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Report on the technical review of the seventh national communication of Canada

Parties included in Annex I to the Convention were requested by decision 9/CP.16 to submit their seventh national communication to the secretariat by 1 January 2018. This report presents the results of the technical review of the seventh national of Canada, conducted by an expert review team in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention".

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Contents

Abbreviations and acronyms

AnnexII Party	Party included in AnnexII to the Convention
AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
BR	biennial report
CAD	Canadian dollars
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CTCN	Climate Technology Centre and Network
CTF	common tabular format
ECCC	Environment and Climate Change Canada
ERT	expert review team
GDP	gross domestic product
GHG	greenhouse gas
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
NA	not applicable
NC	national communication
NE	not estimated
NF_3	nitrogen trifluoride
NGO	non-governmental organization
NO	not occurring
non-AnnexI Party	Party not included in AnnexI to the Convention
non-AnnexII Party	Party not included in AnnexII to the Convention
N_2O	nitrous oxide
PaMs	policies and measures
PCF	Pan-Canadian Framework on Clean Growth and Climate Change
PFC	perfluorocarbon
SF_6	sulfur hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change
UNFCCC reporting guidelines on NCs	"Guidelines for the preparation of national communications by Parties included in AnnexI to the Convention, Part II: UNFCCC reporting guidelines on national communications"
WAM	'with additional measures'
WEM	'with measures'
WOM	'without measures'

I. Introduction and summary

A. Introduction

1. This is a report on the in-country technical review of the NC7 of Canada. The review was coordinated by the secretariat in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention", particularly "Part V: UNFCCC guidelines for the technical review of national communications from Parties included in Annex I to the Convention" (annex to decision 13/CP.20).

2. In accordance with the same decision, a draft version of this report was transmitted to the Government of Canada, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. The review was conducted from 9 to 14 April 2018 in Ottawa by the following team of nominated experts from the UNFCCC roster of experts: Mr. Ole-Kenneth Nielsen (Denmark), Ms. Jacqueline Pham (Australia), Ms. Maia Tskhvaradze (Georgia), Ms. Tatiana Tugui (Republic of Moldova) and Mr. Iván Darío Valencia (Colombia). Mr. Nielsen and Ms. Tugui were the lead reviewers. The review was coordinated by Mr. Peter Iversen and Ms. Inkar Kadyrzhanova (UNFCCC secretariat).

B. Summary

4. The ERT conducted a technical review of the information reported in the NC7 of Canada in accordance with the UNFCCC reporting guidelines on NCs (decision 4/CP.5).

1. Timeliness

5. The NC7 was submitted on 29 December 2017, before the deadline of 1 January 2018 mandated by decision 9/CP.16.

2. Completeness, transparency of reporting and adherence to the reporting guidelines

6. Issues and gaps identified by the ERT related to the reported information are presented in table 1. The information reported by Canada in its NC7 mostly adheres to the UNFCCC reporting guidelines on NCs.

Table 1
Assessment of completeness and transparency of mandatory information reported by Canada in its seventh national communication

Section of NC	*Completeness*	*Transparency*	*Reference to description of recommendations*
Executive summary	Complete	Transparent	NA
National circumstances	Complete	Transparent	NA
GHG inventory	Complete	Transparent	NA
PaMs	Complete	Transparent	NA
Projections and the total effect of PaMs	Mostly complete	Transparent	Issue 1 in table 9; issue 1 in table 10
Vulnerability assessment, climate change impacts and adaptation measures	Complete	Transparent	NA
Financial resources and transfer of technology	Mostly complete	Mostly transparent	Issues 1 and 2 in table 12
Research and systematic observation	Complete	Transparent	NA
Education, training and public awareness	Complete	Transparent	NA

Note: A list of recommendations pertaining to the completeness and transparency issues identified in this table is included in chapter III below.

II. Technical review of the information reported in the seventh national communication

A. Information on national circumstances and greenhouse gas emissions and removals

1. National circumstances relevant to greenhouse gas emissions and removals

(a) Technical assessment of the reported information

7. The national circumstances of Canada explain the relationship between its historic and future emission trends and the climate change policy agenda. The changing nature of those circumstances defines the factors that affect the climate policy development and implementation of the Convention. The NC7 contains key data on legislation, population trends, geography and land use, climate and climate change, economic developments, energy, transport, the buildings sector, industry, trade, the services sector, agriculture, forestry, resource efficiency and wastewater.

8. Canada is a decentralized federation comprising a central federal government, 10 provincial governments and 3 territories, with each level being assigned distinct powers under the Constitution. The environment is an area of shared jurisdiction, and environmental laws are based on constitutional powers. Federal power resides over international borders, international relations, trade, commerce, navigation, shipping, coasts, fisheries, criminal law and legislation in the national interest. Provincial power resides over municipalities, local works, property, civil rights, and provincially owned lands and natural resources, including energy. For example, the provinces own national resources within their boundaries and manage resource development, royalties and land-use planning. Territorial governance is based on delegated powers under the authority of the Parliament of Canada. Devolution of powers is ongoing.

9. Every jurisdiction has an environmental ministry or agency; however, environmental responsibilities are shared differently within the government of each jurisdiction. At the

federal level, ECCC, under the Minister of Environment and Climate Change, leads development and implementation of domestic and international climate change policies.

10. On 9 December 2016, Canada's federal, provincial and territorial governments adopted the PCF with the aim of reducing GHG emissions across all sectors of the economy, stimulating clean economic growth and building resilience to the impacts of climate change. During the review, the Party presented information on the roles and responsibilities of several federal departments and agencies in addition to ECCC that have environmental components; for example, Natural Resources Canada, Transport Canada, Agriculture and Agri-Food Canada and the Canadian Environmental Assessment Agency. In collaboration with a number of federal departments, ECCC leads the process for negotiating international agreements related to climate change, including setting national targets, and for reporting on national GHG emissions and working collaboratively with provinces, territories and federal departments to develop and coordinate the implementation of the PCF. The ERT noted the country's ambitious planned actions to combat climate change and build resilience through clean economic growth.

11. The ERT also noted that ECCC collaborated with other federal departments to coordinate the implementation actions outlined in the PCF. During the review, Canada provided further information on progress relating to the development of new policies and the implementation of regulatory measures, including regulations for reducing CH_4 emissions from the oil and gas sector, regulations for reducing the use of climate-warming HFCs, natural gas-fired electricity regulations, amended coal-fired electricity regulations, the Clean Fuel Standard, and the draft legislation and framework for the federal backstop system on pricing carbon pollution, which has since been passed by Parliament. Canada also launched several funding programmes and initiatives for reducing GHG emissions across all sectors of the economy. These include the Low Carbon Economy Leadership Fund, which allocated CAD 1.4 billion to provinces and territories to support mitigation, and the Low Carbon Economy Challenge Fund, which allocated CAD 500 million to support innovative projects to reduce emissions across Canada. Through the Investing in Canada Plan, Canada is also investing CAD 26.9 billion in green infrastructure and CAD 28.7 billion in public transit over the next decade. Investments are also being made to support clean technology research, development and adoption. Canada's provinces and territories are implementing their own regulatory measures and funding initiatives to reduce emissions. During the review, Canada explained that, to ensure actions identified in the PCF are open to external and independent review, the federal government in its 2018 budget announced CAD 20 million for engaging external experts to assess the effectiveness of its measures and identify best practices.

12. The ERT noted that during the period 1990–2015 Canada's population and GDP increased by 29.0 and 77.1 per cent, respectively. Canada achieved a strong decoupling of CO_2 emissions per capita, reaching a negative rate of change estimated at –8.4 per cent during the period 1990–2015, while GDP per capita increased by 37.3 per cent over the same period. Canada's positive climate change outcomes are based on an economy-wide approach to reducing GHG emissions in key sectors of the economy, such as electricity and transport, while continuing to create jobs and stimulate economic growth. Canada's population growth and its economic growth are the highest among the Group of Seven countries.[1] Table 2 illustrates the national circumstances of Canada by providing some indicators relevant to emissions and removals.

[1] The Group of Seven comprises Canada, France, Germany, Italy, Japan, the United Kingdom of Great Britain and Northern Ireland, and the United States of America.

Table 2
Indicators relevant to greenhouse gas emissions and removals for Canada for the period 1990–2015

Indicator	*1990*	*2000*	*2010*	*2014*	*2015*	*Change (%) 1990–2015*	*Change (%) 2014–2015*
GDP per capita (thousands 2011 USD using purchasing power parity)	31.30	37.43	40.70	42.95	42.98	37.3	0.1
GHG emissions without LULUCF per capita (t CO_2 eq)	21.99	23.99	20.61	20.46	20.13	–8.4	–1.6
GHG emissions without LULUCF per GDP unit (kg CO_2 eq per 2011 USD using purchasing power parity)	0.70	0.64	0.51	0.48	0.47	–33.3	–1.7

Sources: (1) GHG emission data: Canada's 2017 GHG inventory submission, version 4; (2) population, GDP and total primary energy supply data: International Energy Agency.

Note: The ratios per capita and per GDP unit are calculated relative to GHG emissions without LULUCF; the ratios are calculated using the exact (not rounded) values and may therefore differ from a ratio calculated with the rounded numbers provided in the table.

(b) Assessment of adherence to the reporting guidelines

13. The ERT assessed the information reported in the NC7 of Canada and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. There were no issues raised during the review relating to the topics discussed in this chapter of the review report.

2. Information on greenhouse gas inventory arrangements, emissions, removals and trends

(a) Technical assessment of the reported information

14. Total GHG emissions[2] excluding emissions and removals from LULUCF increased by 18.1 per cent between 1990 and 2015, whereas total GHG emissions including net emissions or removals from LULUCF increased by 34.5 per cent over the same period. Table 3 illustrates the emission trends by sector and by gas for Canada.

Table 3
Greenhouse gas emissions by sector and by gas for Canada for the period 1990–2015

	GHG emissions (kt CO_2 eq)					*Change (%)*		*Share (%)*	
	1990	*2000*	*2010*	*2014*	*2015*	*1990–2015*	*2014–2015*	*1990*	*2015*
Sector									
1. Energy	482 707.71	602 186.00	571 375.17	593 505.15	587 071.54	21.6	–1.1	79.0	81.3
A1. Energy industries	145 909.23	198 065.11	165 387.78	154 306.19	151 131.18	3.6	–2.1	23.9	20.9
A2. Manufacturing industries and construction	74 854.33	81 756.50	90 938.89	109 182.41	112 557.82	50.4	3.1	12.3	15.6
A3. Transport	126 321.58	154 044.11	171 357.42	174 920.50	174 979.10	38.5	0.0	20.7	24.2
A4. and A5. Other	86 819.52	98 469.18	89 290.64	95 420.80	91 517.52	5.4	–4.1	14.2	12.7
B. Fugitive emissions from fuels	48 803.05	69 851.01	54 400.35	59 675.14	56 885.83	16.6	–4.7	8.0	7.9

[2] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified. Values in this paragraph are calculated based on the 2017 annual submission, version 4.

