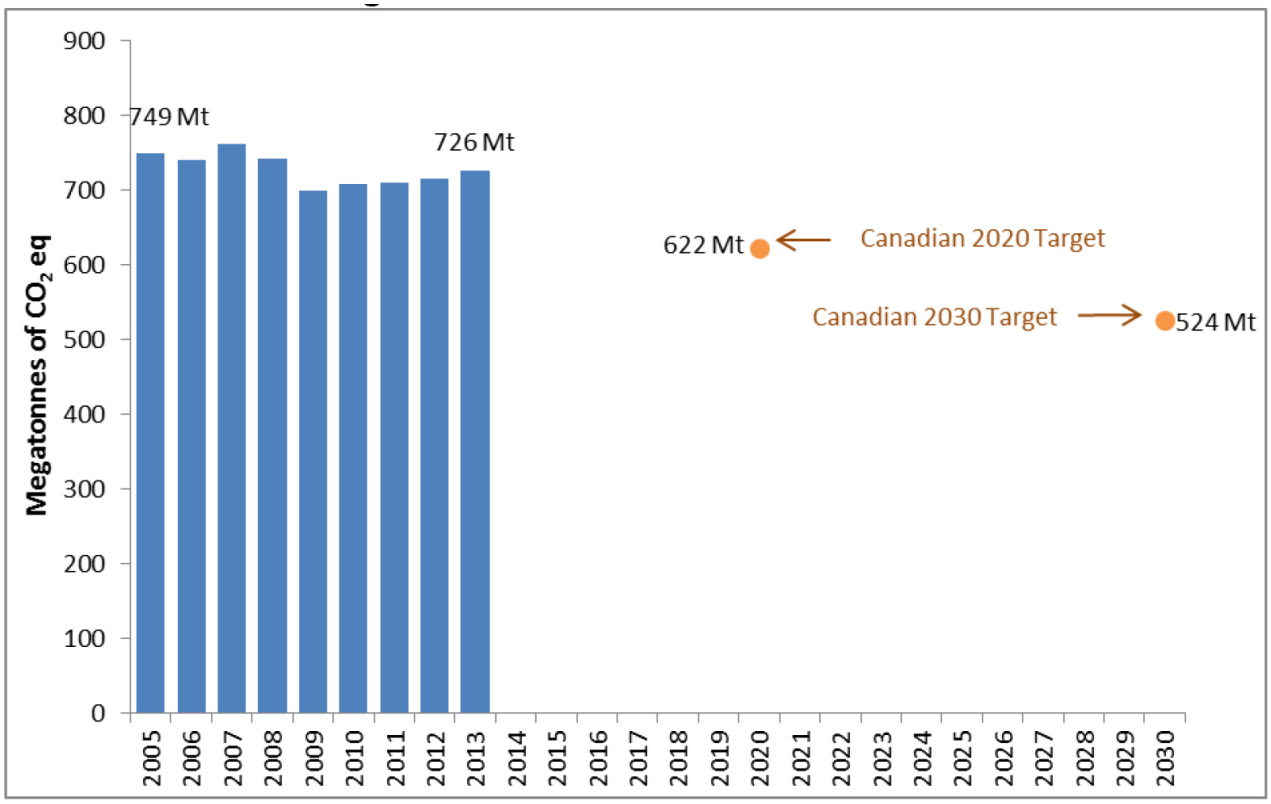
Note: Numbers may not sum to the total due to rounding.

FIGURE 2-2: CANADA'S 2013 EMISSIONS BREAKDOWN BY ECONOMIC SECTOR



Note: Numbers may not sum to the total due to rounding.

FIGURE 2-3: CANADIAN GHG EMISSIONS TREND (2005-2013) AND 2020 TARGET AND ANNOUNCED 2030 TARGET



Canada's national inventory arrangements have been established to ensure the integrity of its annual inventory. Canada's arrangements for the preparation of the inventory encompass the institutional and procedural elements necessary to ensure that Canada meets its reporting obligations. These arrangements include formal agreements supporting data collection and estimates development; a quality assurance/ quality control plan; an improvement 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. Canada's inventory arrangements have not changed since the submission of its First Biennial Report.

3.0 ECONOMY-WIDE EMISSION REDUCTION TARGET

In May 2015, Canada submitted its Intended Nationally Determined Contribution to the UNFCCC. The submission included an economy-wide target to reduce GHG emissions by 30% below 2005 levels by 2030. As outlined in the Paris Agreement and accompanying decisions adopted in December 2015, Parties are invited to submit final targets as part of ratifying the new agreement and will be obligated to submit revised nationally determined contributions every five years. In the context of developing a pan-Canadian framework on climate change, the Government of Canada will be reviewing its Intended Nationally Determined Contribution with provinces and territories.

Under the 2009 Copenhagen Accord, Canada committed to reduce its emissions by 17% below 2005 levels by 2020. This target covers all sectors and GHGs.

Annex 1 provides additional information on these targets.

4.0 CANADA'S PROGRESS IN ACHIEVEMENT OF ITS QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

Action on climate change is being taken across Canada by federal, provincial and territorial governments. While environmental protection is not specifically addressed under Canada's Constitution, it has become an area of shared jurisdiction as governments take action in line with their authorities.

4.1 DOMESTIC INSTITUTIONAL ARRANGEMENTS

Canada's domestic institutional arrangements were outlined in detail in its Sixth National Communication. As noted in Section 1 of this report, key changes in institutional arrangements include the Canadian Energy Strategy, a framework that seeks to expand collaboration amongst provinces and territories on Canada's energy future, with climate change as a key consideration, and the Quebec Climate Change Summit Declaration, which outlines a set of key principles to guide pan-Canadian collaboration on climate change. In addition, other key changes in institutional arrangements include:

- The Government of Canada has committed to working with provinces and territories to develop a pan-Canadian framework to address climate change. Preliminary discussions have already taken place, and governments will work closely to develop the framework.
- Federal, provincial and territorial ministers have agreed to discuss climate change on an ongoing basis at the Canadian Council of Ministers of the Environment, Canada's primary intergovernmental forum for collaboration on environmental issues. A work program has been adopted and a Climate Change Committee has been established to undertake this work. Other federal-provincial councils have been established to engage sub-national governments on issues related to the environment, including the Energy and Mines Ministers Conference and the Canadian Council of Forest Ministers.
- Provinces are also involved in a number of regional initiatives that are promoting sub-national cooperation, such as the Western Climate Initiative, the Pacific Coast Collaborative, the Under 2 Memorandum of Understanding, the New England Governors and Eastern Canadian Premiers annual meeting, and the Compact of States and Regions.

4.2 MITIGATION ACTIONS BY ECONOMIC SECTOR

This section provides an overview of Canada's policies and measures by economic sector. Annex 2 of this report contains supplementary information related to Canada's action on climate change.

ELECTRICITY SECTOR

Canada's electricity sector is already one of the cleanest in the G7, with 79% of electricity generated from non-emitting sources. Some jurisdictions, such as BC, have electricity sectors that are already 95% non-emitting. All levels of government in Canada are taking action to reduce emissions from the electricity sector, including policies to encourage further hydroelectricity development and transmission, and to expand other forms of renewable electricity generation.

In 2012, the Government of Canada published the *Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations*, which came into effect on July 1, 2015. These regulations effectively ban the construction of new traditional coal-fired generation plants, as well as providing an accelerated phase-out schedule for existing plants and establishing high-efficiency gas as the standard for new plants.

The Province of Ontario has phased out coal-fired electricity generation, making Ontario's electricity sector coal-free as of April 2014. Nova Scotia has set a declining cap on GHGs in its electricity sector. In November 2015, Alberta announced that it will reduce GHG emissions from coal-fired electricity to zero by 2030 and that its retired coal plants will be replaced with at least two-thirds renewable energy sources, resulting in up to 30% of generation from renewable sources by 2030.

In addition, Manitoba has implemented an emissions tax on coal and has banned the use of coal and petroleum coke as a space-heating fuel. Manitoba's last remaining coal-fired generating facility can only operate under an emergency order, and this facility will cease coal-fired operations in 2019 when additional hydro power sources come online.

Saskatchewan recently announced that it will have a target to generate 50% of its power by renewable energy by 2030. SaskPower, the provincially owned utility that generates most of Saskatchewan's electricity, will develop wind, solar and geothermal power to meet this target. In 2014, Saskatchewan's Boundary Dam carbon capture and storage project became the world's first commercial-scale coal-fired carbon, capture and storage electricity project. Once fully operational, the Boundary Dam project is expected to capture and sequester 90% of GHG emissions at the facility, removing approximately 1 Mt CO_2 eq every year.

Other provinces and territories are also taking measures to expand renewable electricity generation across Canada. Newfoundland and Labrador's Lower Churchill hydroelectricity project is poised to be one of the largest renewable energy projects in North America. Once the first phase of this project (Muskrat Falls) is completed in 2018, 98% of Newfoundland and Labrador's electricity production will come from renewable sources, with surpluses exported to Nova Scotia and potentially other markets across North America. British Columbia, Manitoba, Quebec, and the Yukon have also announced plans to expand hydroelectric generation capacity.

In addition, many other provinces, including BC, Ontario, New Brunswick, Nova Scotia, and Prince Edward Island, have established a variety of targets to expand renewable energy supplies, including putting in place standard offer contracts, feed-in tariff programs and legislated Renewable Portfolio Standards.

Wind energy has recently experienced strong growth in Canada, with an average annual growth rate of more than 20% over the last 5 years. In 2015, this energy sector benefited from investments reaching nearly CA$3 billion for 36 wind energy projects with a total installed capacity of 1,500 megawatts, including over 870 megawatts in Ontario and over 390 megawatts in Quebec. Today, with over 11,200 megavolts of installed power capacity, Canada ranks among the top ten world leaders in wind energy in terms of installed capacity.

Interprovincial trade in electricity is also expanding access to cleaner forms of electricity. For example, in September 2015, Manitoba and Saskatchewan signed a 20-year agreement that will see a minimum

of 100 megawatts of electricity flow from Manitoba to Saskatchewan, and includes the construction of a new east-west power transmission line. In addition, in January 2016, Alberta and Manitoba signed a bilateral Memorandum of Understanding on Renewable Energy and Climate Change Initiatives. Through the Maritime Link transmission project, starting in 2018, Newfoundland and Labrador will supply from 8-20% of Nova Scotia's electricity needs, reducing the province's reliance on coal-fired electricity.

A number of provinces and territories have also made investments in demand-side management measures in the electricity sector. In Nova Scotia, for instance, through the *Electricity Efficiency and Conservation Restructuring Act (2014)*, the provincial electricity utility is required by law to invest in energy efficiency when it is the most cost-effective option for ratepayers. Demand-side management measures, as well as energy efficiency measures, can result in GHG emission reductions from avoided fossil fuel-fired electricity generation.

Finally, the Canadian Energy Strategy includes a number of interprovincial collaboration objectives aimed at the decarbonization of electricity generation in Canada, notably by encouraging further deployment of alternative renewable energy through the use of innovative approaches, such as energy storage, smart grids and on-site microgeneration.

TRANSPORTATION SECTOR

Federal, provincial and territorial governments have developed numerous measures to enhance efficiency and to reduce GHGs in the transportation sector. Federal GHG emission standards for on-road vehicles, engines and marine vessels are key to these efforts. Other measures include voluntary agreements to reduce emissions from aircraft and locomotives; measures related to biofuels, transit planning frameworks, and policies to encourage the electrification of vehicles.

The Government of Canada has put in place the federal *Renewable Fuels Regulations* for gasoline, diesel fuels and heating oil distillate, while several provinces and territories, including BC, Alberta, Saskatchewan, Manitoba and Ontario, have also established incentive programs and regulations targeting renewable fuels,.

Some provinces have also established incentive programs that aim to increase the number of electric and/or hybrid vehicles on the road. For example, Quebec has implemented the 2015-2020 Transportation Electrification Action Plan and has established a number of related programs, such as the Drive Electric program (purchase rebate), the Connected at Work program, and the Electric Circuit program (public charging station network), which seek to reduce emissions in the transportation sector through accelerating the deployment of electric vehicles and related infrastructure. It should be noted that since January 1, 2015, the coverage of Quebec's cap-and-trade system includes fossil fuel distributors, which contributes to supporting the economic viability of alternative, lower-emitting transportation.

Ontario's Electric Vehicle Incentive Program allows consumers to apply for a rebate towards the purchase or lease of eligible new plug-in hybrid-electric or battery-electric vehicles. Provinces are also undertaking pilot projects; for example, Manitoba is developing and testing new battery-electric transit buses and charging infrastructure.

In addition, many provinces are implementing measures to encourage greener transportation. For example, Ontario's The Big Move: Transforming Transportation in the Greater Toronto and Hamilton Area is an initiative that outlines a long-term sustainable transportation plan for one of Canada's largest urban areas, which includes increasing the use of transit and cycling in the region. Alberta's GreenTRiP is investing CA$2 billion in public transit. Quebec has also implemented a number of programs to encourage a greater reliance on public transportation, support the introduction of green technologies and improve energy efficiency in personal and freight transportation (Ecocamionnage program), as well as to encourage intermodal transportation.

OIL AND GAS SECTOR

Canada is a net energy exporter, and is the world's fourth largest exporter of crude oil and fifth largest exporter of natural gas. Legal authorities over the production of oil and gas resources rest primarily with provincial governments. British Columbia, Alberta, Manitoba and Saskatchewan have put in place a mix of permitting requirements, directives and voluntary measures to reduce flaring and venting emissions from the oil and gas industry and to reduce fugitive emissions from equipment leaks. The Canada-Newfoundland and Labrador Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board have adopted similar measures for offshore facilities.

Alberta's oil sands industry is currently regulated under Alberta's *Specified Gas Emitters Regulation* for large industrial emitters. The regulation was updated in 2015, increasing its stringency from 12% emission intensity reductions to 15% by January 1, 2016, and 20% by January 1, 2017. Similarly, the contribution rate (or carbon price) for the Climate Change and Emissions Management Fund, historically set at CA$15/tonne, will be increased to CA$20/tonne in 2016 and CA$30/tonne in 2017.

The sector will be subject to future regulation under Alberta's recently announced Climate Leadership Plan, which includes: a carbon price that will apply to all transportation and heating fuels starting at CA$20/tonne on January 1, 2017, increasing to CA$30/tonne on January 1, 2018, and continuing to increase in real terms each year after that. The Climate Leadership Plan also includes: a transition from the *Specified Gas Emitters Regulation* facility-specific historical emissions-intensity reduction approach to product-based performance standards in 2018; a commitment to legislate an emissions limit for the oil sands of 100 Mt in any year (with additional provisions for cogeneration and new upgrading capacity); and a reduction of methane emissions by 45% from oil and gas operations by 2025.

Other measures in this sector include Alberta's Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting, and Saskatchewan's Flaring and Venting Reduction Directive (s-10), which include mandatory requirements for reducing flaring, incinerating and venting of associated gas in the upstream petroleum industry. As well, both Alberta and BC require facilities to have in place a fugitive emissions management plan to reduce methane emissions from equipment leaks in the upstream petroleum industry.

Provinces are also implementing measures to address emissions from the export of oil and gas produced in Canada. For example, to prepare for a new liquefied natural gas export industry in the province, BC has established an emissions intensity benchmark, which facility operators can meet by adopting more efficient technologies, using clean energy, investing in offsets, or purchasing "funded units" at CA$25/tonne that contribute to clean technologies.

BUILDINGS SECTOR

A number of federal programs are addressing emissions in the building sector, such as the ecoENERGY Efficiency suite of programs, which contributes to improving energy efficiency across Canada (including the ecoENERGY Efficiency for Buildings and ecoENERGY Efficiency for Housing programs). Through *Canada's Energy Efficiency Act* (1992), regulations are being put in place for minimum energy performance standards for energy-using products. These energy efficiency regulations are effectively reducing emissions in key sectors including buildings and industry.

The implementation of building codes is the responsibility of provinces and territories, and the federal government establishes a model national energy code that provinces and territories can adapt or surpass to suit their circumstances. For example, Quebec's Novo Climat standard for new houses exceeds the recommendations included in the national model building code.

In addition to building code standards, provinces and territories are implementing additional measures to improve energy efficiency and reduce GHG emissions in this sector. For example, New Brunswick has several measures to improve the energy efficiency of residential and commercial buildings, such as the Energy Smart Commercial Buildings Retrofit Program, the Low Income Energy Savings Program, and the Home Insulation Energy Savings Program. Others, such as

Manitoba, Prince Edward Island, Newfoundland and Labrador, the Northwest Territories, and Yukon, are using financial tools to improve energy efficiency in residential and commercial buildings.

EMISSIONS-INTENSIVE AND TRADE-EXPOSED (EITE) SECTOR

This sector encompasses non-oil and gas mining, smelting and refining, pulp and paper, iron and steel, cement, lime and gypsum, and chemical and fertilizer industries. The federal government has established cross-cutting programs to improve energy efficiency across several industrial sectors. For example, the ecoENERGY Efficiency for Industry program aims to improve conservation and energy efficiency within more than 25 industrial sectors.

Provinces and territories are also taking action to address emissions in this sector through cross-cutting measures. For example, the Quebec cap-and-trade system covers businesses that emit over 25,000 tonnes of CO_2 eq per year, including industrial sectors such as aluminum smelters and cement factories. Alberta's *Specified Gas Emitters Regulation* applies to any industrial facilities in that province emitting more than 100,000 tonnes of CO_2 eq, including chemical and fertilizer manufacturers and mineral processors. Moving forward, this sector will be subject to the carbon pricing rules under Alberta's Climate Leadership Plan and under the cap-and-trade programs of Ontario and Manitoba. New Brunswick recently introduced the requirement for industries emitting more than 50,000 tonnes of CO_2 eq, to prepare Greenhouse Gas Management Plans and report on progress.

In addition, British Columbia's revenue-neutral carbon tax, applied to the purchase or use of fossil fuels, is a cross-cutting measure that sends a price signal to all industries within the province to reduce GHG emissions, including those in this sector.

Finally, a number of provinces have implemented programs seeking to support EITE industries in improving their operations' energy efficiency and adopting more effective energy processes that emit fewer GHGs. This includes Quebec's ÉcoPerformance Program and Ontario's Regulatory Changes for Reducing Coal Use in Energy-Intensive Industries.

WASTE AND OTHER SECTOR

The waste sector encompasses solid waste, waste water, and waste incineration. Emissions from the waste sector mainly fall within the responsibilities of municipal governments in Canada, under provincial jurisdiction. However, federal funding has contributed to addressing emissions within this sector, including federal infrastructure programs that have contributed over CA $210 million to 88 solid waste projects since 2005. As a result of a mix of provincial regulations and incentives, approximately 68 of the 88 medium and large-sized landfills in Canada have gas collection systems, with collected gas used in a number of ways including for electricity and/or heat generation.

Other examples of provincial and territorial measures in the waste sector include the Manitoba *Prescribed Landfills Regulation*, which requires the three largest landfills in the province to capture or flare excess methane. Nova Scotia's Solid Waste-Resource Management regulations, implemented in 1996, have led to the province having the highest waste diversion rate in Canada; currently 70% of Nova Scotia's organic waste is diverted from landfills. In addition, the Ontario *Landfilling Sites Regulation* requires all landfills larger than 1.5 million cubic metres to install landfill gas collection systems and the British Columbia *Landfill Gas Management Regulation* requires all municipal solid waste landfills generating over 1,000 tonnes of methane per year to install a landfill gas management system with the performance objective of maintaining at least 75% collection efficiency. Several other provinces, such as New Brunswick, Newfoundland and Labrador, and Quebec, also have measures in place to divert organic waste and increase the methane capture rate.

AGRICULTURE SECTOR

In Canada, agriculture is a shared jurisdiction, and policy frameworks are negotiated and agreed to by the federal, provincial and territorial ministers of agriculture. These frameworks outline broad objectives

and serve as the foundation for agricultural programs and services. Growing Forward 2 is Canada's current agriculture policy framework and covers a five-year period (2013-2018) with a focus on innovation, competitiveness, and market development. This CA$3 billion investment by federal, provincial and territorial governments supports strategic initiatives in priority areas, including cost-shared and federal-only programs to advance environmentally sustainable agriculture in Canada.

Many of these initiatives translate into multiple environmental outcomes, including some related to climate change mitigation. Alongside measures supporting on-farm actions, there are a number of science and innovation programs contributing to enhancing the sustainability of the Canadian agriculture sector. The Agricultural Greenhouse Gases Program provides CA$27 million to support research to enhance the understanding and accessibility of agricultural technologies, beneficial management practices and processes that can be adopted by farmers to mitigate GHG emissions.

Specific examples of provincial initiatives include Quebec's Prime Vert program, which provides farm operators with support for capturing, destroying or using methane and the Ontario Ethanol Growth Fund, which has helped create an industry with seven ethanol facilities in place and domestic production that is currently exceeding 1 billion litres per year. In Alberta, best agricultural practices are supported through the carbon offset system, where Alberta has achieved significant reductions in this sector though the aggregation of credits across smaller projects.

LAND USE, LAND-USE CHANGE AND FORESTRY

Canada's provinces and territories have jurisdiction over 90% of forests in Canada. Examination of forest-related mitigation potential is ongoing, including mitigation related to changes in forest management, increased afforestation, increased use of harvested wood for long-lived products as a substitute for products that are more emissions intensive on a lifecycle basis, and increased use of waste wood for bioenergy in place of fossil fuels. Some current initiatives at the provincial level are seeking to achieve mitigation related to improving forest cover. For example, the Ontario 50 Million Tree Program plants trees on the settled landscape of the southern part of the province, while the British Columbia Forest Carbon Partnership Program seeks to stimulate forest ecosystem restoration and forest regeneration. As well, a number of provinces are encouraging or exploring the development of forest carbon offset project systems.

CROSS-CUTTING MEASURES

Provinces and territories have established or announced recent cross-cutting initiatives to reduce GHG emissions.

Alberta's recently announced Climate Leadership Plan will address GHG emissions through four key actions: pricing carbon at CA$20/tonne starting in 2017 and increasing to CA$30 in 2018; phasing out coal-fired electricity and developing more renewables; legislating a cap on emissions from the oil sands; and reducing methane emissions by 45% by 2025. Carbon pricing revenue will be fully reinvested into measures that reduce emissions, including clean technology, renewable energy, green infrastructure and energy efficiency, and will also be used to provide transition support to individuals and families, small businesses, Indigenous communities and people working in the coal industry. This new plan will put a price on 78-90% of GHGs in the province, representing an increase in coverage over Alberta's existing *Specified Gas Emitters Regulation* for large industrial emitters, which applies to approximately 50% of emissions.

Other carbon pricing policies are in place or announced at the provincial and territorial level that target emissions reductions across a range of sectors. British Columbia has had an economy-wide, revenue-neutral carbon tax in place since 2008 that is now at CA$30/tonne of CO_2eq emissions, and it plans to update its Climate Action Plan in spring 2016. Quebec established a cap-and-trade system in 2013 and officially linked it to the California system through the Western Climate Initiative in 2014, thereby creating the largest carbon market in North America. Both administrations held their first joint auction the same year. In Quebec, 85% of provincial emissions are currently capped, and this

CARBON PRICING IN CANADA

Carbon pricing is an important tool to help reduce GHG emissions. The Government of Canada has committed to partnering with provinces and territories to address climate change, and it intends to build on provincial carbon pricing initiatives, such as the revenue-neutral carbon tax in British Columbia, the cap-and-trade systems in place in Quebec and planned for Ontario and Manitoba, and the carbon pricing system that was recently announced by Alberta. Internationally, at the Paris Conference, Canada joined with other countries to support the Carbon Pricing Leadership Coalition, which is lending momentum to global efforts to put a price on carbon. The provinces of Alberta, British Columbia, Manitoba, Ontario and Quebec are also members of this coalition.