	GHG emissions (kt CO_2 eq)					*Change (%)*		*Share (%)*	
	1990	*2000*	*2010*	*2014*	*2015*	*1990–2015*	*2014–2015*	*1990*	*2015*
C. CO_2 transport and storage	NA, NO	0.09	0.09	0.10	0.10	NA	0.0	NA	0.0
2. IPPU	55 875.41	52 260.83	48 474.66	50 902.59	51 069.74	–8.6	0.3	9.1	7.1
3. Agriculture	48 517.02	57 955.55	56 193.26	58 192.68	58 961.64	21.5	1.3	7.9	8.2
4. LULUCF	–99 274.88	–62 412.26	–28 185.59	–32 925.97	–33 543.53	–66.2	1.9	NA	NA
5. Waste	23 900.64	25 783.28	24 794.90	24 557.74	24 698.54	3.3	0.6	3.9	3.4
6. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect CO_2	709.27	631.81	463.11	429.89	440.23	–37.9	2.4	NA	NA
Gas[a]									
CO_2	463 496.84	569 999.95	553 720.59	572 728.38	568 094.19	22.6	–0.8	75.9	78.7
CH_4	93 532.06	117 997.57	99 750.04	104 775.08	102 399.97	9.5	–2.3	15.3	14.2
N_2O	42 217.19	39 544.51	37 293.12	38 137.93	38 901.21	–7.9	2.0	6.9	5.4
HFCs	970.54	2 754.84	7 774.50	10 065.96	11 014.12	1 034.8	9.4	0.2	1.5
PFCs	7 557.90	4 985.57	1 859.18	1 088.04	967.92	–87.2	–11.0	1.2	0.1
SF_6	3 225.93	2 902.96	440.42	362.63	423.90	–86.9	16.9	0.5	0.1
NF_3	0.32	0.24	0.15	0.15	0.15	–53.4	0.0	0.0	0.0
Total GHG emissions without LULUCF	**611 000.78**	**738 185.65**	**700 838.00**	**727 158.16**	**721 801.45**	**18.1**	**–0.7**	**100.0**	**100.0**
Total GHG emissions with LULUCF	**511 725.90**	**675 773.39**	**672 652.41**	**694 232.20**	**688 257.93**	**34.5**	**–0.9**	**NA**	**NA**
Total GHG emissions without LULUCF, including indirect CO_2	**611 710.05**	**738 817.46**	**701 301.11**	**727 588.05**	**722 241.68**	**18.1**	**–0.7**	**NA**	**NA**
Total GHG emissions with LULUCF, including indirect CO_2	**512 435.17**	**676 405.20**	**673 115.52**	**694 662.09**	**688 698.16**	**34.4**	**–0.9**	**NA**	**NA**

Source: GHG emission data: Canada's 2017 annual submission, version 4.

[a] Emissions by gas without LULUCF and without indirect CO_2.

15. The increase in total GHG emissions was driven mainly by geographic, demographic and economic circumstances. Climate and geography contribute to making Canada a heavy energy user. The large distances between metropolitan areas and the low population density lead to high emissions from the transport sector. In addition, Canada's economic growth was fastest among the Group of Seven economies in 2016. Sectors such as manufacturing, construction, mining, oil and gas, and forestry represent about 30 per cent of the national economy.

16. Between 1990 and 2015, GHG emissions from the energy sector increased by 21.6 per cent (104,363.83 kt CO_2 eq) owing mainly to an increase in energy consumption and in fugitive emissions in oil and gas operation, as well as an increase in the number of heavy-duty diesel vehicles in operation. The trend in GHG emissions from fuel combustion showed notable increases in transport (38.5 per cent or 48,657.52 kt CO_2 eq) and energy use in the manufacturing industries and construction sectors (50.4 per cent or 37,703.49 kt CO_2 eq). Decreasing energy generation from coal and oil, accompanied by an increase in hydro, nuclear and wind power generation, was the largest driver of the 31.0 per cent decrease in emissions associated with electricity production between 2005 and 2015.

17. Between 1990 and 2015, GHG emissions from IPPU decreased by 8.6 per cent (4,805.67 kt CO_2 eq) owing to various factors, such as technological improvements in aluminium production to mitigate PFC emissions, closure of magnesium plants and a decrease in iron and steel production. The overall decrease in GHG emissions from the chemical industry is the result of the closure, in 2009, of the only Canadian adipic acid plant, located

in Ontario. Between 1990 and 2015, GHG emissions from the agriculture sector increased by 21.5 per cent (10,444.62 kt CO_2 eq), owing mainly to fluctuation in livestock populations and in the application of inorganic nitrogen fertilizers. The LULUCF sector was a net sink of 33,543.53 kt CO_2 eq in Canada in 2015; net GHG removals have decreased by 65,731.35 kt CO_2 eq since 1990. The decline in the forest sink was largely driven by higher harvests relative to those in 1990, and by natural disturbances, including significant outbreaks of pest infestations and large areas being burned by wildfire. During the review, Canada explained that, building on the managed land proxy, the Party has classified emissions from managed land where a natural disturbance has taken place as non-anthropogenic. As a result, significant non-anthropogenic emissions and removals associated with natural disturbances in managed forests have been excluded from Canada's national GHG inventory. However, some smaller impacts continue to be captured, for example, areas where pest infestations have resulted in less than 20 per cent tree mortality. Between 1990 and 2015, GHG emissions from the waste sector increased by 3.3 per cent (797.90 kt CO_2 eq). Municipal waste disposal and wood waste disposal sites accounted for 90.0 per cent of the waste sector emissions.

18. Canada's emission profile is similar to that of the most industrialized countries, where CO_2 is the largest contributor to GHG missions. In Canada CO_2 accounted for 78.7 per cent of total emissions in 2015. Most of the CO_2 emissions resulted from the combustion of fossil fuel. CH_4 emissions arising from fugitive emissions from oil and natural gas systems, agriculture and landfills amounted to 102,399.97 kt CO_2 eq or 14.2 per cent of Canada's total GHG emissions. The N_2O emissions arise from categories such as agricultural soil management and transport and accounted for 38,901.21 kt CO_2 eq or 5.4 per cent of Canada emissions in 2015. Emissions of fluorinated gases (HFCs, PFCs, SF_6 and NF_3) constituted slightly less than 2.0 per cent of total emissions.

19. The summary information provided on GHG emissions was consistent with the information reported in the 2015 annual submission.

(b) Assessment of adherence to the reporting guidelines

20. The ERT assessed the information reported in the NC7 of Canada and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

B. Information on policies and measures

Policies and measures

(a) Technical assessment of the reported information

21. Canada provided information on its package of PaMs implemented, adopted and planned, by sector and by gas, in order to fulfil its commitments under the Convention. Canada reported on its policy context and legal and institutional arrangements put in place to implement its commitments and monitor and evaluate the effectiveness of its PaMs.

22. Canada provided information on a set of PaMs similar to those previously reported, with some notable additions; for example, the many measures being implemented as part of the PCF. Canada also provided information on changes made since the previous submission to its institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress made towards its target. The key change in the institutional arrangements is the introduction of the PCF and its supporting governance architecture, which is now the overarching framework for the coordination and implementation of climate change policy in Canada. The coordination of PCF implementation is the responsibility of ECCC, which has created the Pan-Canadian Framework Implementation Office to ensure collaboration on climate action across Canada's 19 federal departments and 13 provincial and territorial governments.

23. Canada gave priority to implementing the PaMs that make the most significant contribution to its emission reduction efforts. Canada provided information on how it believes its PaMs are modifying longer-term trends in anthropogenic GHG emissions and removals in

accordance with the objective of the Convention. Canada reported on how it periodically updates its PaMs to reduce greater levels of emissions and on the PaMs that have been discontinued since the previous submission.

24. A large number of PaMs are implemented at the provincial and territorial level owing to the different jurisdictions for different policy areas.

25. Although Canada has made improvements to the reporting of mitigation effects, the ERT noted that there are still many measures for which the mitigation effects have not been estimated (see issue 1 in table 5). The mitigation effect has been quantified for 85 out of 181 PaMs for the year 2020 or 2030, or both. The mitigation effects of several measures in the energy sector have not been estimated and reported. Canada explained that some policies are still under development so it is not possible to estimate their mitigation effect at this time. When requesting input on the PaMs chapter for the NC7, Canada requested the provinces and territories to include, wherever possible, the estimated mitigation impact of PaMs being developed by them. While the ERT noted that Canada has been able to quantify the effect of more measures compared with the previous submission, it considers that Canada should continue to work on estimating the effect of PaMs for all sectors at both the federal and the provincial and territorial level. The ERT also noted that transparency could be further improved by streamlining the descriptions in such a way that the most significant PaMs are described in the most detail.

26. The PaMs are presented on a sectoral basis defined by the Party on the basis of its economic structure. This approach is different from the IPCC classification, but more detailed than both it and the proposed sector split in the UNFCCC reporting guidelines on NCs. The following sectors are some of those distinguished in Canada's NC7: electricity, oil and gas, transport, buildings, emission-intensive and trade-exposed industries, agriculture and waste. The sectoral classification for the PaMs uses the same sectoral categories as in the projections chapter of the NC7. The ERT recognizes the rationale for reporting the sectoral split to reflect the country's sector-by-sector regulatory approach to reducing GHG emissions. The ERT noted that Canada has implemented an encouragement made in the previous review report, namely, to provide information on the link between the economic sectors and the IPCC sectors used in its inventory reporting.

27. Canada did not report in the NC7 on PaMs that are no longer in place, but did provide this information during the review, following a request by the ERT. The PaMs no longer in place include the ecoENERGY suite of programmes, including ecoENERGY Efficiency, ecoENERGY Innovation and the Clean Energy Fund. These were not reported because they were time-limited and funding had been depleted. In addition, a number of provincial PaMs are no longer in place, mostly those related to programmes no longer being funded (see issue 2 in table 5).

28. Some of the recommendations made in the previous review report were taken into consideration to improve reporting in the NC7, including: restructuring the chapter on PaMs from reporting by province to reporting by sector; providing an estimate of the mitigation effect for more of the reported PaMs; and describing more transparently the reasons for not estimating a mitigation effect.

29. The key overarching cross-sectoral policy reported by Canada is the PCF (see para. 22 above). While some measures associated with this policy have been implemented, many are still under development (see para. 32 below). The current federal measures in place that are expected to deliver the highest mitigation impact for 2020 are: the light-duty vehicle GHG regulations phase 1, the federal Energy Efficient Equipment and Appliances Programme, the regulations to address CH_4 in the oil and gas sector, and the federal renewable fuels regulations. These four measures are expected to have mitigation impacts in 2020 of 11,900, 4,100, 4,000 and 4,000 kt CO_2 eq, respectively. In addition, some implemented measures are expected to have a significant mitigation impact in 2030. These include regulations to address CH_4 in the oil and gas sector (20,000 kt CO_2 eq), the federal Energy Efficient Equipment and Appliances Programme (10,400 kt CO_2 eq), the federal energy efficient buildings initiatives (11,000 kt CO_2 eq) and regulations for HFCs (9,000 kt CO_2 eq). Other measures that have not yet been quantified are also expected to have a significant mitigation impact in 2030, including the Federal Carbon Pricing Approach and Backstop System and the Clean Fuel Standard.