In addition, Quebec, British Columbia, Ontario and Manitoba are members of the International Carbon Action Partnership, while Quebec is also a technical partner of the Partnership for Market Readiness program of the World Bank.

cap is set to reduce by an average of 4% per year to help achieve Quebec's GHG emission reduction target of 20% below 1990 levels by 2020. Ontario has announced that it intends to join Quebec and California for its carbon pricing system. Likewise, the Province of Manitoba has announced that it will also develop a cap-and-trade system linked with these jurisdictions.

The federal government has also made significant investments to support green infrastructure, energy efficiency, and the development of clean energy technologies. For example, carbon capture and storage (CCS) research, development and deployment has been part of Canada's strategy to address climate change. Canada is a global leader in CCS, with four commercial-scale projects in operation or under construction, including the Boundary Dam project mentioned above. Canada has significant storage potential for CCS, which the 2012 North American Carbon Storage Atlas estimated as 132 billion tonnes of storage resources available – over 150 times more than Canada's annual GHG emissions. Together, the Government of Canada and the governments of Alberta, Saskatchewan and British Columbia have invested over CA$1.8 billion in funding for CCS, with the potential to leverage up to CA$4.5 billion in public-private investment. Most recently, the Quest project in Alberta came online in 2015 and is expected to capture and store over 1 Mt CO_2 per year from Shell's Scotford Oil Sands Upgrader.

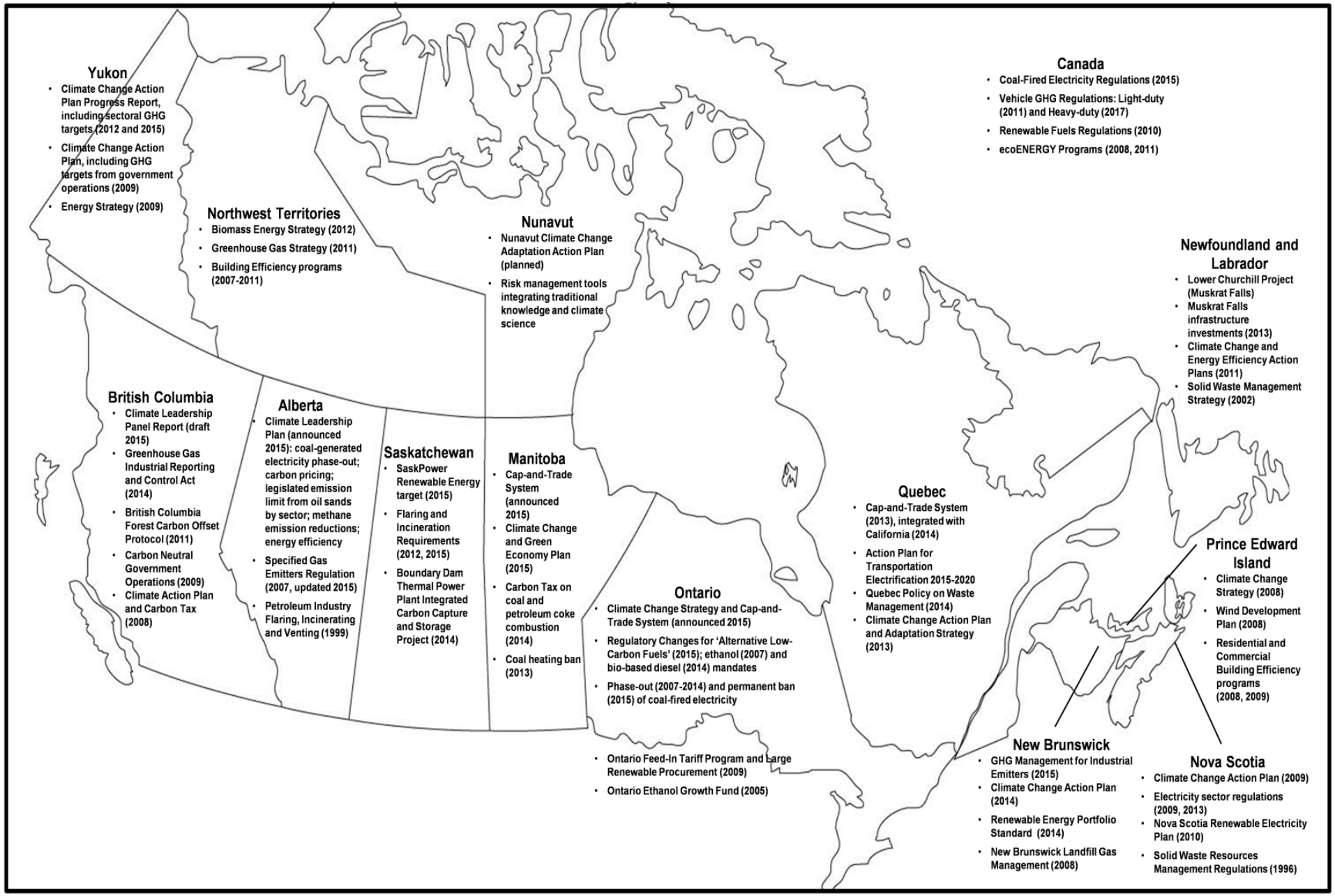
Sustainable Development Technology Canada (SDTC) manages funds endowed by the Government of Canada to support the development and demonstration of innovative Canadian clean technology projects. In particular, the Sustainable Development Tech Fund supports projects that address climate change, air quality, clean water and clean soil. The Government of Canada has provided CA$915 million in funding, and to date SDTC has allocated CA$740 million from this fund to support 285 projects in Canada, leveraging an additional CA$2 billion from industry and other sources.

A number of provinces and territories have also implemented programs to support the development and deployment of low-emission technologies in all sectors. For example, in Quebec, the Technoclimat program offers financial support to project proponents, as well as proposals for mobilizing projects for the development of green and innovative products and processes, bringing together universities, public research centres as well as small and large businesses. In addition, Alberta's Climate Change Emissions Management Fund has invested in projects and technology to reduce GHG emissions in Alberta, including renewable forms of energy and cleaner energy development. Contributions to the fund come from companies that have chosen this compliance option under Alberta's *Specified Gas Emitters Regulation*. Since 2007, CA$503 million has been paid into the fund.

MISSION INNOVATION

At the Paris Climate Change Conference in December 2015, Canada joined Mission Innovation, an initiative that aims to accelerate global clean energy innovation. By signing onto this initiative, Canada – along with 19 other countries including the United States, Australia, China and Brazil– committed to doubling investments in clean energy innovation within 5 years, and to collaborating with partners to promote commercialization and dissemination of clean energy technologies. Working with global partners, including from the private sector, Canada will aim to accelerate innovation in transformative clean energy solutions, an important part of an effective, long-term global response to the shared climate challenge.

FIGURE 4-1: SELECTION OF MITIGATION MEASURES BY JURISDICTION



5.0 PROJECTIONS

5.1 CANADA'S GREENHOUSE GAS EMISSIONS PROJECTIONS

This chapter provides projections of Canada's GHG emissions through 2030, excluding emissions and removals from LULUCF.[4] Projections are aligned to Canada's historical emissions from 1990 to 2013 as presented in Canada's 2015 National Inventory Report (NIR) and Section 2 of this report.

Projections presented in this section represent a "with current measures" scenario and include actions taken by governments, consumers and businesses up to 2013, as well as the future impacts of existing policies and measures that have been put in place as of September 2015. The projections do not reflect the impact of additional federal, provincial or territorial measures that were announced since September 2015 or that are still under development. The projections are presented by sector in two ways – by IPCC sector and by economic sector – and by gas. As shown in the tables below, under the "with current measures" scenario GHG emissions in Canada are projected to be 768 Mt CO_2 eq in 2020 and 815 Mt CO2 eq in 2030. Key drivers of GHG emissions in Canada are oil and gas prices (which are subject to external commodity market pricing) and economic growth. Because these can be quite volatile and have a critical impact on GHG projections, alternative scenarios that reflect different assumptions about oil and natural gas prices and production, as well as different rates of economic growth, have been developed.

4 Canada is in the process of developing an estimation methodology that focuses on anthropogenic LULUCF emissions and removals and that would remove the impacts of natural disturbances (e.g., forest fires, insect infestations) for the full time series of managed forest emissions/removals (both historical and projected emissions). As this work is still underway, and results are not yet available, Canada has not shown projections here. A unique challenge in both projecting and accounting for emissions and removals in Canada's managed forest is the fact that natural disturbances result in significant variations in annual forest emission and removal estimates. As well, natural disturbances generally cannot be predicted for future years. The historical estimates for LULUCF from 1990-2013 found in Canada's 2015 NIR include the impacts of natural disturbances that occurred in the historical period. It is incorrect to compare these estimates for LULUCF for one year to estimates for another year and assume that the difference represents the effect of human activity. It does not: much of the large year-to-year variation in Canada's LULUCF emission estimates is due to natural disturbances in the managed forest, not human activity. Canada has indicated that its accounting for managed forests towards its emissions reductions target will exclude the impacts of natural disturbances because these impacts are non-anthropogenic. It is expected that the work underway to develop estimates that focus on anthropogenic emissions and removals will provide a better basis for reporting and accounting for LULUCF.

TABLE 5-1: DETAILED EMISSION PROJECTIONS BY IPCC SECTOR – 2005 BASE YEAR

Note: Numbers may not sum to the total due to rounding.

Sector	Historical			Projected	
	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Energy	405,000	373,000	384,000	417,000	450,000
Transportation	195,000	200,000	204,000	204,000	198,000
Industrial Processes	59,000	51,000	52,000	66,000	84,000
Agriculture	62,000	57,000	60,000	60,000	61,000
Waste	28,000	27,000	25,000	21,000	20,000
Total	**749,000**	**707,000**	**726,000**	**768,000**	**815,000**

TABLE 5-2: DETAILED EMISSION PROJECTIONS BY ECONOMIC SECTOR – 2005 BASE YEAR

Note: Numbers may not sum to the total due to rounding.

Sector	Historical			Projected	
	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	157,000	160,000	179,000	210,000	242,000
Electricity	121,000	99,000	85,000	74,000	58,000
Transportation	169,000	169,000	170,000	169,000	164,000
EITE	89,000	75,000	76,000	9,0000	107,000
Buildings	87,000	82,000	86,000	96,000	109,000
Agriculture	71,000	70,000	75,000	74,000	76,000
Waste & Others	54,000	53,000	54,000	54,000	59,000
Total	**749,000**	**707,000**	**726,000**	**768,000**	**815,000**

TABLE 5-3: DETAILED EMISSION PROJECTIONS BY GAS – 2005 BASE YEAR

Note: Numbers may not sum to the total due to rounding.

Sector	Historical			Projected	
	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
CO_2	580,000	556,000	570,000	608,000	643,000
CH4	117,000	104,000	107,000	103,000	104,000
N2O	41,000	38,000	41,000	40,000	42,000
HFCs	5,300	5,700	6,400	14,400	22,200
PFCs	3,800	1,900	1,600	1,800	2,400
SF6	1,400	400	400	300	300
Total	**749,000**	**707,000**	**726,000**	**768,000**	**815,000**

The highest emissions are projected under a scenario aligned with Canada's National Energy Board's[5] high oil and gas prices with higher-than-average annual growth in gross domestic product (GDP) between 2013 and 2030 (2.3% compared with 1.8% in the reference scenario). Alternatively, the lowest emissions scenario includes slower GDP growth (average growth of 1.1% between 2013 and 2030) and the National Energy Board's low world oil and gas prices. The National Energy Board's forecasted price of oil under its low energy prices scenario is US$66 per barrel (bbl) in 2030 compared to US$90/bbl (both in US 2013 dollars) in the reference case. A more complete list of assumptions for Canada's reference scenario is presented in Annex 3.

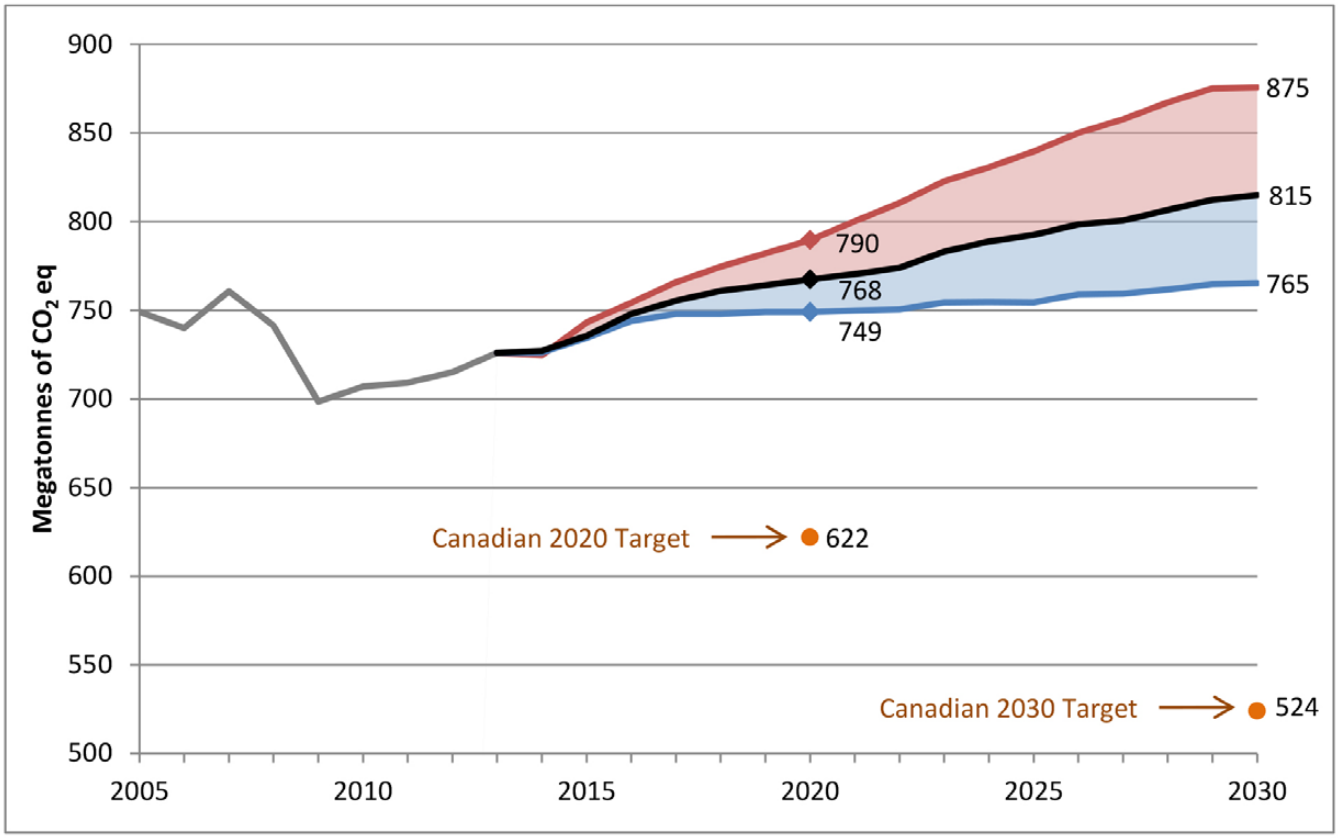
5 The emissions projections incorporate the National Energy Board's integrated forecasts of energy prices and production from its report, *Canada's Energy Future 2016 – Energy Supply and Demand Projections to 2040*.

As shown in Figure 5-1 below, these scenarios suggest that the expected range of emissions in 2030 could be between 765 Mt in the lowest emissions scenario and 875 Mt in the highest emissions scenario, not including contributions for LULUCF. This 110 Mt range will continue to change over time with further government actions, technological change, economic conditions and developments in energy markets.

Additional detail on emission trends by province, sector and subsector, as well as more information on assumptions and emissions drivers per sector can be found in Annex 3.

The projections in this report use the same modelling framework as the projections presented by Canada in the Sixth National Communication and First Biennial Report, and are generated from Environment and

FIGURE 5-1: CANADA'S EMISSION PROJECTIONS IN 2020 AND 2030 (MT CO_2 EQ)



Climate Change Canada's Energy, Emissions and Economy Model for Canada (see Annex 3 for more detail). Differences in projected emissions arise from updated input data (e.g., historical GHG emissions, GDP, population, etc.), updated assumptions about domestic and international evolving energy markets, the inclusion of new provincial and federal government measures, and improvements to the modelling methodology undertaken to provide better estimates of energy and emissions. Some key improvements since the First Biennial Report are noted in Annex 3.

OIL PRICE ASSUMPTIONS

Although oil prices have declined recently, there is significant uncertainty around how these changes will affect longer-term oil production. The emissions projections for the current measures reference case in this report incorporate the National Energy Board's integrated forecasts of oil and other energy prices and production from its report, *Canada's Energy Future 2016 - Energy Supply and Demand Projections* to 2040. The National Energy Board's expectation of medium-term recovery of oil prices is consistent with other major price forecasts.

GHG emissions are driven by oil production rather than price. While an expectation of lower oil prices for the foreseeable future does have the effect of reducing oil production forecasts, increases in the productivity of oil producers have reduced this impact in the National Energy Board's projections. Furthermore, existing oil sands production will likely continue due to substantial existing investments and the long time horizon of projects.

Finally, lower oil prices will lead to higher emissions as a result of an increase in energy demand from other sectors. Thus, any drop in GHG emissions in the oil-producing sector would be partially offset by a rise in emissions from other sectors.

6.0 PROVISIONS OF FINANCIAL, TECHNOLOGICAL AND CAPACITY-BUILDING SUPPORT TO DEVELOPING COUNTRY PARTIES

6.1 FINANCE

In November 2015, Canada made a historic pledge of CA$2.65 billion over the next five years to support developing countries' transition to low-carbon economies that are both greener and more climate resilient. This financial contribution is a substantial increase from past levels of climate funding, scaling up to CA$800 million during the fifth year (2020-2021), and represents a doubling of Canada's previous climate investment.

Canada's contribution will be used to support climate change adaptation and mitigation programming, prioritizing the most vulnerable countries, such as small island developing states, Africa and the least developed countries. In fact, Canada announced a new CA$30 million contribution to the Least Developed Countries Fund to address some of their most urgent and immediate needs, and CA$10 million to the World Meteorological Organization to support the improvement of early warning systems in some of the most vulnerable communities.

Canada's climate financing will also ensure that global efforts address development needs in a coherent and mutually supportive manner and that it will also provide innovative tools aimed at removing barriers to and risk from investments from the private sector.

Tables 6-1 to 6-2 present detailed and transparent information on contributions provided by Canada to developing countries and multilateral agencies over the past two years (2013-2014 and 2014-2015). A significant portion of Canada's fast-start financing (2010-2011 to 2012-2013), reported to the UNFCCC in Canada's First Biennial Report (January 2014), established Canadian facilities at multilateral development banks (MDBs) designed to catalyze private sector investments. It is estimated that this Canadian support, alongside co-financing from MDBs, and other public sources have collectively mobilized approximately US$1.44 billion of private climate finance over the same period. Repayable contributions of approximately CA$2.49 million in 2013-2014 and CA$3.96 million in 2014-2015 have been returned to Canada from multilateral agencies. The successful performance of these projects is demonstrating how investing in climate change action in developing economies is becoming more and more viable for the private sector.

EFFECTIVELY ADDRESSING DEVELOPING COUNTRY NEEDS

- Canada's recent support for climate change adaptation focused primarily on the needs of the poorest and most vulnerable countries, with a view to further underpinning the achievement of results related to food security and sustainable economic growth and to supporting the principles of aid effectiveness. A good example of Canada's efforts to support adaptation action is a contribution of

approximately CA$5 million to the Food and Agriculture Organization of the United Nations for strengthening food security in the poorest municipalities in Honduras over fiscal years 2013-2014 and 2014-2015. The project aims to improve the food security of vulnerable households through providing farmers with best practices and improved technologies for integrated soil and water management, and establishing information and early warning systems for natural disasters that could impact farmers at municipal levels.

- Another example is Canada's contribution of CA$2.76 million over two years to the Asian Development Bank for the Integrated Disaster Risk Management project. This project aims to reduce the impact of disasters on vulnerable populations in Southeast Asia by providing support to governments and civil society to manage and reduce disaster risk. Natural hazards impact Asia and the Pacific to a greater extent than any other region. This project is addressing this issue through three main activities: (i) reducing the risks associated with disasters and increasing the resilience of people and communities to disasters; (ii) adapting to climate change, which involves incorporating viable adaptive strategies into existing disaster risk management initiatives; and (iii) developing disaster risk financing, including insurance.

In addition to these actions, Canada provided CA$3.5 million over fiscal years 2013-2014 and 2014-2015 through the Latin American Energy Organization to improve sustainable and affordable energy access in Latin America and the Caribbean. This project is expected to improve planning, management, and regulation of the energy sector by national governments and increase the application of corporate social responsibility best practices in the energy sector by governments and the private sector. With support from Canada's contribution, a workshop on clean energy development and climate change mitigation activities was held in Jamaica and attended by 58 representatives from 12 countries.

Over fiscal years 2013-2014 and 2014-2015 Canada provided CA$10 million to the International Development Research Centre-led Climate Change and Water Program. This program supports research institutions in developing countries to advance knowledge about the water-related impacts of climate change, identify a range of options and strategies for coping with such impacts, and generate evidence that can be used to inform adaptation policy and practice. To date, the program has supported more than 78 projects in 50 countries across Africa, Asia, Latin America and the Caribbean.

TABLE 6-1: PROVISION OF PUBLIC FINANCIAL SUPPORT SUMMARY INFORMATION IN 2013-2014

2013-2014		
Allocation Channel	**Domestic Currency CA$ (millions)**	**US$ (millions)**
Multilateral	178.17	172.96
Bilateral	60.80	59.02
Total	**238.97**	**231.98**

* Based on OECD/DAC exchange rates for fiscal year 2013/2014: 1.0302

TABLE 6-2: PROVISION OF PUBLIC FINANCIAL SUPPORT SUMMARY INFORMATION IN 2014-2015

2014-2015		
Allocation Channel	**Domestic Currency CA$ (millions)**	**US$ (millions)**
Multilateral	161.15	145.87
Bilateral	75.25	67.30
Total	**236.4**	**213.17**

* Based on OECD/DAC exchange rates for fiscal year 2014/2015: 1.1047

CANADA'S 2015 CLIMATE FINANCE ANNOUNCEMENTS

At the Malta Commonwealth Heads of Government meeting, Canada pledged CA$2.65 billion over five years – its largest climate finance contribution to date. This funding will be instrumental in helping developing countries take action to address climate change and respond to its effects. Announcements made during the Paris Climate Conference as part of this pledge include:

- Climate Risk and Early Warning Systems: CA$10 million to support the improvement early warning systems in some of the most vulnerable communities.
- Least Developed Countries Fund: CA$30 million to finance projects to address the urgent and immediate adaptation needs of the poorest and most vulnerable countries.
- G7 Initiative on Climate Risk Insurance: CA$50 million to help people in developing countries protect themselves against the economic consequences of more intense and increasingly frequent natural catastrophes due to climate change.
- G7 African Renewable Energy Initiative: CA$150 million to accelerate the deployment of renewable energy in Africa.
- Short-lived climate pollutants (SLCPs): CA$35 million to combat SLCPs like black carbon and methane, including CA$10 million to the Climate and Clean Air Coalition.

6.2 NATIONAL APPROACH FOR TRACKING FINANCE SUPPORT

Canada uses a results-based management approach to effectively manage its international climate finance. It also tracks and reports on whole-of-government international climate change financing, and works with its international partners to strengthen climate finance reporting through the UNFCCC and other organizations that address the reporting of climate flows, such as the Organization for Economic Cooperation and Development. This includes efforts to develop a robust methodology for tracking private sector climate finance mobilized from public interventions in order to provide transparency towards the goal to jointly mobilize US$100 billion in climate finance from a wide variety of sources by 2020.