30. At the provincial and territorial level, the implemented measures with the highest mitigation effect are: the British Columbia carbon tax, the Alberta specified gas emitters regulation (which has been replaced by the Alberta carbon competitiveness regulation), the Ontario natural gas demand-side management programmes, the Ontario Feed-In Tariff Program and the Large Renewable Procurement (both of which sunsetted in 2016), the Nova Scotia electricity sector regulations, the Newfoundland and Labrador Lower Churchill Project (Muskrat Falls), and the Alberta directive 060 on upstream petroleum industry flaring, incinerating and venting.

31. Within the Government of Canada, ECCC, under the Minister of Environment and Climate Change, is the lead authority for federal and international climate change policies. The Canadian Environmental Protection Act of 1999 provides the legal authority for ECCC to regulate GHG emissions as a toxic substance. Under the Act, the Minister of Environment and Climate Change may establish regulations on various aspects related to the release of GHGs, including setting quantities or concentrations of GHGs that may be released from various types of facilities or from vehicles, engines and equipment manufactured or imported into Canada for the purpose of sale.

32. Canada highlighted the mitigation actions that are under development, such as many of the initiatives under the PCF. Among the mitigation actions that provide a foundation for significant additional actions, the following are critical for Canada to attain its emission reduction targets: the federal carbon pricing approach and backstop system, the Clean Fuel Standard, regulations to address HFCs, regulations to address CH_4 in the oil and gas sector, light- and heavy-duty vehicle GHG regulations, the Low Carbon Economy Fund, strategic interconnections of electricity grids, and the National Zero Emission Vehicle Strategy. Table 4 provides a summary of the reported information on the PaMs of Canada.

Table 4
Summary of information on policies and measures reported by Canada

Sector	*Key PaMs*	*Estimate of mitigation impact by 2020 (kt CO_2 eq)*	*Estimate of mitigation impact by 2030 (kt CO_2 eq)*
Policy framework and cross-sectoral measures			
	Federal carbon pricing approach and backstop system	NE	NE
	Clean Fuel Standard	NE	30 000
	Regulation of HFCs	1 000	9 000
	Low Carbon Economy Fund	NE	NE
Energy			
	Regulations for reducing CO_2 emissions from the coal-fired generation of electricity	3 100	5 000
	Amended regulations for reducing CO_2 emissions from the coal-fired generation of electricity	NE	NE
	Strategic interconnections of electricity grids	NE	12 700
	Alberta coal-fired electricity generation phaseout	NE	NE
	Ontario coal phaseout	30 000	NE
	Regulations to address CH_4 in the oil and gas sector	4 000	20 000
	British Columbia electrification of the natural gas sector	1 600	4 000
	Alberta Carbon Capture and Storage Funding Act	2 760	2 760
	Alberta directive 060 on upstream petroleum industry flaring, incinerating and venting	4 000	NE

Sector	*Key PaMs*	*Estimate of mitigation impact by 2020 (kt CO_2 eq)*	*Estimate of mitigation impact by 2030 (kt CO_2 eq)*
	Energy Innovation Program	282	NE
	Nova Scotia electricity sector regulations	2 500	NE
Transport			
	National Zero Emission Vehicle Strategy	NE	NE
	Light-duty vehicle GHG regulations phase 1	11 900	23 300
	Light-duty vehicle GHG regulations phase 2	2 800	24 300
	Heavy-duty vehicle GHG regulations phase 1	2 600	5 700
	Heavy-duty vehicle GHG regulations phase 2	25	3 000
	Federal renewable fuels regulations	4 000	NE
	Retrofit requirements for existing heavy-duty trucks to install fuel-saving devices	NE	NE
	Electric vehicle charging and alternative fuel refuelling infrastructure	NE	NE
	Energy-efficient transportation initiatives	1 100	1 900
Renewable energy			
	ecoENERGY for Renewable Power Programme	6 000	6 000
	Newfoundland and Labrador Lower Churchill Project (Muskrat Falls)	1 200	NE
	Alberta Renewable Electricity Program	NE	NE
	SaskPower electricity initiatives	NE	6 000
Energy efficiency			
	Federal Energy Efficient Equipment and Appliances Programme	4 100	10 400
	Federal energy-efficient buildings initiatives	NE	11 200
	Ontario energy efficiency standards for products and appliances	NE	NE
	Nova Scotia electricity efficiency regulations	1 300	NE
IPPU			
	Energy efficiency in industry initiatives	1 100	6 700
	Alberta carbon competitiveness regulation (formerly Alberta specified gas emitters regulation)	10 000	NE
	Ontario natural gas demand-side management programmes	5 706	NE
	British Columbia GHG Industrial Reporting and Control Act	180	3 960
Agriculture			
	Growing Forward 2 federal, provincial and territorial government cost-shared programmes	NE	NE
	Growing Forward 2 federal-only programme: AgriInnovation	NE	NE

Sector	*Key PaMs*	*Estimate of mitigation impact by 2020 (kt CO_2 eq)*	*Estimate of mitigation impact by 2030 (kt CO_2 eq)*
	Agricultural Greenhouse Gases Programme	NE	NE
	British Columbia Nutrient Management Program	100	NE
LULUCF			
	Forest Bioeconomy Framework for Canada	NE	NE
	British Columbia Great Bear Rainforest (Forest Management) Act	2 000	NE
	Quebec Wood Innovation Workplan	NE	NE
	Alberta forestry and agriculture offset protocols	NE	NE
Waste			
	Ontario waste and agriculture-related actions	1 800	NE
	British Columbia landfill gas management regulation	811	NE
	Quebec regulation on respecting the landfilling and incineration of residual materials	NE	NE

Note: The estimates of mitigation impact are estimates of emissions of CO_2 or CO_2 eq avoided in a given year as a result of the implementation of mitigation actions.

33. The ERT noted that in order for Canada to significantly reduce GHG emissions in line with its 2020 target under the Convention, and also its 2030 target, it is of critical importance that the many planned PaMs that are part of the PCF are implemented as soon as possible. The ERT also noted that Canada has established a domestic reporting structure under which annual progress reports on PCF implementation are provided to the Prime Minister and to provincial and territorial premiers, as well as made public.

(b) Policies and measures in the energy sector

34. **Cross-cutting policies.** One of the major planned cross-cutting measures is national carbon pricing. Different types of carbon pricing have been implemented in different provinces, but not all provinces have implemented carbon pricing. Canada has developed a federal approach to pricing carbon pollution as a backstop to ensure that all jurisdictions have a price on carbon by 2019. Although the effect of carbon pricing has not been quantified in this submission, if implemented, it will have an effect on all fuel combustion sectors. Canada has also developed policies to accelerate technology innovation in order to complement regulatory measures such as carbon pricing and the Clean Fuel Standard. Programmes such as the Clean Growth Program enhance emission reductions under regulations by expanding the portfolio of low-carbon technology options.

35. **Electricity supply**. Canada's electricity supply is to a large extent (nearly 81 per cent) based on renewable energy and non-emitting energy. However, a few provinces and territories still rely on fossil fuels for electricity generation. Canada is amending its existing regulations to reduce CO_2 emissions from coal-fired electricity and to accelerate the phaseout of traditional coal-fired electricity generation by 2030. Although the effect of the accelerated phaseout was not quantified at the time of Canada's submission, the phaseout will have an effect on Canada's generation mix and GHG emissions from the electricity sector.

36. **Renewable energy sources**. Canada has vast renewable energy resources, especially hydro and wind power. There is still great potential for further expansion of renewable energy, which is partly reflected in measures establishing targets for renewable energy; for example, the New Brunswick Electricity Act Renewable Portfolio Standard Regulation, the Nova Scotia electricity sector regulations, the Prince Edward Island wind farm development and the Alberta coal-fired electricity generation phaseout (which includes a 30 per cent renewable energy target in 2030). The further use of renewable energy is, to some extent, impeded by a

lack of interconnection among provinces. This has been addressed in some cases (e.g. the Prince Edward Island–New Brunswick Cable Interconnection Upgrade Project) through implemented measures.

37. **Energy efficiency**. Energy efficiency is addressed through several federal and provincial and territorial PaMs. The mitigation effect of some of these PaMs is substantial (see table 4. For example, under the PCF, efforts are under way to adopt more stringent codes for new and existing buildings, including the goal that provinces and territories adopt a 'net-zero energy ready' model building code by 2030. Canada is also: setting new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable; updating and introducing new energy efficiency standards under its energy efficiency regulations; and updating and introducing new high performance ENERGY STAR specifications. In the industrial sector, Canada is taking steps to reduce GHG emissions via energy efficiency benchmarking programmes such as ENERGY STAR for Industry and ISO 50001.

38. **Transport sector**. In the transport sector, the federal government collaborates with partners to develop and implement regulatory regimes. For example, it has worked with the International Civil Aviation Organization to develop regulations. The government has also partnered with the International Maritime Organization to implement regulations. Additional complementary PaMs to support the uptake of clean transportation technologies and practices are also being advanced through voluntary agreements with industry, providing economic incentives for deployment and for research into new technologies. Canada has also implemented regulations targeting GHG emissions from on-road vehicles. As part of the PCF, a National Zero Emission Vehicle Strategy is to be developed. Canada plans to announce the strategy in 2018.

(c) Policies and measures in other sectors

39. **Industrial processes.** Heavy industry and oil and gas are significant contributors to the total GHG emissions in Canada. Several PaMs have been implemented affecting emissions from industry, including energy efficiency measures but also other targeted measures. A significant measure comprises the regulations to address CH_4 in the oil and gas sector, which aim to reduce CH_4 emissions from the oil and gas sector by 40–45 per cent below the 2012 level by 2025.

40. **Agriculture**. For the agriculture sector, Canada reported on three federal and three provincial PaMs related to investments in research as well as programmes to reduce GHG emissions in farming operations. Of the six PaMs, only two (both provincial) have a quantified mitigation effect in 2020, together totalling 108 kt CO_2 eq in 2020. No mitigation effect has been estimated for 2030. In the NC7 (referenced in the BR3 and during the in-country review), Canada informed the ERT that under the PCF it is working with provincial and territorial governments to enhance carbon storage in agricultural lands and it is supporting innovation to advance GHG efficient management practices in agriculture. In 2018, the Canadian Agricultural Partnership was agreed among federal, provincial and territorial governments for investing in innovative climate research and programmes to reduce GHG emissions in agricultural production.

41. **LULUCF**. Only one federal measure has been reported for the LULUCF sector and six PaMs at the provincial level. Of the seven PaMs, only two have a quantified mitigation effect in 2020, totalling 2,111 kt CO_2 eq. No mitigation effect has been estimated for 2030.

42. **Waste management**. As a result of the different jurisdictions in Canada, the regulation of the waste sector predominantly falls to the provincial and territorial level. Canada provided several examples of collaboration across federal, provincial and territorial governments, including the commitment to identify opportunities to produce renewable fuels and bioproducts from waste, and work on the Canada-wide Action Plan for Extended Producer Responsibility. At the provincial level, 12 PaMs are reported. Most of those PaMs target emissions from solid waste disposal on land through landfill gas recovery. The mitigation effect has been estimated for six PaMs in 2020, that is, half of the PaMs reported. The quantified effect of the PaMs is reported as 3,315 kt CO_2 eq in 2020.