Canada has also developed a database tool to help track and support the reporting of all of Canada's climate finance, facilitating the online provision of detailed project-by-project information.[6] This whole-of-government tracking approach and rigorous performance measurement at the program level ensures that Canada's support effectively addresses the needs of developing countries, allows for a better understanding of the concrete results climate finance achieved on the ground, and provides further transparency on how Canada is fulfilling its financing commitments.

Canada monitored the progress and results achieved through its support for a project in Nigeria that aimed at supporting local capacity to reduce poverty in a sustainable way through effective climate change governance. Through this project, a technical report of climate change scenarios and vulnerabilities was produced and seven pilot projects assessing appropriate climate change adaptation measures in 15 communities were implemented. Ultimately, this project supported the adoption of a National Adaptation Strategy and Plan of Action for Climate Change in Nigeria.

6 http://www.climatechange.gc.ca/finance

Canada's provision of financial, technological and capacity-building support to developing countries over the reporting period is new and additional, as it is above what was planned prior to the Copenhagen Accord. Canada responds to needs expressed by developing-country partners, working to mainstream climate change results in programming and development, consistent with a country-driven approach.

6.3 TECHNOLOGY AND CAPACITY BUILDING

Canada is committed to advancing the development and deployment of clean technologies to address the effects of climate change globally and is actively engaged in technology and capacity building activities with developing-country partners through bilateral and multilateral channels. Canada has focused efforts in a number of areas, including forestry and land-use management, clean energy, adaptation, and other cross-cutting sectors.

Canada has demonstrated leadership in developing and making globally available tools to support clean energy deployment, as well as forest sector mitigation and adaptation goals. Examples of such tools include the RETScreen Clean Energy Software and the Carbon Budget Model of the Canadian Forest Sector, which are offered free of charge in multiple languages. Access to these tools is supplemented by considerable resources and training materials, including case studies, presentations, training sessions and workshops. Canada is also a global leader in the research, development and demonstration of carbon capture and storage technologies.

Canada also continues to engage actively in a number of international fora whose mandates and activities focus on the advancement of clean technologies. This includes the Clean Energy Ministerial and its Clean Energy Solutions Center, which provides tools, resources and advice to developing countries. Canada also engages in the Clean Technology Centre and Network through membership on its advisory board and by having a National Designated Entity. Canada has also engaged with the Private Financing Advisory Network, which seeks to connect viable projects with funding. Together, these activities aim to provide developing countries with support for the deployment of clean energy. In addition, Canada cooperates with a number of international partners on science and technology activities.

6.4 PROVINCIAL AND TERRITORIAL ACTIONS

During the Paris Conference, Quebec announced a financial investment of CA$25.5 million to support actions to fight against climate change in francophone countries that are most vulnerable and exposed to the impacts of climate change. This type of financial commitment is a first from a subnational government on the international stage.

ANNEX 1: ECONOMY-WIDE EMISSION REDUCTION TARGET

TABLE A1: BASE YEAR 2020 TARGET

Base year	2005
Emission reduction target (% of base year)	17% below 2005
% of 1990	1.5% above 1990 levels, based on the 2015 emission inventory for historical data
Period for reaching target	2020

TABLE A2: BASE YEAR 2030 TARGET

Base year	2005
Emission reduction target (% of base year)	30% below 2005
% of 1990	14.5% below 1990 levels, based on the 2015 emission inventory for historical data
Period for reaching target	2030

TABLE A3: GASES AND SECTORS COVERED

Gases Covered	**Base Year for Each Gas (year)**
CO_2	2005
CH_4	2005
N_2O	2005
HFCs	2005
PFCs	2005
SF_6	2005
NF_3	2005

IPCC Sectors Covered		**Economic Sectors Covered**	
Energy	Yes	Oil and Gas	Yes
		Electricity	Yes
Transportation	Yes	Transportation	Yes
Industrial Processes	Yes	Emissions-Intensive & Trade-Exposed Industries	Yes
		Buildings	Yes
Agriculture	Yes	Agriculture	Yes
Waste	Yes	Waste and Others	Yes
LULUCF*		LULUCF*	

* LULUCF = Land Use, Land-use Change and Forestry. Canada will account for a LULUCF contribution and has indicated that its accounting for managed forests will exclude the impacts of natural disturbances (such as fires and insect infestations) because these impacts are non-anthropogenic. Work is underway to develop LULUCF estimates that focus on anthropogenic emissions and removals as a basis for improved reporting and accounting for LULUCF.

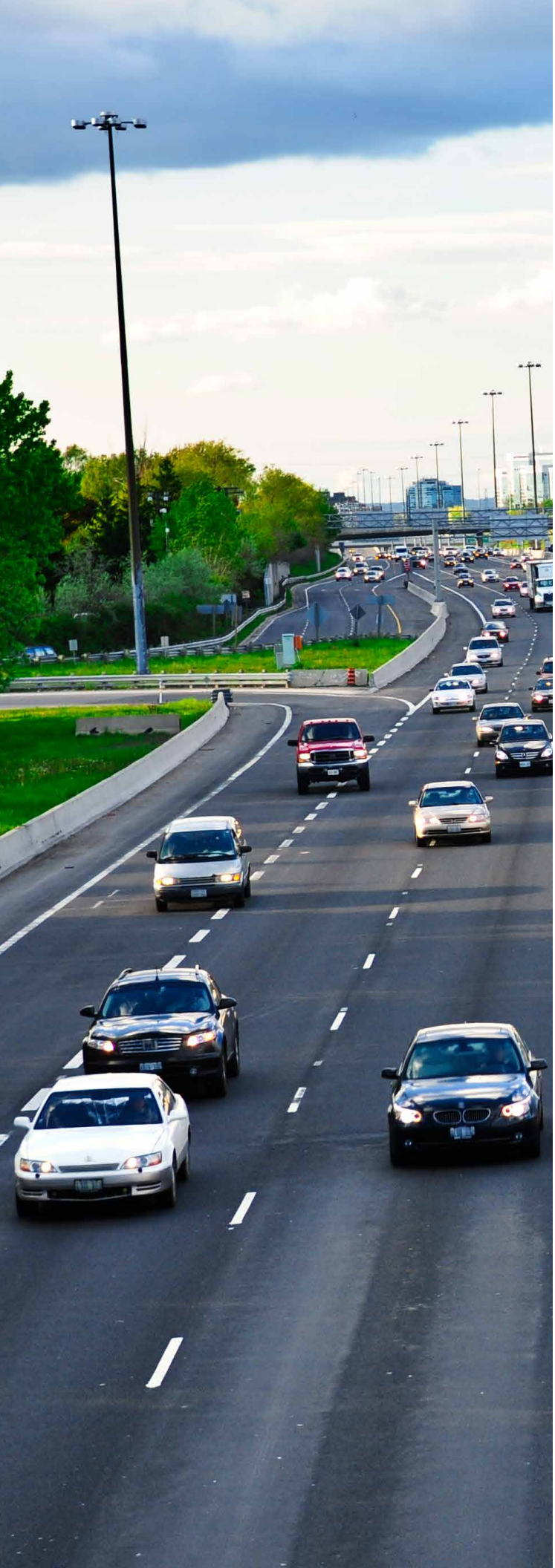


TABLE A4: DESCRIPTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: GLOBAL WARMING POTENTIAL VALUES (GWP)

Gases	**GWP Values**
CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	As per the Intergovernmental Panel on Climate Change's Fourth Assessment Report

MARKET MECHANISMS

Canada may consider using international mechanisms to meet its emission reduction targets. No decisions have been taken on potential approaches at this time. Within the context of negotiations to elaborate the climate change regime, Canada will continue to work with other countries to explore the best options for the use of international mechanisms.

ANNEX 2: SUPPLEMENTARY INFORMATION FOR CANADA'S PROGRESS IN ACHIEVEMENT OF ITS QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

A) MITIGATION ACTIONS BY GAS

Canada's mitigation policies and measures are addressing GHG emissions across all economic sectors. Cross-cutting initiatives, such as current and planned carbon pricing systems, address a number of gases noted in this section.

CARBON DIOXIDE EMISSIONS

Carbon dioxide represents the majority (nearly 80%) of Canada's GHG emissions. As carbon dioxide largely results from the combustion of fossil fuels, a wide variety of activities contribute to carbon dioxide emissions, including the production of energy for building heating and cooling, transportation, manufacturing of cement, and other industrial processes.

Policies and measures across several economic sectors are addressing carbon dioxide emissions. For example, in the electricity sector, more than three quarters of the electricity supply in Canada is already generated by non-GHG-emitting sources of power, and electricity-related emissions have declined since 1990 due to a return to service of a number of nuclear units, fuel switching to natural gas, as well as the closure of a number of coal-fired electricity generation facilities. Specific policies and measures targeting carbon dioxide from the electricity sector include: federal coal-fired power regulations, Ontario's phase-out of coal, as well as renewable portfolio standards and other measures to enhance renewables in several provinces.

Key policies and measures in place to address transportation-related carbon dioxide emissions include federal vehicle fuel efficiency regulations—the *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* and the *Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations*—as well as federal Renewable Fuels Regulations. Provinces and territories are taking a variety of actions that address carbon dioxide emissions, including measures to enhance renewable fuel content of gasoline and diesel, vehicle electrification initiatives, as well as public transit planning.

Several other key policies and measures are influencing carbon dioxide emissions in Canada, including in the building and oil and gas sectors.

METHANE

Methane accounted for 15% of Canada's total emissions in 2013, largely from fugitive emissions from oil and natural gas systems, as well as domestic livestock and landfills from the agriculture and waste sectors. Measures in place to address these emissions include

provincial measures to address flaring from oil and gas development, as well as a variety of policies targeting methane emissions from waste.

Methane emissions generated by municipal solid waste landfills increased by 35% in 2013; however, the amount of methane captured increased by 144% in the same year. The number of landfill sites with capture systems is rapidly rising in Canada, with 81 such systems operating in 2013. Many Canadian provinces, territories and municipalities have implemented regulations requiring landfill gas capture, regulations aimed at diverting waste away from landfills, and programs to support improved waste management practices that will reduce methane emissions from the waste sector.

In addition, many oil and gas producing provinces have also implemented measures that help to reduce methane emissions. For example, Alberta has successfully reduced flaring and venting, and associated emissions of methane and black carbon, by combining regulations with financial incentives. Saskatchewan and Manitoba are implementing regulations that generally align with those of Alberta, while in British Columbia, a multipronged approach applies to venting and flaring emissions.

For more information on Canada's methane emissions, please see Canada's National Black Carbon and Methane Report 2015 to the Arctic Council.[7]

NITROUS OXIDE EMISSIONS

Nitrous oxide emissions from activities such as agriculture soil management and transport accounted for 6% of Canada's GHG emissions in 2013. Key policies affecting nitrous oxide emissions in Canada include federal vehicle emission standard regulations, Canada's Action Plan to Reduce GHG Emissions from Aviation, as well as efforts to address emissions from locomotives and marine vessels.

PERFLUOROCARBONS, SULPHUR HEXAFLUORIDE, HYDROFLUOROCARBONS, AND NITROGEN TRIFLUORIDE

In 2013, perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and nitrogen trifluoride (NF_3) accounted for slightly more than 1% of Canada's GHG emissions. However, emissions from HFCs are the fastest-growing GHGs globally; in Canada, the consumption of HFCs accounts for a 5.4 Mt CO_2e (450%) increase in emissions since 1995.

Canada, the United States, and Mexico have proposed a global phase-down of HFCs under the Montreal Protocol, which proposes that HFCs be replaced by available lower-emitting alternatives. In addition, measures at the provincial level are affecting emissions of these gases. For example, British Columbia's Carbon Tax affects emissions of HFCs, PFCs and SF_6; Quebec's cap-and-trade system affects emissions of all GHGs; and Quebec has established regulations to lower emissions of halocarbons, including HFCs and PFCs.

B) ECONOMIC AND SOCIAL CONSEQUENCES OF MEASURES TAKEN TO ADDRESS CLIMATE CHANGE

Canada's *Cabinet Directive on Streamlining Regulation* sets out guidance on the federal regulatory process and applies to all federal departments and agencies. The Directive requires all federal regulatory authorities to conduct detailed analysis through a Regulatory Impact Analysis Statement, which provides information on the issue being regulated, the reason for its regulation, the government's objectives, any costs and benefits associated with the regulation, who will be affected, who was consulted in developing the regulation, and how the government will evaluate and measure the implementation of the regulation. The Regulatory Impact Analysis Statement is published in the Canada Gazette as part of the public consultation on proposed regulations and considers international impacts of the regulation, where applicable.

7 Canada's National Black Carbon and Methane Report (2015) http://www.arctic-council.org/index.php/en/expert-groups/339-egbcm

In addition, for federal policy, planning and program proposals, departments and agencies are required to conduct a Strategic Environmental Assessment to examine any potential environmental effects. Strategic Environmental Assessments consider the scope and nature of the likely environmental effects, the need for mitigation to reduce or eliminate adverse effects, and the likely importance of any adverse environmental effects, taking mitigation into account.

Canada is taking steps to assist developing countries with the transition to low-carbon, climate resilient economies, which is a central means to maximize the effect of actions taken to address climate change. Information on Canada's efforts to assist developing countries to reduce their emissions and adapt to climate change can be found in Section 6 of this report.

ANNEX 3: SUPPLEMENTARY INFORMATION FOR PROJECTIONS

EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

This section describes projected emissions by economic sector and subsector for the current measures reference scenario, which takes into account existing actions, policies and measures. In order to be included in the "with current measures" scenario, actions must be concrete or legislated, financially backed and specific enough to add to the modelling platform as of September 2015 (the policies and measures modelled for the reference scenario are listed in Table A31). The projections do not reflect the impact of additional federal, provincial or territorial measures that were announced since September 2015 or that are under development.

The following tables summarize total GHG projections by sector and by gas and illustrate how the projected trends in GHG emissions vary by economic sector. Between 2005 and 2013, GHG emissions dropped 23 Mt to 726 Mt. The decline in emissions was primarily due to lower emissions in the Electricity and Emissions-Intensive and Trade-Exposed (EITE) sectors. Emission declines in these sectors were offset by a 22 Mt increase in the Oil and Gas sector over the same time period. Without additional measures, continued strong emissions growth in the Oil and Gas sector is anticipated to further drive emissions to 768 Mt in 2020 and 815 Mt in 2030. Reductions in electricity-related emissions are projected to continue to partially offset growth in Oil and Gas, EITE and Buildings emissions.

TABLE A5: CHANGE IN GHG EMISSIONS BY ECONOMIC SECTOR (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Oil and Gas	157	179	210	242	54	85
Electricity	121	85	74	58	-48	-64
Transportation	169	170	169	164	0	-5
EITE	89	76	90	107	1	18
Buildings	87	86	96	109	9	21
Agriculture	71	75	74	76	3	5
Waste and Others	54	54	54	59	0	5
Total	**749**	**726**	**768**	**815**	**18**	**66**

Note: Numbers may not sum to the total due to rounding.

DETAILED ECONOMIC SECTOR TABLES

OIL AND GAS

TABLE A6: OIL AND GAS SECTOR: EMISSIONS BY PRODUCTION TYPE (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Natural Gas Production and Processing	58	54	55	60	-3	1
Conventional Oil Production	31	33	32	32	1	1
Light Oil Production	12	15	16	18	4	5
Heavy Oil Production	17	16	14	13	-3	-4
Frontier Oil Production	2	2	3	2	1	0
Oil Sands	32	62	90	116	58	84
Bitumen In Situ	10	27	45	67	35	57
Bitumen Mining	10	16	24	26	14	16
Bitumen Upgrading	13	18	22	23	9	10
Oil and Natural Gas Transmission	12	8	9	10	-3	-2
Downstream Oil and Gas	23	23	22	20	-2	-3
Petroleum Products	22	22	21	19	-2	-3
Natural Gas Distribution	1	1	1	2	0	0
Liquid Natural Gas Production	0	0	1	4	1	4
Total	**157**	**179**	**210**	**242**	**54**	**85**

Note: Numbers may not sum to the total due to rounding.

TABLE A7: SELECTED UPSTREAM OIL AND NATURAL GAS SUBSECTORS: EMISSIONS AND DRIVERS

	2005	2013	2020	2030
Conventional Oil Production				
Emissions (Mt CO_2 eq)	31	33	32	32
Production (1,000 barrels/day)	1,362	1,379	1,368	1,302
Natural Gas Production and Processing				
Emissions (Mt CO_2 eq)	58	54	55	60
Gross Production (billion cubic feet)	7,748	6,449	6,826	7,442
Oil Sands				
Emissions (Mt CO_2 eq)	32	62	90	116
Production (1,000 barrels/day)	1,066	2,086	3,306	4,258

TABLE A8: PETROLEUM REFINING: EMISSIONS AND DRIVERS

	2005	2013	2020	2030
Traditional Refineries				
Emissions (Mt CO_2 eq)	22	22	21	19
Refined Petroleum Processed (1,000 barrels/day)	2,095	1,975	1,966	2,058

ELECTRICITY GENERATION[8]

TABLE A9: ELECTRICITY GENERATION: EMISSIONS BY FUEL TYPE (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Coal	97	64	52	24	-45	-73
Refined Petroleum Products	11	4	3	3	-9	-9
Natural Gas	12	16	18	30	6	18
Biomass	<1	<1	<1	<1	0	0
Total	**121**	**85**	**74**	**58**	**-48**	**-64**

Note: Numbers may not sum to the total due to rounding.

TABLE A10: ELECTRICITY SECTOR: EMISSIONS AND DRIVERS

	2005	2013	2020	2030
Emissions (Mt CO_2 eq)	121	85	74	58
Generation (Terawatt Hours)	553	556	588	638

TRANSPORTATION

TABLE A11: TRANSPORTATION: EMISSIONS (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Passenger Transport	**98**	**97**	**90**	**74**	**-7**	**-23**
Cars, Trucks and Motorcycles	88	88	80	64	-8	-24
Bus, Rail and Domestic Aviation	9	10	10	10	1	1
Freight Transport	**57**	**62**	**67**	**75**	**9**	**18**
Heavy Duty Trucks, Rail	50	56	59	66	9	17
Domestic Aviation and Marine	8	6	8	9	0	1
Other: Recreational, Commercial and Residential	**14**	**11**	**13**	**15**	**-2**	**0**
Total	**169**	**170**	**169**	**164**	**0**	**-5**

Note: Numbers may not sum to the total due to rounding.

8 Electricity Generation is defined as power generation from facilities whose primary purpose is to sell electricity to the grid.

EMISSIONS-INTENSIVE AND TRADE-EXPOSED INDUSTRIES[9]

TABLE A12: EMISSIONS-INTENSIVE AND TRADE-EXPOSED INDUSTRIES: EMISSIONS BY SUBSECTOR (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Mining	6	7	9	10	3	5
Smelting and Refining (non-ferrous metals)	14	11	13	17	-1	3
Pulp and Paper	9	7	8	9	-1	0
Iron and Steel	20	14	15	19	-5	-1
Cement	13	10	11	12	-2	-1
Lime and Gypsum	3	2	3	3	-1	-1
Chemicals and Fertilizers	24	25	31	36	7	13
Total	**89**	**76**	**90**	**107**	**1**	**18**

Note: Numbers may not sum to the total due to rounding.

BUILDINGS

TABLE A13: BUILDINGS: EMISSIONS (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Residential	48	46	47	51	0	3
Commercial	40	40	49	58	9	18
Total	**87**	**86**	**96**	**109**	**9**	**21**

Note: Numbers may not sum to the total due to rounding.

TABLE A14: BUILDINGS: DRIVERS (MILLION HOUSEHOLDS AND MILLION M^2 FLOORSPACE)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Residential (households)	12	14	15	17	3	5
Commercial (floorspace)	654	747	843	972	189	318

9 Environment and Climate Change Canada defines the EITE sector to include non-oil-and-gas mining and manufacturing industries that have a relatively high GHG emissions intensity, and a high degree of international trade exposure. The EITE sector includes metal and non-metal mining activities, smelting and refining, and the production and processing of industrial goods, such as chemicals, fertilizers, aluminum, pulp and paper, iron and steel, and cement.

AGRICULTURE

TABLE A15: AGRICULTURE SECTOR: EMISSIONS (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
On-farm Fuel Use	10	15	15	15	5	5
Crop Production	16	24	21	22	5	6
Animal Production	45	37	38	39	-7	-6
Total	**71**	**75**	**74**	**76**	**3**	**5**

Note: Numbers may not sum to the total due to rounding.

WASTE AND OTHERS[10]

TABLE A16: WASTE AND OTHERS: EMISSIONS (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Waste	28	25	21	20	-7	-8
Coal Production	3	5	4	3	1	1
Light Manufacturing, Construction and Forest Resources	23	24	29	35	6	12
Total	**54**	**54**	**54**	**59**	**0**	**5**

Note: Numbers may not sum to the total due to rounding.

DETAILED EMISSIONS BY GAS AND BY ECONOMIC SECTOR

TABLE A17: CO_2 EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

	Historical						Projected	
Sector	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	70,000	83,000	102,000	109,000	117,000	132,000	163,000	192,000
Electricity	94,000	98,000	129,000	120,000	98,000	84,000	73,000	57,000
Transportation	124,000	131,000	147,000	160,000	161,000	164,000	160,000	152,000
EITE	71,000	75,000	81,000	79,000	71,000	72,000	85,000	101,000
Buildings	68,000	73,000	78,000	78,000	72,000	76,000	81,000	89,000
Agriculture	8,000	10,000	11,000	10,000	14,000	16,000	16,000	16,000
Waste & Others	27,000	25,000	24,000	24,000	24,000	26,000	30,000	36,000
Total	**463,000**	**494,000**	**572,000**	**580,000**	**556,000**	**570,000**	**608,000**	**643,000**

Note: Numbers may not sum to the total due to rounding.

10 The Waste and Others sector comprises a number of diverse subsectors, including waste and other non-emissions-intensive industrial subsectors such as light manufacturing, construction and forestry.

TABLE A18: CH_4 EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	36,000	49,000	55,000	47,000	42,000	46,000	46,000	47,000
Electricity	0	0	0	0	0	0	0	0
Transportation	1,000	1,000	1,000	1,000	0	0	0	0
EITE	0	0	0	0	0	0	0	0
Buildings	7,000	6,000	6,000	5,000	5,000	5,000	5,000	5,000
Agriculture	27,000	31,000	33,000	36,000	30,000	29,000	30,000	31,000
Waste & Others	26,000	26,000	27,000	28,000	27,000	26,000	21,000	20,000
Total	**96,000**	**114,000**	**121,000**	**117,000**	**104,000**	**107,000**	**103,000**	**104,000**

Note: Numbers may not sum to the total due to rounding.

TABLE A19: N_2O EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	0	1,000	1,000	1,000	1,000	1,000	2000	2000
Electricity	1,000	1,000	1,000	1,000	1,000	1,000	0	0
Transportation	5,000	6,000	8,000	7,000	5,000	4,000	4,000	4,000
EITE	12,000	12,000	3,000	4,000	2,000	2,000	2,000	3,000
Buildings	1,000	1,000	2,000	1,000	1,000	1,000	1,000	1,000
Agriculture	22,000	24,000	25,000	25,000	27,000	30,000	28,000	29,000
Waste & Others	1,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000
Total	**42,000**	**46,000**	**40,000**	**41,000**	**38,000**	**41,000**	**40,000**	**42,000**

Note: Numbers may not sum to the total due to rounding.

TABLE A20: HFC EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	0	0	0	0	0	0	0	0
Electricity	0	0	0	0	0	0	0	0
Transportation	0	600	1,900	2,200	2,200	2,200	5,000	7,700
EITE	1,000	0	0	0	0	0	0	0
Buildings	0	300	1,700	2,900	3,400	3,900	8,800	13,500
Agriculture	0	0	0	0	0	0	0	0
Waste & Others	0	0	0	100	200	300	700	1,000
Total	**1,000**	**1,000**	**3,600**	**5,300**	**5,700**	**6,400**	**14,400**	**22,200**

Note: Numbers may not sum to the total due to rounding.