(d) Assessment of adherence to the reporting guidelines

43. The ERT assessed the information reported in the NC7 of Canada and identified issues relating to transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 5.

Table 5
Findings on policies and measures from the review of the seventh national communication of Canada

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 23 Issue type: transparency	The quantification of PaMs is important in terms of assessing whether the implemented measures are sufficient to reach the defined targets. While Canada has improved its reporting since the previous submission by estimating the effect of more PaMs and including explanatory footnotes in the cases where an estimate of the effect is not provided, there is still a large number of PaMs for which the mitigation effect is not quantified.
	Assessment: encouragement	During the review, Canada recognized that improvements could be made to the number of PaMs with an estimated mitigation impact. The Party expects to be able to include mitigation estimates for a number of new measures being developed under the PCF in its next reporting cycle. Canada will continue encouraging provinces and territories to report the estimated mitigation impacts of their PaMs. The ERT encourages Canada to continue to improve the reporting on PaMs by including the quantified effect for more of the reported PaMs, for both the federal and the provincial and territorial level, and report the estimates in the next NC.
2	Reporting requirement[a] specified in paragraph 26	In order to assess changes between the current and previous submissions, it is of great value to have information on the PaMs no longer in place. In its submission, Canada did not provide information on PaMs no longer in place.
	Issue type: transparency	In response to a question raised during the review, Canada provided the ERT with information on PaMs no longer in place (see para. 27 above).
	Assessment: encouragement	The ERT encourages Canada to report on PaMs no longer in place in the next submission.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs.

C. Projections and the total effect of policies and measures

1. Projections overview, methodology and results

(a) Technical assessment of the reported information

44. Canada reported updated projections for 2020 and 2030 relative to actual inventory data for 2015 under the WEM scenario. The WEM scenario reported by Canada includes implemented and adopted PaMs until September 2017.

45. In addition to the WEM scenario, Canada reported a WAM scenario. The WAM scenario includes planned PaMs. During the review, Canada provided a definition of its scenarios, explaining that its WEM scenario includes federal policies that are legislated, have funding certainty and/or have been announced with accompanying detail. This includes policies such as the GHG emission standards for light- and heavy-duty vehicles, regulations for reducing CO_2 emissions from coal-fired electricity generation and standards for supporting energy efficiency and renewable energy development, as well as other provincial or territorial PaMs implemented. The WAM scenario includes federal and provincial and territorial policies announced that are still under development but where enough information is available to be included in the scenario. The definitions indicate that the scenarios were prepared in accordance with the UNFCCC reporting guidelines on NCs.

46. The projections are presented on a sectoral basis, for sectors defined by the Party as economic sectors, which is different to the IPCC classification, but in line with the UNFCCC reporting guidelines on NCs. Table 5.7 of the NC7 and CTF tables 6(a) and 6(c) present the Party's 'with measures' projection by IPCC classification. The ERT noted that projections for the LULUCF sector for 2020 and 2030 were not provided, either as the IPCC classification or within Canada's grouping by economic sector. See table 9 for further information. The sectoral classification used for the projections uses the same sectoral categories as those used in the reporting on mitigation actions in the NC7. Projections are presented on a gas-by-gas basis for CO_2, CH_4, N_2O, PFCs, HFCs and SF_6 as well as NF_3 for 1990–2030. The projections are also provided in an aggregated format for each sector as well as for the total GHG emissions using global warming potential values from the AR4.

47. In order to provide the reader with an understanding of emission trends, Canada presented information on drivers with the most significant impact on the trends for each sector. The ERT noted that the explanation is much improved compared to previous submissions, in which no description of emission trends was provided.

48. Canada did not report emission projections for indirect GHGs such as carbon monoxide, nitrogen oxides, non-methane volatile organic compounds or sulfur oxides. During the review, Canada confirmed that it would not provide emission projections for indirect GHGs for the NC7 but would consider doing so for future NCs.

49. Emission projections related to fuel sold to ships and aircraft engaged in international transport were reported separately and were not included in the totals.

(b) Methodology, assumptions and changes since the previous submission

50. The methodology used for the preparation of the projections is based on the same modelling framework used for the preparation of the emission projections for the BR2. The methodology is applicable to all sectors, with the exception of the forest sector, for which all estimates, including projections, are modelled using the Carbon Budget Model of the Canadian Forest Sector.

51. Canada's approach to projecting GHG emissions has two key parts: collating the most current and credible data available on GHG emissions and energy use; and developing emission projection scenarios through the use of the in-house E3MC model.[3] E3MC has two dynamically linked components: Energy 2020, which incorporates Canada's energy supply and demand structure; and the in-house macroeconomic model of the Canadian economy. E3MC is subject to annual data updates and methodology improvements, as required. The modelling approach includes a peer review of the assumptions and projections by external experts and some stakeholders. During the review, Canada outlined the action items following the peer review, which include investigating how technological change is accounted for, and expanding the sensitivity analyses undertaken. The NC7 (chapter 5, annex 2) describes various sector-specific methodological changes since the BR2, such as: updated growth rates for transport-related HFC emissions; updated assumptions of zero-emission vehicle sales; changes to the calibration process for the buildings sector to better capture historical energy efficiency improvements; and the use of actual historical electricity transmissions and distribution losses in the model.

52. To prepare its projections, Canada relied on the following key underlying assumptions: energy prices, macroeconomic developments, population trends and agriculture indicators. These variables and assumptions were reported in CTF table 5 and tables 5A.1 and 5A.2 of the NC7. The assumptions were updated on the basis of the most recent economic developments known at the time of the preparation of the projections. The sources of the assumptions are agencies such as Statistics Canada, Finance Canada, the National Energy Board, and Agriculture and Agri-Food Canada. The major assumptions compared with historical data are described in the NC7. The ERT notes that explanations of the modelling approach, data and assumptions in the NC7 have improved compared with Canada's previous NC submission.

[3] Environment Canada's Energy, Emissions and Economy Model for Canada.

53. Canada provided information in CTF table 5 on assumptions, methodologies, models and approaches used and on the key variables and assumptions used in the preparation of the projection scenarios.

54. Canada also provided information on sensitivity analyses. Sensitivity analyses were conducted for changes in future economic growth and higher or lower world oil and gas prices. The 'high' scenario assumes higher values for GDP growth over the period 2015–2030 (of about 2.5 per cent per year) than in the WEM projection, and higher world oil (USD 81 and 116 per barrel in 2020 and 2030, respectively) and gas prices (USD 3.55 and 4.67 per gigajoule in 2020 and 2030, respectively). The 'low' scenario assumes lower values for GDP growth over 2015 to 2030 (of about 1.0 per cent per year), and lower oil (USD 39 and 37 per barrel in 2020 and 2030, respectively) and gas prices (USD 2.65 and 2.86 per gigajoule in 2020 and 2030, respectively).

55. The results of the sensitivity analyses indicate that emissions will increase under the 'high' scenario and decrease under the 'low' scenario, but not to the point where the 2020 (or 2030) targets would be achieved. Under the 'high' scenario, emissions are projected to be 0.4 per cent (2,700 kt CO_2 eq) and 53.2 per cent (53,700 kt CO_2 eq) above 2005 levels in 2020 and 2030, respectively. Under the 'low' scenario, emissions are projected to be 4.1 per cent (30,300 kt CO_2 eq) and 25.8 per cent (88,300 kt CO_2 eq) below 2005 levels in 2020 and 2030, respectively.

(c) Results of projections

56. The projected emission levels under different scenarios and information on the quantified economy-wide emission reduction target are presented in table 6 and the figure below.

Table 6
Summary of greenhouse gas emission projections for Canada

	GHG emissions (kt CO_2 eq per year)	*Changes in relation to base-year[a] level (%)*	*Changes in relation to 1990 level (%)*
Quantified economy-wide emission reduction target under the Convention	613 619	17.0	0.5
Inventory data 1990[b]	610 800	–17.4	NA
Inventory data 2015[b]	721 400	–2.4	18.1
WEM projections for 2020[c]	728 400	–1.5	19.3
WAM projections for 2020[c]	690 400	–6.6	13.0
WEM projections for 2030[c]	721 400	–2.4	18.1
WAM projections for 2030[c]	583 400	–21.1	–4.5

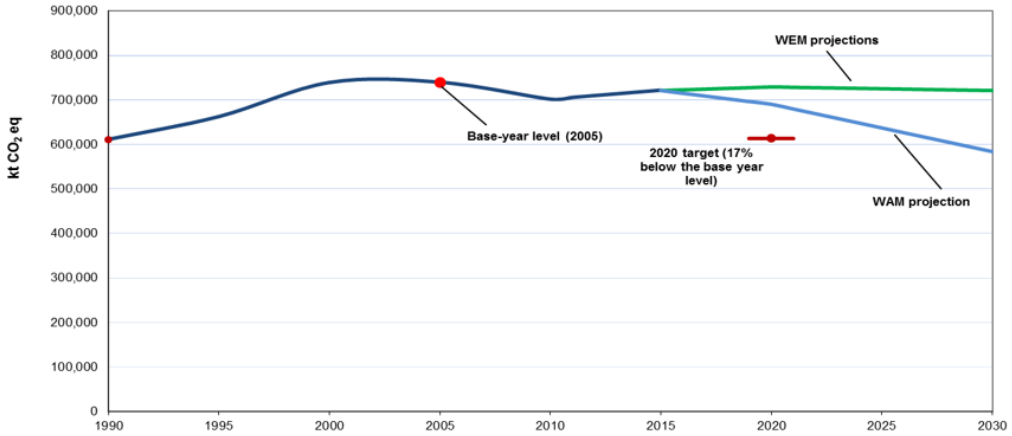
Note: The projections are for GHG emissions without LULUCF.

[a] "Base year" in this column refers to the base year used for the target under the Convention, which is 2005.

[b] From Canada's BR3 CTF table 6.

[c] From Canada's NC7 and/or BR3.

Greenhouse gas emission projections reported by Canada



Sources: Data for the years 1990–2030: Canada's NC7 and BR3; total GHG emissions excluding LULUCF.

57. Canada's total GHG emissions excluding LULUCF are projected to be 728,400 kt CO_2 eq and 721,400 kt CO_2 eq in 2020 and 2030, respectively, under the WEM scenario, which is an increase of 19.3 and 18.1 per cent, respectively, above the 1990 level. Under the WAM scenario, emissions in 2020 are projected to be higher than emissions in 1990 by 79,600 kt CO_2 eq or 13.0 per cent and amount to 690,400 kt CO_2 eq. Emissions in 2030 under the WAM scenario are projected to be lower than those in 1990 by 27,400 kt CO_2 eq or 4.5 per cent and amount to 583,400 kt CO_2 eq. Under the WEM scenario, Canada's total GHG emissions excluding LULUCF in 2020 and 2030 are projected to be 1.5 per cent (10,900 kt CO_2 eq) and 2.4 per cent (17,900 kt CO_2 eq), respectively, below 2005 levels.

58. The 2020 projections (excluding LULUCF) suggest that Canada is likely to face significant challenges in achieving its 2020 target under the Convention (see para. 57 above). The ERT noted that many additional PaMs under the PCF have been announced and have various timelines for implementation, and that, if implemented, the PaMs could better position Canada to meet its 2030 target. However, in the light of the limited time remaining until 2020, the ERT considers that it would be difficult for Canada to meet its 2020 target and that clarity is required regarding the role of the LULUCF sector and market-based mechanisms.

59. Canada presented the WEM and WAM scenarios by sector for 2020 and 2030, as summarized in table 7.

Table 7
Summary of greenhouse gas emission projections for Canada presented by sector

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
		2020		*2030*		*1990–2020*		*1990–2030*	
Sector	*1990*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
Energy (not including transport)	334 000	388 000	376 000	382 000	318 000	16.2	12.6	14.4	–4.8
Transport	148 000	199 000	189 000	190 000	173 000	34.5	27.7	28.4	16.9
Industry/industrial processes	56 000	57 000	58 000	64 000	65 000	1.8	3.6	14.3	16.1
Agriculture	49 000	57 000	57 000	58 000	58 000	16.3	16.3	18.4	18.4
LULUCF	–99 000	NE	NE	NE	NE	NA	NA	NA	NA
Waste	24 000	27 000	27 000	28 000	28 000	12.5	12.5	16.7	16.7
Total GHG emissions without LULUCF	**610 800**	**728 400**	**690 400**	**721 400**	**583 400**	**19.3**	**13.0**	**18.1**	**–4.5**

Source: Canada's 2017 annual submission, version 4, and Canada's NC7 and BR3 CTF tables.

60. According to the projections reported for 2020 under the WEM scenario, emissions from all sectors are projected to increase between 1990 and 2020. The most significant emission increases are expected to occur in the energy and transport sectors, amounting to projected increases of 54,000 kt CO_2 eq (16.2 per cent) and 51,000 kt CO_2 eq (34.5 per cent) between 1990 and 2020, respectively. The pattern of projected emissions reported for 2030 under the same scenario remains the same, with emissions from all sectors expected to increase.

61. The ERT noted that the projection trends in the energy sector reflect Canada's efforts to replace coal-fired electricity generation and increase renewable energy sources. However, absolute reductions in emissions from electricity generation from 2005 to 2030 (70,000 kt CO_2 eq) are largely offset by projected growth in emissions from the oil and gas sector (57,000 kt CO_2 eq) over the same period. Energy sector emissions in 2020 and 2030 are 16.2 per cent and 14.4 per cent above 1990 levels, respectively, although they are 3.0 per cent and 4.5 per cent below 2005 levels, respectively.

62. If additional measures are considered (i.e. under the WAM scenario), the patterns of emission reductions between 1990 and 2020 presented by sector and by gas remain the same as for the WEM scenario, that is, emissions from all sectors are projected to increase; however, the extent of that increase is slightly less than without the additional measures. For 2030, emissions from all gases, with the exception of PFCs and SF_6, are projected to decline.

63. Canada presented the WEM and WAM scenarios by gas for 2020 and 2030, as summarized in table 8.

Table 8
Summary of greenhouse gas emission projections for Canada presented by gas

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
		2020		*2030*		*1990–2020*		*1990–2030*	
Gas	*1990*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
CO_2	463 000	579 000	557 000	584 000	506 000	25.1	20.3	26.1	9.3
CH_4	94 000	96 000	96 000	86 000	85 000	2.1	2.1	–8.5	–9.6
N_2O	42 000	38 000	38 000	39 000	39 000	–9.5	–9.5	–7.1	–7.1
HFCs	1 000	15 000	15 000	12 000	12 000	1 400.0	1 400.0	1 100.0	1 100.0
PFCs	7 600	300	300	300	300	–96.1	–96.1	–96.1	–96.1
SF_6	3 200	100	100	100	100	–96.9	–96.9	–96.9	–96.9
NF_3	0	0	0	0	0	–	–	–	–
Total GHG emissions without LULUCF	**610 800**	**728 400**	**690 400**	**721 400**	**583 400**	**19.3**	**13.0**	**18.1**	**–4.5**

Source: Canada's 2017 annual submission, version 4, and Canada's NC7 and BR3 CTF tables.

64. For 2020 the most significant reductions under the WEM scenario are projected for PFC emissions: 7,300.00 kt CO_2 eq (96.1 per cent). Emissions of N_2O and SF_6 are also projected to decrease by 4,000.00 kt CO_2 eq (9.5 per cent) and 3,100.00 kt CO_2 eq (96.9 per cent), respectively, between 1990 and 2020. The ERT noted, however, that emissions (excluding LULUCF) of all other gases are projected to increase between 1990 and 2020. Emissions of CO_2, HFCs and CH_4 are projected to increase by 116,000.00 kt CO_2 (25.1 per cent), 14,000.00 kt CO_2 eq (1,400.0 per cent) and 2,000.00 kt CO_2 eq (2.1 per cent), respectively.

65. Under the same scenario, the pattern of projected emissions of gases reported to 2030 remains largely the same, with the exception of emissions of CH_4, which are projected to decrease by 8,000.00 kt CO_2 eq (8.5 per cent) between 1990 and 2030 owing to reductions in the waste and agriculture sector and expected declines as a result of proposed government regulations to reduce CH_4 emissions from the oil and gas sector.

66. If additional measures are considered (i.e. under the WAM scenario), the patterns of emission reductions by 2020 presented by sector and by gas remain the largely same; that is, emissions of PFCs, N_2O, SF_6 decrease between 1990 and 2020, while emissions of CO_2, HFCs and CH_4 increase, although not to the same levels. Under the same scenario, the pattern of projected emissions by gas to 2030 is largely the same, with the exception of CH_4 emissions, which are projected to decrease further, by 9,000.00 kt CO_2 eq (9.6 per cent).

(d) Assessment of adherence to the reporting guidelines

67. The ERT assessed the information reported in the NC7 of Canada and identified issues relating to completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 9.

Table 9
Findings on greenhouse gas emission projections reported in the seventh national communication of Canada

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 34 Issue type: completeness Assessment: recommendation	Canada did not provide projections of LULUCF emissions. During the review, Canada informed the ERT that it is continuing to refine LULUCF estimates to better focus on anthropogenic emissions and removals. In turn, this is expected to provide a basis for improved reporting and accounting for LULUCF. As this work is still under way, only historical inventory estimates were provided in the NC7. Canada advised the ERT that it expects to be in a position to provide the LULUCF projections in the BR4, which is due 1 January 2020. The ERT recommends that, to enhance the completeness of its reporting, Canada provide in the next submission projections of LULUCF emissions for 2020 and 2030.
2	Reporting requirement[a] specified in paragraph 35 Issue type: completeness Assessment: encouragement	Canada did not provide projections of indirect GHG emissions, such as carbon monoxide, nitrogen oxides and non-methane volatile organic compounds or sulfur oxides. Canada confirmed during the review that it has not provided projections of indirect GHG emissions for the NC7, but that it would consider including these in its next submission. The ERT encourages Canada to enhance completeness by reporting projections of indirect GHG emissions such as carbon monoxide, nitrogen oxides, non-methane volatile organic compounds and sulfur oxides.
3	Reporting requirement[a] specified in paragraph 43 Issue type: transparency Assessment: encouragement	In the NC7, Canada did not provide a description of: the original purpose for which the E3MC model was built and how it has been modified for climate change purposes; strengths and weaknesses of the E3MC model; and how the E3MC model accounts for the overlap that may exist between different PaMs. During the review, Canada provided extensive information on the E3MC model, including its strengths and weaknesses, changes made to the model and planned improvements, and outlined how it accounted for different PaMs to avoid any possible double counting of emission reductions. The ERT encourages Canada to enhance transparency by providing in the next submission the details of its model, E3MC.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs.

2. Assessment of the total effect of policies and measures

(a) Technical assessment of the reported information

68. In the NC7, Canada did not present the estimated and expected total effect of implemented and adopted PaMs. Canada explained that projecting a counterfactual scenario (i.e. a WOM scenario) would be highly speculative and, as such, the total estimated effect of implemented and adopted PaMs has not been provided.

(b) Assessment of adherence to the reporting guidelines

69. The ERT assessed the information reported in the NC7 of Canada and identified the following issue relating to completeness and adherence to the UNFCCC reporting guidelines on NCs. The finding is described in table 10.

Table 10
Findings on the assessment of the total effect of policies and measures from the review of the seventh national communication of Canada

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 39 Issue type: completeness Assessment: recommendation	Canada did not provide an estimate of the total effect of PaMs. During the review, Canada explained its concerns with developing a WOM scenario that would be uncertain and speculative. As such, Canada did not provide the total effect of implemented and adopted PaMs. The ERT reiterates the recommendation made in the previous review report that Canada enhance completeness of reporting by providing an estimate of the total effect of PaMs, presented on a gas-by-gas basis, in its next submission.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs.

D. Provision of financial and technological support to developing country Parties

1. Financial resources

(a) Technical assessment of the reported information

70. Canada reported information on the provision of financial support required under the Convention, including on financial support provided, committed and pledged, allocation channels and annual contributions. This information was provided for calendar years 2015 and 2016. In response to a question raised by the ERT on why the calendar years 2013 and 2014 were not reported in the NC7, Canada explained that these were reported in the BR2 (using fiscal years 2013 (1 April 2013 to 31 March 2014) and 2014 (1 April 2014 to 31 March 2015)) and that Canada was following the draft UNFCCC reporting guidelines on NCs that had not yet been adopted by the UNFCCC.

71. The ERT noted that, according to the UNFCCC guidelines on NCs, Annex II Parties should report financial information covering a three-year period, and if possible, a four-year period, whereas in the BR they are expected to report financial information covering the most recent two-year period. The ERT also noted that Canada moved from fiscal year reporting in its BR2 (1 April to 31 March) to calendar year reporting to align itself with reporting by other donor countries and other reporting mechanisms such as the Organisation for Economic Co-operation and Development – Development Assistance Committee. In response to a question raised by the ERT on the possible overlap between financial support reported in the BR2 for the period January–March 2015 (part of fiscal year 2014) with financial support reported in the NC7 for calendar year 2015, Canada indicated that the overlap was minimal because most disbursements in fiscal year 2014 occurred in the early part of the fiscal year.

72. Canada indicated how it has determined that financial resources are "new and additional". Canada's definition of "new and additional" is financing that is additional to what was planned before the Copenhagen Accord. In response to a question raised by the ERT, Canada indicated that funding prior to the Copenhagen Accord was in the order of CAD 75 million per year, as shown in the NC6, whereas in the period 2015–2016 it amounted to USD 439.75 million (CAD 576 million). The ERT calculated based on the CTF tables that in 2015 provision of "new and additional" financial resources were in the order of CAD 91.74 million, and in 2016 in the order of CAD 232.78 million. Climate finance delivered as part of Canada's CAD 2.65 billion climate finance commitment is also new and additional.

73. Canada described how its resources address the adaptation and mitigation needs of non-Annex I Parties. It also described how those resources assist non-Annex I Parties to mitigate and adapt to the adverse effects of climate change, facilitate economic and social response measures, and contribute to technology development and transfer and capacity-building related to mitigation and adaptation. Canada reported that it supports non-Annex I Parties in the development of their nationally determined contributions and national adaptation plans, particularly the poorest and most vulnerable countries, the least developed countries and small island developing States. Climate-smart agriculture, access to water, and forestry were among the topics highlighted as important for climate-related international assistance to developing countries.