TABLE A21: PFC EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	0	0	0	0	0	0	0	0
Electricity	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0
EITE	7,600	6,300	4,900	3,800	1,800	1,600	1,800	2,400
Buildings	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Waste & Others	0	0	0	0	0	0	0	0
Total	**7,600**	**6,300**	**5,000**	**3,800**	**1,900**	**1,600**	**1,800**	**2,400**

Note: Numbers may not sum to the total due to rounding.

TABLE A22: SF_6 EMISSIONS PROJECTIONS BY ECONOMIC SECTOR

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Oil and Gas	0	0	0	0	0	0	0	0
Electricity	200	200	200	200	200	100	100	100
Transportation	0	0	0	0	0	0	0	0
EITE	3,000	2,100	2,700	1,200	200	300	200	200
Buildings	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Waste & Others	0	0	0	0	0	0	0	0
Total	**3,200**	**2,300**	**2,900**	**1,400**	**400**	**400**	**300**	**300**

Note: Numbers may not sum to the total due to rounding.

The table below presents the historical and projected emissions from foreign passenger and foreign freight (both aviation and marine). These emissions are not included in the current measures reference scenario.

TABLE A23: TOTAL GHGS FROM FOREIGN PASSENGER AND FREIGHT (AVIATION AND MARINE)

Sector	Historical						Projected	
	1990 (kt CO_2 eq)	1995 (kt CO_2 eq)	2000 (kt CO_2 eq)	2005 (kt CO_2 eq)	2010 (kt CO_2 eq)	2013 (kt CO_2 eq)	2020 (kt CO_2 eq)	2030 (kt CO_2 eq)
Foreign Passenger	5,000	5,000	8,000	8,000	8,000	10,000	10,000	11,000
Foreign Freight	4,000	5,000	5,000	5,000	4,000	3,000	3,000	4,000

EMISSIONS PROJECTIONS BY PROVINCE AND TERRITORY

Emissions vary significantly by province and territory, driven by diversity in population size, economic activities and resource base, among other factors. For example, provinces where the economy is oriented more toward resource extraction will tend to have higher emission levels whereas more manufacturing or service-based economies tend to have lower emissions levels. Electricity generation sources also vary, with provinces that rely on fossil fuels for their electricity generation having higher emissions than provinces that rely more on hydroelectricity. The tables below show the provincial/territorial distribution of emissions and per capita emissions.

TABLE A24: PROVINCIAL AND TERRITORIAL GHG EMISSIONS: 2005 TO 2030 (MT CO_2 EQ)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Newfoundland and Labrador	10	9	9	8	-1	-3
Prince Edward Island	2	2	2	2	0	0
Nova Scotia	24	18	15	14	-9	-10
New Brunswick	21	16	17	16	-4	-4
Quebec	90	83	85	90	-6	0
Ontario	211	171	171	181	-40	-30
Manitoba	21	21	22	24	1	3
Saskatchewan	70	75	75	73	6	4
Alberta	234	267	297	320	63	86
British Columbia	64	63	72	83	7	18
Yukon Territory	0	0	1	1	0	0
Northwest Territory	2	1	2	2	0	0
Nunavut	0	0	0	0	0	0
Canada	749	726	768	815	18	66

Note: Numbers may not sum to the total due to rounding.

TABLE A25: PROVINCIAL AND TERRITORIAL PER CAPITA GHG EMISSIONS: 2005 TO 2030 (T/CAPITA)

	2005	2013	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Newfoundland and Labrador	20.1	16.4	17.7	15.0	-2.4	-5.1
Prince Edward Island	15.3	12.3	12.1	11.4	-3.2	-3.9
Nova Scotia	25.5	19.4	16.2	14.8	-9.3	-10.7
New Brunswick	27.5	20.8	22.4	22.2	-5.0	-5.3
Quebec	11.9	10.1	9.9	9.9	-2.0	-2.0
Ontario	16.8	12.6	11.8	11.5	-5.1	-5.4
Manitoba	17.5	16.9	15.9	15.2	-1.7	-2.3
Saskatchewan	70.0	67.6	63.7	57.6	-6.3	-12.3
Alberta	70.4	66.7	64.1	57.9	-6.3	-12.5
British Columbia	15.4	13.7	14.5	15.3	-0.8	-0.1
Yukon Territory	14.6	9.8	15.4	17.7	0.8	3.1
Northwest Territory	38.2	33.2	41.5	47.3	3.3	9.1
Nunavut	11.4	6.2	8.7	9.4	-2.7	-2.0
Canada	**23.2**	**20.7**	**20.3**	**19.8**	**-2.9**	**-3.5**

Note: Numbers may not sum to the total due to rounding.

KEY ASSUMPTIONS

GHG emissions projections depend on a number of economic and energy variables and are subject to significant uncertainty, especially in the longer term. The emissions projections "with current measures" scenario is designed to incorporate the best available information about economic growth as well as energy demand and supply into the future. The projections capture the impacts of future production of goods and services in Canada on GHG emissions.

Historical data on GDP and disposable personal income are provided by Statistics Canada, including their *Report on Energy Supply and Demand in Canada*. Consumer price index and population demographics are also produced by Statistics Canada, while historical GHG emissions data are provided by the 2015 NIR.

The modelling framework is updated annually using the most recent data available from Statistics Canada's *Report on Energy Supply and Demand in Canada*. The economic projections to the year 2019 are calibrated to Finance Canada's March 2015 Private Sector Survey. The outer years (2019-2030) are based on Finance Canada's longer-term fiscal projections included in their "Update of Economic and Fiscal Projections–2014."

Forecasts of major energy supply projects and price forecasts from the National Energy Board's biennial *Canada's Energy Future* report were incorporated for key variables and assumptions in the model (e.g., oil sands production, large hydro capacity expansions). The National Energy Board is an independent federal agency that regulates international and interprovincial aspects of the oil, gas and electric utility industries.

TABLE A26: MACROECONOMIC ASSUMPTIONS, 2005-2030 AVERAGE ANNUAL GROWTH RATES

Assumption	**2005-2013**	**2013-2020**	**2020-2030**
Average Annual GDP Growth Rate	1.5%	2.2%	1.6%
Average Annual Population Growth Rate	1.1%	1.0%	0.9%
Average Annual Labour Force Growth Rate	1.2%	0.6%	0.5%

Oil and gas production assumptions for the Reference scenario are noted in the tables below. Oil and natural gas price and production forecasts were provided by the National Energy Board. The National Energy Board presents its most recent forecast in *Canada's Energy Future 2016 – Energy Supply and Demand Projections to 2040*.

TABLE A27: CRUDE OIL PRODUCTION IN THOUSANDS OF BARRELS PER DAY

	2005	2013	2020	2030
Crude and Condensates	**1,534**	**1,534**	**1,598**	**1,565**
Conventional Heavy	557	490	451	415
Conventional Light	481	649	624	687
C5 and Condensates	173	155	230	263
Frontier Light (offshore + northern)	324	240	293	200
Oil Sands	**1,066**	**2,086**	**3,306**	**4,258**
Oil Sands: Primary	151	274	345	397
Oil Sands: In Situ	288	835	1,487	2,278
Steam-assisted Gravity Drainage	*83*	*581*	*1,116*	*1,810*
Cyclic Steam Stimulation	*205*	*254*	*370*	*468*
Oil Sands Mining	627	977	1,475	1,583
Total Production (gross)	**2,600**	**3,620**	**4,904**	**5,823**

Note: Numbers may not sum to the total due to rounding.

TABLE A28: OIL SANDS DISPOSITION IN THOUSANDS OF BARRELS PER DAY

	2005	2013	2020	2030
Oil Sands (gross)	**1,066**	**2,086**	**3,306**	**4,258**
Oil Sands (net)	983	1,973	3,158	4,102
Synthetic	611	1,003	1,242	1,278
Non-upgraded Bitumen	371	970	1,916	2,824
Own Use	83	112	148	156

Note: Numbers may not sum to the total due to rounding.

TABLE A29: NATURAL GAS PRODUCTION AND SUPPLY IN BILLION CUBIC FEET

	2005	2013	2020	2030
Natural Gas Supply	**6,595**	**6,058**	**7,411**	**8,560**
Marketable Gas	6,263	5,115	5,850	6,430
Gross Production	*7,748*	*6,449*	*6,827*	*7,442*
Own-use Consumption	*1,485*	*1,334*	*976*	*1,013*
Imports	332	943	1,561	2,130
Liquid Natural Gas Production	**0**	**0**	**365**	**912**

Note: Numbers may not sum to the total due to rounding.

TABLE A30: UTILITY ELECTRICITY GENERATION BY FUEL, TERAWATT-HOURS

	2005	2013	2020	2030
Coal and Petroleum Coke	98	67	56	30
Hydro	327	357	383	435
Natural Gas	25	33	39	68
Nuclear	87	82	82	75
Other Renewables	4	14	27	29
Refined Petroleum Products	12	3	1	1
Total Generation	**553**	**556**	**588**	**638**

Note: Numbers may not sum to the total due to rounding.

FEDERAL, PROVINCIAL AND TERRITORIAL MEASURES

Table A31 identifies the major federal, provincial and territorial measures that are included when modelling the reference case. This includes federal measures that have been implemented or announced in detail as of September 2015. Where program funding is set to end, the projections assume that the impacts of these programs, other than those embodied in consumer behaviour, cease when the approved funding terminates.

The analysis also includes existing provincial and territorial measures. Environment and Climate Change Canada involves provinces and territories in extensive consultations to ensure that their initiatives are accounted for in analysis and modelling of emissions projections. For the purposes of this report, provincial/territorial measures announced and fully implemented as of September 2015 have been included in the reference case wherever possible.

The reference case 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 projections as their details become finalized.

In addition, modelling of the reference case does not take full account of the emission reductions from programs that are directly financed by revenues of provincial carbon pricing initiatives, primarily because sufficiently detailed information is not always available. This would include some of Quebec's measures that are funded by revenues of their cap-and-trade program under the Western Climate Initiative. In addition, the reference case does not include purchases of international emission credits.

Economic modelling only accounts for measures that have been fully funded, legislated or where sufficiently detailed data exists that make it possible to add to the modelling platform. In addition, due to the interactive effects between federal and provincial/territorial measures, it is not possible to accurately split aggregate emissions reductions into federal, provincial or territorial measures.

Canadian provinces and territories have committed to taking action on climate change through various programs and regulations. Environment and Climate Change Canada's emissions reduction modelling does not take these generalized targets into consideration in the emissions projections modelling within this report. Instead, individual policies that are brought forward as methods to attain the provincial targets may be included in the modelling platform if they meet the criteria discussed above.