74. As examples of this support, Canada highlighted projects in Jordan of CAD 1.73 million and 0.67 million to support low-carbon development, renewable energy and the installation of solar panels in poor households. It also highlighted support provided to the World Meteorological Organization's Climate Risk Early Warning Systems, and CAD 0.97 million provided to Haiti to address emissions from charcoal combustion in households. Other relevant initiatives reported in CTF table 7(b) include several international assistance projects that support climate objectives; for example, strengthening climate-resilient agriculture in Bolivia (Plurinational State of), Ethiopia, Ghana, Guatemala, Honduras, Kenya, Mali, Nicaragua and the United Republic of Tanzania, and increasing food security and promoting sustainable livelihoods in Bolivia (Plurinational State of), Burkina Faso, the Democratic Republic of the Congo, Ethiopia, Ghana, Haiti, Peru and Senegal.

75. Canada explained the principles underlying its climate finance, including commitments to act in accordance with science, promote decarbonization and clean technology, support climate change efforts in developing countries, empower women and girls, and enable prosperity through a sustainable economy. Canada made a reference to its new Feminist International Assistance Policy, adopted in June 2017, which aims to empower women and girls and promote gender equality across all development assistance. The Party also indicated that its climate finance is aligned with the 2030 Agenda for Sustainable Development, and in particular Sustainable Development Goal 13 related to climate action. Canada also highlighted that the province of Quebec delivered CAD 6 million in 2016 to the Global Environment Facility's Least Developed Countries Fund, with funds coming from Quebec's cap-and-trade carbon market system.

76. Canada reported information on the assistance that it has provided to developing country Parties that are particularly vulnerable to the adverse effects of climate change to help them meet the costs of adaptation to those adverse effects. In particular, it highlighted the Caribbean Disaster Risk Management Programme to improve resilience in communities to hurricanes and other extreme weather events, with a particular focus on gender equality. Canada has also supported disaster preparedness institutional capacity-building in South-Eastern Asian countries, and it provided USD 1.3 million in relief and reconstruction aid to the Philippines after Typhoon Haiyan.

77. With regard to the most recent financial contributions aimed at enhancing implementation of the Convention by developing countries, Canada reported that it did not have specific priority countries or sectors. Rather, it has general priorities for its climate finance, including: supporting ambitious mitigation action in line with developing countries' needs; scaling up support for adaptation, particularly for the poorest and most vulnerable; mobilizing private sector finance; and supporting gender equality and the empowerment of women and girls. Quebec has prioritized support to be delivered in 2017 and 2018 for technology transfer and capacity-building in francophone countries. Quebec's climate finance support is funded by Quebec's Green Fund through the 2013–2020 Action Plan on Climate Change. Table 11 includes some of the information reported by Canada on its provision of financial support.

Table 11
Summary of information on provision of financial support by Canada in 2015–2016
(Millions of United States dollars)

	Year of disbursement	
Allocation channel of public financial support	*2015*	*2016*
Official development assistance	4 277.23	3 930.44
Climate-specific contributions through multilateral channels, including:	108.83	99.99
Global Environment Facility	29.96	28.92
Least Developed Countries Fund	0	453
Green Climate Fund	0	126.75
Trust Fund for Supplementary Activities	0.20	0
Financial institutions, including regional development banks:	74.72	67.08
African Development Bank	5.40	0.00
Asian Development Bank	5.59	5.40
Inter-American Development Bank	1.58	1.69
International Development Association	62.15	59.99
United Nations bodies, including:	4.31	13.10
Partnership for Clean Fuels and Vehicles	0.01	0.01
Contribution to the Global Framework for Climate Services	0.16	0.15
International Fund for Agricultural Development: Climate Change Adaptation	0	7.54
Multilateral Fund of the Montreal Protocol	4.14	3.99
United Nations Development Programme support for the twenty-second session of the Conference of the Parties	0	1.06
World Meteorological Organization Climate Risk Early Warning Systems	0	0.35
Consultative Group on International Agricultural Research	2.35	2.26
Support to the International Organisation of La Francophonie	0.23	0.38

Sources: (1) Query Wizard for International Development Statistics, available at http://stats.oecd.org/qwids/; (2) BR3 CTF tables.

78. Canada reported in CTF table 7(b) 80 bilateral assistance projects in the form of grants over the course of 2015 and 2016, including 52 projects for 2015 and 63 projects for 2016, 35 of which had continued from 2015. As reported in CTF table 7(b), 100 per cent of the public bilateral financing provided by Canada in this reporting period was in the form of grants. However, the Party does not count financing from Export Development Canada, whose projects were not listed in CTF table 7(b). Of the 80 international bilateral assistance projects that involved climate change objectives, 10 were listed with climate change as the principal objective. Of the 80 projects, 41 projects in 2015 and 44 in 2016 were classified as adaptation-focused projects; 8 projects in 2015 and 13 in 2016 were classified as mitigation-focused projects; 3 projects in 2015 and 6 in 2016 were classified as cross-cutting; 33 projects in 2015 and 35 in 2016 targeted the agriculture and food security sectors; 8 projects in 2015 and 8 in 2016 were related to disaster preparedness, prevention, relief and reconstruction; and 3 projects in 2015 and 8 in 2016 addressed energy issues. Overall, adaptation has the highest share of bilateral international assistance projects, while sectorally, agriculture and food security is the most frequent focus of these projects.

(b) Assessment of adherence to the reporting guidelines

79. The ERT assessed the information reported in the NC7 of Canada and identified issues relating to completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 12.

Table 12
Findings on financial resources from the review of the seventh national communication of Canada

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 53 Issue type: completeness Assessment: recommendation	In its NC7, Canada reported financial information provided for calendar years 2015 and 2016 only, and did not report information for 2013 and 2014. In response to a question raised by the ERT, Canada indicated that this information had been reported in the BR2 and that Canada was following the draft UNFCCC reporting guidelines on NCs, which had not yet been adopted by the UNFCCC. The ERT recommends that Canada maintain its reporting spanning four years and, at a minimum, provide three years of financial information in its next NC, in accordance with the UNFCCC reporting guidelines on NCs in decision 4/CP.5, until any new guidelines come into effect.
2	Reporting requirement[a] specified in paragraph 51 Issue type: transparency Assessment: recommendation	Canada did not indicate in the NC7 the specific level of funding prior to the Copenhagen Accord above which climate financing would be "new and additional". In response to a question raised by the ERT, Canada indicated that funding prior to the Copenhagen Accord was in the order of CAD 75 million per year, as reported in the NC6, whereas in the period 2015–2016 it amounted to USD 439.75 million (CAD 576 million). The ERT reiterates the recommendation made in the previous review report that Canada include in the next submission information on how financial resources have been determined as being "new and additional", by indicating the level of financing (in numbers) prior to the Copenhagen Accord or by providing other reference levels of finance, in order to enable ERTs to assess comparatively the definition of "new and additional" finance provided by the country.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph numbers listed under reporting requirement refer to the relevant paragraphs of the UNFCCC reporting guidelines on NCs.

2. Technology development and transfer

(a) Technical assessment of the reported information

80. Canada provided information on steps, measures and activities related to technology transfer, access and deployment benefiting developing countries undertaken by the public sector and public–private partnerships. Canada provided examples of support provided for the deployment and enhancement of the endogenous capacities of non-Annex I Parties.

81. Canada reported information on technology transfer activities undertaken in the 2015 and 2016 calendar years in CTF table 8, reporting several public and public and private interventions. In response to a question raised by the ERT, Canada indicated that it was not able to obtain information for privately financed technology transfer activities because the country does not track purely private sector transactions in developing countries.

82. The ERT took note of the information provided in CTF table 8 on recipient countries, target areas, measures and focus sectors of technology transfer programmes. Canada has focused its activities on technology development and transfer in the areas of adaptation, business development, clean energy management, smart grids, fugitive emission reductions, and forestry and land-use management. Several programmes focused on training and dissemination of tools developed in Canada for clean energy and forestry, technology exchange for CH_4 emission reductions in the oil and gas sector, and support of global initiatives such as the CTCN, Private Financing Advisory Network and Global Observation of Forest Cover and Landcover Dynamics.

83. The ERT noted that Canada reported on its PaMs as well as success and failure stories in relation to technology transfer, and in particular on measures taken to promote, facilitate and finance the transfer and deployment of climate-friendly technologies.

84. Canada highlighted RETScreen as one of its most successful examples of technology transfer. RETScreen is a clean energy management software managed and maintained by Natural Resources Canada and used for energy efficiency, renewable energy and cogeneration project feasibility analysis. Natural Resources Canada has developed detailed training materials for the software, which is available free of charge in 36 languages. It has more than 525,000 users worldwide. Canada estimated that emission reductions of around 20 million CO_2 eq annually have been delivered by the projects designed with this software. The Party reported several training activities in 2015 and 2016, such as webinars and in-person workshops for countries in Western Africa and Latin America.

85. Through the national designated entity at Natural Resources Canada, Canada has encouraged Canadian private sector organizations and NGOs to become members of the CTCN. In response to a question raised by the ERT, Canada indicated that the Government has reached out to more than 400 organizations to promote the CTCN through delivering presentations at conferences and key events, engaging directly with companies and organizations, and informing Canada's trade commissioners about the CTCN. There are 24 Canadian members of the Network, 17 of them private sector companies, 4 not-for profit organizations and 2 academic institutions. In CTF table 8, Canada reported seven webinars with private sector partners in 2015 and 2016 through the CTCN, covering RETScreen, energy efficiency and risk mapping, mitigation technologies for small farmers, and utility demand-side energy management programmes. The Canadian firms Econoler, Island Water Technologies Inc., Design+Environment and Ecoaction Innovative Solutions Inc., in collaboration with Natural Resources Canada, delivered these webinars.

86. Canada also highlighted a project of the International Development Research Centre and the Private Financing Advisory Network (currently hosted by the United Nations Industrial Development Organization and the Renewable Energy and Energy Efficiency Partnership). This project assessed barriers to private investment in adaptation, and built investor capacity to better understand and manage the risks implicit in adaptation projects. The project also created a pipeline of bankable projects that have the potential to attract private sector financing. Through an investor forum (on business plan competition) this initiative secured private finance for a number of recipients, particularly small and medium-sized enterprises looking for equity investment. The recipients included African Bamboo, which produces bamboo floors in Ethiopia and provides adaptation benefits (e.g. providing livelihoods to communities, and soil and water conservation), and Classic Foods in Kenya, which helps farmers implement sustainable farming practices and improve farm economics. The International Development Research Centre also supports a network of 'B Corporations' in Latin America to accelerate the impact of these companies in implementing innovations related to climate change.

87. Furthermore, Canada highlighted technology transfer and support for the Carbon Budget Model of the Canadian Forest Sector, through which Mexico was one of the beneficiaries. Under this model, methods were developed to integrate data from the United States of America and Mexico into Canadian carbon models to support analyses of mitigation options in all three countries. In the forest sector, an example of an important technology collaboration with developing countries is the installation of fire danger rating systems in Armenia and Georgia and in Mexico, as part of the Global Fire Early Warning System operated by Canada, and the use of the Canadian Fire Weather Index by Chile as a tool to prevent and manage wildfires.

88. Overall, Canada reported 10 technology development and transfer projects and initiatives implemented in 2015 and 2016, 5 of which were public and private, and 5 were purely public.

89. During the review, Canada highlighted some domestic technology development programmes that have international elements, including in developing countries. Specifically, the Clean Growth Hub, which is being established within Innovation Canada and which will help clean technology proponents connect with international markets through a single information hub. Funding for Export Development Canada is being mobilized to help the growth and expansion of Canadian clean technology firms through exports.

90. Support provided for the deployment and enhancement of the endogenous capacities and technologies of non-Annex I Parties includes activities related to technology development

and transfer in the areas of adaptation, business development, clean energy management, smart grids, fugitive emission reductions, and forestry and land-use management.

(b) Assessment of adherence to the reporting guidelines

91. The ERT assessed the information reported in the NC7 of Canada and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

E. Vulnerability assessment, climate change impacts and adaptation measures

1. Technical assessment of the reported information

92. In the NC7, Canada provided the required information on the expected impacts of climate change in the country; the adaptation policies covering regional, sectoral and cross-sectoral vulnerabilities and considerations; and an outline of the actions taken to implement Article 4, paragraph 1(b) and (e), of the Convention with regard to adaptation. Canada provided a description of climate change vulnerability and impacts in coastal zones and northern territories. It also provided a description of the impacts on communities, public safety, health and well-being, the economy and the natural environment. It highlighted the adaptation response actions taken and planned at different levels of government.

93. Canada has developed a number of sectoral and provincial climate change impact assessments and plans that were used as a basis for adaptation measures, and which strengthened the implementation of domestic climate change adaptation action by providing funding to federal departments and agencies for a suite of adaptation programmes. In 2017, the Party announced funding of CAD 260 million over five years for federal adaptation programmes relating to information and capacity-building, climate-resilient infrastructure, human health and well-being, vulnerable regions, and climate-related hazards and disaster risks. It also announced funding over 10 years for green infrastructure and updated standards and codes to support resilience in infrastructure.

94. Recognizing that adaptation is a long-term challenge, adaptation and climate resilience is one of the four pillars of the PCF, which includes priorities such as: ensuring that Canadians have the information and expertise to consider climate change in their planning and decision-making; building climate resilience through infrastructure; working to protect the health and well-being of Canadians; supporting particularly vulnerable regions and indigenous peoples in addressing climate impacts; and reducing the risks to communities from climate-related hazards and disasters. The PCF will help link policy direction to delivery of programmes.

95. Provinces and territories have undertaken a variety of adaptation activities, including: Yukon's Climate Change Action Plan Progress Report (2015); the Climate Change Strategic Framework of the Government of the Northwest Territories; the Manitoba Climate and Green Plan; Climate Ready: Ontario's Adaptation Strategy and Action Plan (2011–2014); and the Sustainable Development Strategy of Quebec 2015–2020. These provide further direction to government agencies on enhancing preparedness for climate change.

96. During the review, the Party informed the ERT that IPCC methodologies were used while developing the NC and BR reports. Table 13 summarizes the information on vulnerability and adaptation to climate change presented in the NC7 of Canada.

Table 13
Summary of information on vulnerability and adaptation to climate change reported by Canada

Vulnerable area	*Examples/comments/adaptation measures reported*
Agriculture and food security	*Vulnerability*: limited access to traditional food sources; risks directly related to increased incidence of drought, floods, storms and heatwaves, as well as changes to plant life cycles and productivity, plant and animal ranges, the spread of invasive species, and the emergence and spread of pests and diseases. *Adaptation*: Agriculture and Agri-Food Canada provides a variety of climate data products, information and services specifically for Canada's agriculture and agrifood sector.
Biodiversity and natural ecosystems	*Vulnerability*: increased droughts, floods and natural disasters leading to biodiversity loss. *Adaptation*: development of climate and climate change scientific advice, which includes research on the impacts of climate change on biodiversity and ecosystem services, as well as options and opportunities for using ecosystems to support climate change adaptation.
Canada's Arctic and northern areas	*Vulnerability:* reduction in sea ice cover, accelerated permafrost thaw, loss of glaciers, and other ecosystem impacts. *Adaptation*: funding to build adaptation capacity including through research and development and standards development, and funding for infrastructure, including roads, buildings, communications towers, energy systems and facilities.
Coastal zones	*Vulnerability*: changes in relative sea levels, rising water temperatures, increasing ocean acidity and loss of sea ice (resulting in an increase in the risk of storm surge and coastal erosion) and permafrost. *Adaptation*: enhanced use of natural infrastructure as an alternative to hard coastal protection measures to reduce climate risks.
Drought	*Vulnerability*: changes in temperature and precipitation patterns have made the wildfire season longer, while drought- and pest-stressed forests and rangelands are increasing the severity of wildfires. Droughts are impacting agricultural productivity and access to traditional food sources. *Adaptation*: Drought Watch provides timely information on weather and climate relevant to the agriculture sector in Canada.
Fisheries	*Vulnerability*: higher water temperatures (and less available oxygen) and higher acidity in the water threaten marine life and habitats, impacting commercial, recreational and subsistence fisheries and aquaculture activities. *Adaptation*: Fisheries and Oceans Canada completed four large aquatic basin risk assessments covering the Pacific, Arctic and Atlantic Oceans and Canada's inland waters, represented by the Lake Winnipeg and Great Lakes' drainage systems. Each large basin assessment included an analysis of climate trends and projections for the aquatic environment in order to help managers make strategic, climate-sensitive decisions about aquatic resource management activities and coastal infrastructure at risk from a changing climate.
Forests	*Vulnerability*: Canada's vast forest ecosystems are exposed to significant natural disturbances such as fire, insects, disease and weather-related events that affect forest health and structure. *Adaptation*: Canada's ongoing fire suppression efforts; policy initiatives and federal adaptation strategies.
Human health	*Vulnerability*: more frequent and severe or extreme weather events increase the risk of physical injury, illness and death. Heatwaves cause heat-related illness and death, as well as exacerbate existing conditions, such as respiratory and cardiovascular diseases. *Adaptation*: the Canadian Environmental Protection Act (1999) is the primary legal instrument allowing the Government of Canada to take action to protect the environment and human health in order to contribute to sustainable development.

Vulnerable area	*Examples/comments/adaptation measures reported*
	Health Canada, the Public Health Agency of Canada, the Canadian Institute of Health Research, and the Department of Indigenous Services work with partners to plan for the broad range of health risks caused by climate change.
Indigenous peoples	*Vulnerability:* increased vulnerability and fragility of the livelihoods of indigenous peoples owing to their living closer to the land and having a strong socioeconomic and spiritual connection to it. *Adaptation:* developing and implementing climate change adaptation plans in communities; adjusting subsistence activities in response to environmental changes; launching a website to share indigenous knowledge of the impacts of climate change; and developing indigenous guardians' programmes.
Infrastructure and economy	*Vulnerability*: flooding in 2017 caused thousands of people to evacuate their homes, and even more people were affected. More than 2,000 Canadian armed forces personnel were deployed to assist in flood relief efforts. Disruptions to productivity, critical trade infrastructure, electricity generation, and supply chains have broad consequences for many economic sectors and services to consumers and businesses. *Adaptation*: the Government of Canada announced green infrastructure funding, a significant portion of which will help communities prepare for challenges that result from climate change.
Transport	*Vulnerability*: impacts associated with climate change and extreme weather events affect transportation systems, services and operations across all modes in all regions of Canada, disrupting the movement of both freight and people. *Adaptation*: a national-level assessment of climate risks and adaptation practices for the Canadian transportation sector was released in 2017 ("Climate Risks and Adaptation Practices for the Canadian Transportation Sector 2016").
Water resources	*Vulnerability*: water availability, in terms of both the amount of water and the times of minimum and peak flows, is impacted by changes in spring precipitation and reduced snow accumulation. These changes in the timing and amount of water have consequences for agriculture, industrial activities, power generation and ecological function. *Adaptation*: the Government of Canada allocated CAD 70 million over six years in its 2017 budget for further support of agricultural discovery science and innovation, with a focus on addressing emerging priorities, such as climate change and soil and water conservation.

97. Canada provided a detailed description of international adaptation activities, including: the provision of support, through its CAD 30 million contribution to the Least Developed Countries Fund, to vulnerable countries faced with the challenge of adapting to the impacts of climate change; and its pledge of CAD 2.65 billion over five years (2015–2020) to help developing countries tackle climate change, including CAD 10 million to improve early warning systems for hazards such as tropical cyclones, floods, heatwaves and forest fires. Canada also provided information on bilateral cooperation with developing countries on adaptation, such as its CAD 122 million funding of bilateral adaptation and mitigation projects in Burkina Faso, Haiti, Morocco, Senegal, South Africa and Viet Nam, as well as countries in Latin America and the Caribbean.

2. Assessment of adherence to the reporting guidelines

98. The ERT assessed the information reported in the NC7 of Canada and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

F. Research and systematic observation

1. Technical assessment of the reported information

99. Canada provided information on its contributions to the Global Climate Observing System and the IPCC. During the review, the ERT noted that information on the general policy for funding research and systematic observation was missing. Canada informed the ERT that that there is no single overarching national policy for, or funding of, research and systematic observation for climate change. Canada further informed the ERT that evidence-based decision-making is a foundational concept in Canadian environmental policy. The ERT also noted that the NC7 did not include information on the identification of opportunities for and barriers to free and open international exchange of data and information and on action taken to overcome such barriers. During the review, Canada informed the ERT that barriers are mainly related to ownership, security, privacy and confidentiality of the information.

100. Canada has implemented international and domestic policies and programmes on climate change research, systematic observation and climate modelling that aim to advance capabilities to predict and observe the physical, chemical, biological and human components of the Earth's system over space and time. The programmes that contribute to this work include: the renewal of the core monitoring infrastructure of Meteorological Services of Canada's Surface Weather Networks, Climate Networks and Marine Networks; the ECCC's Climate Change Prediction and Scenarios programme; the Aquatic Climate Change Adaptation Services programme of Fisheries and Oceans Canada; the Sustainable Science and Technology Advancement initiative of Agriculture and Agri-Food Canada's Growing Forward 2 policy framework; the Earth Observation Application Development Programme; the Sun–Earth System Sciences Programme; and the Polar Space Task Group of the World Meteorological Organization.

101. In terms of activities related to systematic observation, Canada reported on national plans, programmes and support for ground- and space-based climate observing systems, including satellite and non-satellite climate observation. Canada also reported on challenges related to the maintenance of a consistent and comprehensive observation system. Recognizing the complexity and horizontality of many national policy priorities that include climate change, Canada has developed the Federal Geospatial Platform, an initiative designed to bring together economic, social and environmental data from multiple departments and agencies and make it publicly available to support climate resilience.