TABLE A31: GHG MEASURES REFLECTED IN PROJECTIONS (IN PLACE AS OF SEPTEMBER 2015)

Provincial/Territorial Measures	
Alberta	• *Specified Gas Emitters Regulation* (includes the revisions announced in June 2015), including carbon offset and technology investment systems • Alberta's renewable fuels standard • Alberta's microgeneration regulation • Alberta's bioproducer and public transit programs • Quest carbon capture and storage project • Alberta Carbon Trunk Line Project – CO_2 capture and use for enhanced oil recovery
British Columbia	• BC carbon tax • BC renewable and low carbon fuel requirements regulation • BC emissions offsets regulation • Landfill gas management regulation
Manitoba	• Manitoba's ethanol sales mandate • Manitoba's biodiesel mandate • Manitoba emissions tax on coal
New Brunswick	• New Brunswick's renewable portfolio standard
Newfoundland and Labrador	• Muskrat Falls hydro project
Nova Scotia	• Renewable portfolio standard for electricity generation • Electricity demand-side management policies • Solid Waste-Resource Management Regulations • Cap on GHG emissions from the electricity sector
Ontario	• Ontario residential electricity peak savings (time-of-use pricing) • Ontario feed-in tariff program • Landfill gas regulation (O. Reg. 216/08 and 217/08) • Ontario coal phase-out • Independent Electricity System Operator contracted electricity supply • Ontario's ethanol in gasoline rules • Ontario's greener diesel mandate • Ontario's nuclear refurbishment
Quebec	• Quebec cap-and-trade system for GHG emission allowances (includes reductions occurring in Quebec only) • Quebec's 5% ethanol objective in gasoline distributors fuel sales • Quebec's drive electric program • Landfill gas regulation
Saskatchewan	• Saskatchewan ethanol fuel program • Saskatchewan renewable diesel program • Boundary Dam Carbon Capture Project

Federal Measures
• Reduction of carbon dioxide emissions from coal-fired generation of electricity regulations
• Residential building code changes to incorporate energy efficiency for adoption by provinces across Canada
• Commercial building code changes to incorporate energy efficiency for adoption by provinces across Canada
• *Renewable Fuels Regulations*
• Commercial appliance efficiency improvements (excludes lighting)
• Residential appliance efficiency improvements, includes refrigeration, freezers, ranges and dryers
• New housing and retrofit efficiency improvements
• Facilitation of industry adoption of an energy management standard, acceleration of energy-saving investments, and exchange of best practices information within Canada's industrial sector
• Light-duty vehicles 1 (LDV-1) GHG emissions standards for the light-duty vehicle model years 2011 to 2016
• Light-duty vehicles 2 (LDV-2) GHG emissions standards increases stringency for model years 2017 to 2025
• Heavy-duty vehicles (HDV) GHG emissions standards for heavy-duty vehicle model years 2014 to 2018
• The pulp and paper green transformation program, to improve environmental performance of mills including GHG emissions reductions; the program ended in 2012 but will result in ongoing emission reductions
• Incandescent lighting phase-out

ALTERNATE EMISSIONS SCENARIOS

Given the uncertainty regarding the key drivers of GHG emissions, the scenario presented in the previous section should be seen as one estimate within a set of possible emissions outcomes in the projection period, as events that will shape emissions and energy markets cannot be fully anticipated. In addition, future developments in technologies, demographics and resources cannot be foreseen with certainty. The variation in these complex economic and energy variables implies that modelling results are most appropriately viewed as a range of plausible outcomes. Environment and Climate Change Canada addresses this uncertainty via modelling and analysis of alternate cases that focus on variability in two key factors: future economic growth projections and the evolution of oil and natural gas prices and production as per the National Energy Board's high and low scenarios. These assumptions are presented in Tables A32 and A33, and the overall range of emissions is presented in Table A34.

FIGURE A1: PROJECTED GHG EMISSIONS UNDER ALTERNATE ECONOMIC ASSUMPTIONS

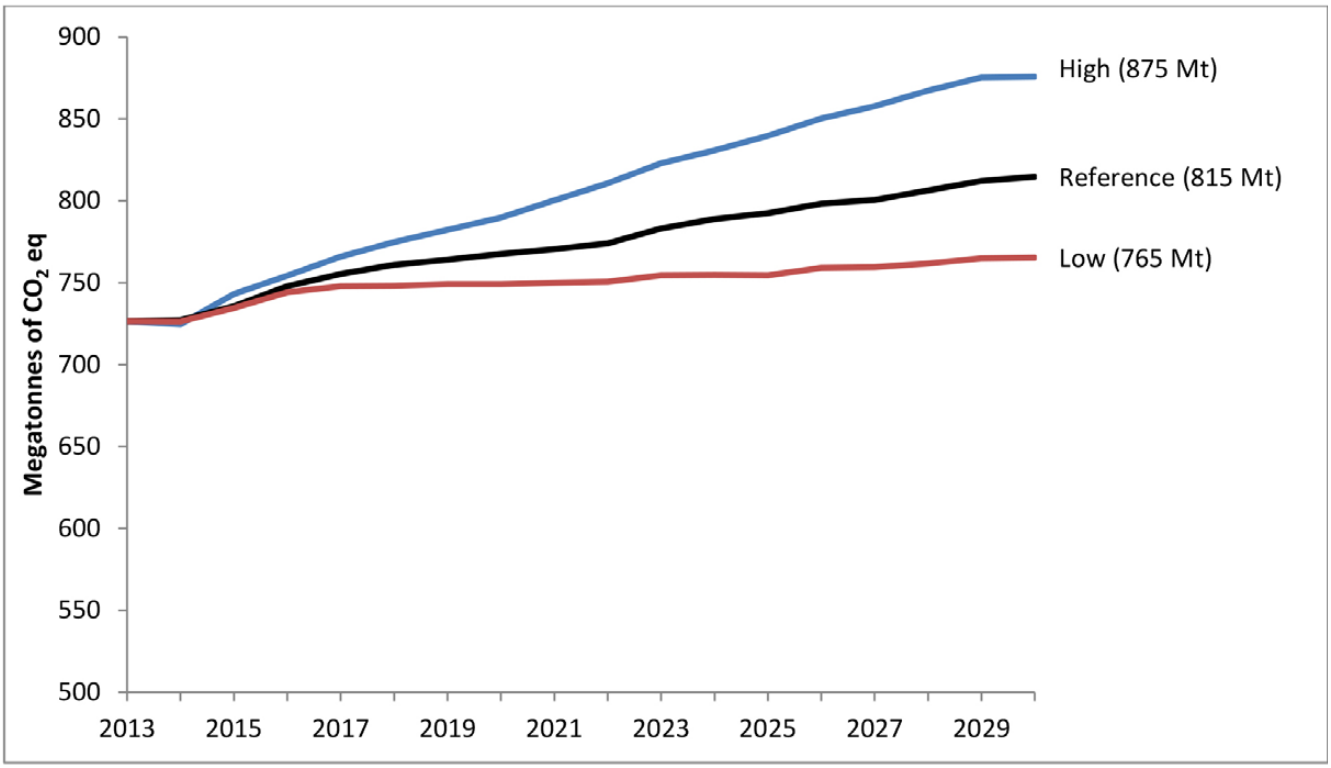


TABLE A32: ECONOMIC GROWTH AND POPULATION FROM 2013 TO 2030

Assumption	2013 to 2020			2020 to 2030		
	Low	Reference	High	Low	Reference	High
Average Annual GDP Growth Rate	1.5%	2.2%	3.0%	0.8%	1.6%	1.9%
Average Annual Population Growth Rate	0.7%	1.0%	1.3%	0.5%	0.9%	1.2%

TABLE A33: OIL AND GAS PRICE AND PRODUCTION IN 2020 AND 2030

Assumption	2020			2030		
	Low	Reference	High	Low	Reference	High
Crude Oil Price: WTI (2013 US$/bbl)	52	75	97	66	90	114
Crude Oil Price: WCS (2013 US$/bbl)	42	62	79	54	74	94
Crude Oil Production (1,000 bbl/day)*	4,490	4,673	4,883	4,602	5,560	6,250
Natural Gas Price: Henry Hub (2013 US$/GJ)	2.79	3.53	4.15	3.10	3.89	4.85
Natural Gas Production (billion cubic feet)	6,580	6,827	7,622	6,960	7,442	9,539

* Numbers are not including C5 and condensates.

TABLE A34: SENSITIVITY OF GHG EMISSIONS TO CHANGES IN GDP AND PRICE (EXCLUDING LULUCF) IN MT CO_2 EQ

	2020	2030	Change 2005 to 2020	Change 2005 to 2030
Slow GDP, Low World Oil and Gas Prices	749	765	0	16
Fast GDP, High World Oil and Gas Prices	790	875	41	126
Reference Scenario	768	815	19	66
Sensitivity Range	**749 to 790**	**765 to 875**	**0 to 41**	**16 to 126**

METHODOLOGY AND MODELLING ASSUMPTIONS

The approach to developing Canada's GHG emissions projections is in line with generally recognized best practices and involves two main features:

1. 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; and

1. Developing scenarios of emission projections using a detailed, proven Energy, Emissions and Economy Model for Canada (E3MC). E3MC has two components: Energy 2020, which incorporates Canada's energy supply and demand structure, and the in-house macroeconomic model of the Canadian economy. For more information on the models and methodology, please see *Canada's Emissions Trends 2014*.

Modelling estimates are subject to consultations with various stakeholders, including provincial and territorial governments, to review modelling assumptions, implemented policies and measures and emission estimates. Modelling assumptions also undergo a periodic external review process.

In addition to annual data updates, improvements to the E3MC modelling methodology are periodically undertaken to provide better estimates of energy and emissions. Some key improvements since the First Biennial Report are the following:

- The economic driver for hydrofluorocarbon (HFC) projections was changed from population to GDP. In addition, HFC emission factors were revised to account for differing leakage rates throughout the lifecycle of equipment. Changes resulted in a halving of the average annual HFC emission factor for air conditioning and refrigeration.

- Historical passenger and freight efficiency variables used for projections were revised.

- Energy inputs for liquefied natural gas (LNG) production were revised downward and relative quantities of natural gas and electricity were adjusted. An exogenous forecast for cogeneration and fugitive emissions from LNG production was also added.

- The growth rate of oil sands cogeneration was increased in the forecast.

- Historical supply and demand of electricity was balanced prior to model input.

- Missing historical electric generation from solar, wind, landfill gas and industrial hydroelectricity was added.

- Some utility-owned electric generation units in manufacturing and commercial sectors were allocated to industrial cogeneration.
- A portion of producer consumption of electricity reported by Statistics Canada was allocated to industrial/institutional sectors after accounting for 5% transmission line loss.
- Some additional projected carbon capture and storage offsets were allocated to Fertilizers and Petroleum Products sectors.
- Provincial building codes, appliance and floor space trends, capital costs and energy efficiencies for appliances and building shells were revised.
- Agriculture non-combustion related emissions were included from liming and urea application.
- The model incorporated the revised global warming potentials (GWPs) from the IPCC Fourth Assessment Report, consistent with what was used for the 2015 National GHG Inventory. For example, the 100-year GWP for methane is now 25, compared with 21 in previous years.

ANNEX 4: OTHER REPORTING MATTERS

DOMESTIC ARRANGEMENTS FOR SELF-ASSESSMENT

There are several processes in Canada that allow for self-assessment of progress toward emission reduction goals. On behalf of the Auditor General of Canada, the Commissioner of the Environment and Sustainable Development provides objective, independent analysis and recommendations on the federal government's efforts to protect the environment and foster sustainable development. The Commissioner conducts performance audits and is responsible for assessing whether federal government departments are meeting their sustainable development objectives, including on climate change. Reports and audits are tabled in Parliament and provide observations and recommendations for initiatives that require improvement. In addition to arrangements at the federal level, provinces and territories also have their own respective arrangements to audit the effectiveness of environmental policies and programs.

In addition, *Canada's Federal Sustainable Development Act* provides a legal framework for developing and implementing a Federal Sustainable Development Strategy that makes environmental decision-making transparent and accountable to Parliament. The Act requires the development of a Federal Sustainable Development Strategy every three years and it provides a whole-of-government view of federal actions to achieve environmental sustainability, including progress on GHG emission reductions. Progress Reports are also published every few years to review progress towards these indicators, and the 2016-19 Federal Sustainable Development Strategy will be published in 2016.

Accurate and transparent monitoring, reporting and verification of Canada's GHG emissions and removals are a requirement of the UNFCCC, and regular reporting allows Canada to assess its progress in reducing emissions and combatting climate change, including Canada's National Inventory Report, National Communications and Biennial Reports. In addition to reporting to the UNFCCC, *Canada's Emissions Trends* report has presented analysis and projections of Canada's GHG emissions in the context of its emission targets.

At the federal level, environmental regulations are enforced under relevant legislative authorities. Regulations to reduce greenhouse gas emissions are established under the *Canadian Environmental Protection Act (1999)*. Environmental enforcement officers enforce federal legislation dealing with risks to the environment and biodiversity, and enforce these laws in collaboration with provincial and territorial governments and national and international agencies and organizations.

ADDITIONAL INFORMATION CAN BE OBTAINED AT:
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