102. In December 2016, following the Paris Agreement, Canada endorsed a Joint Declaration on Harnessing the Data Revolution for Climate Resilience, and has made a commitment to sharing tools and best practices from Open Maps. In 2013, Canada and the other Group of Eight[4] members adopted the Open Data Charter, committing to a set of open data principles: open data by default; timely and comprehensive; accessible and usable; comparable and interoperable; for improved governance and citizen engagement, and for inclusive development and innovation.

103. The ECCC's national ground-based weather, climate, upper air and meteorological marine observation networks follow well-defined operating standards and procedures in accordance with the climate monitoring principles and standards of the Global Climate Observing System and related programmes. In the NC7 Canada reported that, although network spatial densities and station distributions are relatively stable, lower densities are found in the sparsely populated northern regions. To address these spatial gaps, ECCC continues to make it a strategic priority to transform its monitoring capabilities in collaboration with other federal departments and levels of government in Canada, as well as the private sector through a 'network of networks' approach.

104. The NC7 reflects actions taken to support capacity-building and the establishment and maintenance of observation systems and related data and monitoring systems in developing countries. Canada provided funding for scientists from developing countries working on global climate change research. However, the ERT noted that more elaborated information on

[4] The Group of Eight comprises Canada, France, Germany, Italy, Japan, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, and the United States of America.

how Canada takes into account the particular concerns and needs of developing countries when providing such support could further improve the completeness of the report.

2. Assessment of adherence to the reporting guidelines

105. The ERT assessed the information reported in the NC7 of Canada and identified issues relating to completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 14.

Table 14
Findings on research and systematic observation from the review of the seventh national communication of Canada

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement [a] specified in paragraph 62 Issue type: transparency Assessment: encouragement	The NC7 includes a description of Canada's initiatives with regards to open and international exchange of data and information, however, Canada did not identify the barriers on the way to free and open exchange of data or on action taken to overcome these barriers. During the review, Canada provided the requested information (see para. 100 above). The ERT encourages Canada to reflect this information in the next NC submission.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph numbers listed under reporting requirement refer to the relevant paragraphs of the UNFCCC reporting guidelines on NCs.

G. Education, training and public awareness

1. Technical assessment of the reported information

106. In the NC7, Canada provided information on its actions relating to education, training and public awareness at the domestic and international level. The Party provided information on education, training and public awareness, primary, secondary and higher education, public information campaigns, training programmes, education materials, resource or information centres, the involvement of the public and NGOs and its participation in international activities.

107. The ERT noted that Canada does not have a national education policy or curriculum. Rather, the education policy is set according to the requirements of each of the 13 provincial and territorial governments across the country. Coordination between the provinces and territories occurs through the Council of Ministers of Education, Canada. The Council has included education for sustainable development as one of the key activity areas in Learn Canada 2020, which is a framework to enhance Canada's education system, learning opportunities and overall education outcomes at all levels.

108. During primary and secondary education, climate change is taught across a range of subjects and grades, but is traditionally part of science and geography studies. The study of climate change is treated progressively more comprehensively starting from grade 4, with studies in grades 10–12 exploring the more complex nature of climate change, including global impacts and anthropogenic drivers. Climate change training programmes in Canada cover a wide range of activities, from improving vehicle fleet and building operations to best practices for businesses.

109. The ERT noted that Canada did not report on the extent of public participation in the preparation or domestic review of the NC. During the review, Canada informed the ERT that public participation was not sought for the NC.

110. The Government of Canada actively uses the Internet and social media for public information campaigns (e.g. Canada's Action on Climate Change website; Natural Resources Canada's website; Twitter, Facebook, YouTube and Instagram accounts) to highlight government-led climate change initiatives and to promote public engagement opportunities. Canada participates in a number of national and international conferences and trade shows to share Canada's best practices and gain knowledge for addressing climate change.

111. Numerous organizations in Canada act as climate change resources or information centres for Canadian citizens, governments and businesses. These include federal government departments (e.g. ECCC, Natural Resources Canada, Transport Canada and Health Canada), provincial and municipal governments, utilities and climate-focused NGOs.

112. The ERT commends Canada for its efforts on the involvement of the public (including indigenous peoples) and NGOs in a number of policy initiatives through different sources, such as the interactive website "Let's Talk Climate Action", created to provide information on the development of Canada's climate change plan.

2. Assessment of adherence to the reporting guidelines

113. The ERT assessed the information reported in the NC7 of Canada and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

III. Conclusions and recommendations

114. The ERT conducted a technical review of the information reported in the NC7 of Canada in accordance with the UNFCCC reporting guidelines on NCs. The ERT concludes that the reported information mostly adheres to the UNFCCC reporting guidelines on NCs and that the NC7 provides an overview of the national climate policy of Canada.

115. Canada's total GHG emissions excluding LULUCF covered by its quantified economy-wide emission reduction target were estimated to be 18.1 per cent above its 1990 level, whereas total GHG emissions including LULUCF were 34.5 per cent above its 1990 level in 2015. Emission increases were driven by strong economic and population growth, dominated by the growth in the oil and gas sector. Emission increases were also driven by geographic, demographic and economic circumstances, which make Canada a heavy energy user. The large distances between metropolitan areas and the low population density lead to high emissions from the transport sector. Those factors outweigh improvements in the efficiency of energy supply and use.

116. Canada's main policy framework relating to energy and climate change is the PCF, which includes a number of specific measures. While some measures associated with this policy have been implemented, many are still under development. The current federal measures in place that are expected to deliver the highest mitigation impact for 2020 are: the light-duty vehicle GHG regulations phase 1, the federal Energy Efficient Equipment and Appliances Programme, the regulations to address CH_4 in the oil and gas sector, and the federal renewable fuels regulations. These four measures are expected to have a mitigation impact by 2020 of 11,900, 4,100, 4,000 and 4,000 kt CO_2 eq, respectively. In addition, some implemented measures are expected to have a significant mitigation impact in 2030. These include regulations to address CH_4 in the oil and gas sector (20,000 kt CO_2 eq), the federal Energy Efficient Equipment and Appliances Program (10,400 kt CO_2 eq), the federal energy efficient buildings initiatives (11,000 kt CO_2 eq) and regulations for HFCs (9,000 kt CO_2 eq). Other measures that have not yet been quantified are also expected to have a significant mitigation impact in 2030, including the pan-Canadian carbon price and the Clean Fuel Standard.

117. The GHG emission projections provided by Canada include those under the WEM and WAM scenarios. In the two scenarios, emissions are projected to be 19.3 and 13.0 per cent above the 1990 level in 2020, respectively. On the basis of the reported information, the

ERT concludes that Canada is likely to face challenges in achieving its 2020 target, which is a reduction in emissions by 17 per cent compared with the 2005 level, under the WEM and WAM scenarios.

118. Canada continues to provide climate financing to developing countries in line with its climate finance announcements, such as the CAD 2.65 billion commitment announced to ramp up climate finance to CAD 800 million per year in 2020. It has reported an increase in its contributions of 21 per cent since the NC6, although the figures are not strictly comparable; its public financial support in 2015 and 2016 totalled USD 150.38 million and USD 298.37 million per year, respectively. For those years, Canada provided less support for mitigation than for adaptation through bilateral cooperation, although funding from Export Development Canada was not divided between adaptation and mitigation. The biggest share of bilateral financial support went to projects in the agriculture sector, followed by projects related to disaster prevention, preparedness, relief, reconstruction and rehabilitation.

119. With respect to technology development and transfer to developing countries, Canada highlighted several successful experiences related to energy planning management software, fostering of technology transfer through the CTCN, adaptation technology support, and forest mitigation modelling and forest fire monitoring. In terms of capacity-building support, Canada reported participation in multiple international initiatives and partnerships, particularly in the areas of clean energy, carbon dioxide capture utilization and storage, oil and gas mitigation, and forestry.

120. Canada provided information on vulnerable sectors such as agriculture and food security, fisheries, water resources and transport, and outlined the expected impacts of climate change and the actions taken with regard to adaptation. The PCF is the first national climate change plan wherein adaptation is prominently highlighted alongside climate change mitigation. The provinces and territories of Canada have undertaken a variety of adaptation activities.

121. Canada communicated information on its actions relating to research and systematic observation. It has implemented international and domestic policies and programmes on climate change research, systematic observation and climate modelling that aim to advance capabilities to predict and observe the physical, chemical, biological and human components of the Earth's system. The programmes that contribute to this work include: the renewal of the core monitoring infrastructure of Meteorological Services of Canada's Surface Weather Networks, Climate Networks and Marine Networks; the ECCC's Climate Change Prediction and Scenarios programme; the Aquatic Climate Change Adaptation Services programme of Fisheries and Oceans Canada; the Sustainable Science and Technology Advancement initiative of Agriculture and Agri-Food Canada's Growing Forward 2 policy framework; the Earth Observation Application Development Programme; and the Sun–Earth System Sciences Programme. Canada reported on plans, programmes and support for ground- and space-based climate observing systems, including satellite and non-satellite climate observation. Canada has developed the Federal Geospatial Platform, an initiative designed to bring together economic, social and environmental data from multiple departments and agencies and make it publicly available to support climate resilience.

122. Canada communicated information on its actions relating to education, training and public awareness. For strengthening public participation, Canada used an interactive website, "Let's Talk Climate Action", when developing its climate change plan, and it continues to use various social media channels to engage with the public. Within the framework of Learn Canada 2020, the Council of Ministers of Education has included education for sustainable development as one of the key activities.

123. In the course of the review, the ERT formulated the following recommendations for Canada to improve its adherence to the UNFCCC reporting guidelines on NCs:[5]

(a) To improve the completeness of its reporting by:

(i) Providing information on projected emissions for the LULUCF sector for 2020 and 2030 (see issue 1 in table 9);

[5] The recommendations are given in full in the relevant sections of this report.

(ii) Providing information on the total effect of PaMs in accordance with the WEM definition and in terms of GHG emissions avoided or sequestered on a gas-by-gas basis (see issue 1 in table 10);

(iii) Maintaining a span of four years in reporting and, at a minimum, providing three years of financial information, in accordance with the UNFCCC reporting guidelines on NCs in decision 4/CP.5, until any new guidelines come into effect (see issue 1 in table 12);

(b) To improve the transparency of its reporting by:

Elaborating on how financial resources have been determined as being "new and additional" and what "new and additional" resources have been provided (see issue 2 in table 12).

Annex

Documents and information used during the review

A. Reference documents

2017 GHG inventory submission of Canada. Available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php.

BR3 of Canada. Available at http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf.

BR3 CTF tables of Canada. Available at http://unfccc.int/national_reports/biennial_reports_and_iar/biennial_reports_data_interface/items/10132.php.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories". Annex to decision 24/CP.19. Available at http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications". FCCC/CP/1999/7. Available at http://unfccc.int/resource/docs/cop5/07.pdf.

"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention". Annex to decision 13/CP.20. Available at http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf.

NC7 of Canada. Available at http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf.

Report on the individual review of the annual submission of Canada submitted in 2017. FCCC/ARR/2018/CAN. Available at http://unfccc.int/resource/docs/2018/arr/can.pdf.

Report of the technical review of the second biennial report of Canada. FCCC/TRR.2/CAN. Available at http://unfccc.int/resource/docs/2016/trr/can.pdf.

Report on the technical review of the sixth national communication of Canada. FCCC/IDR.6/CAN. Available at http://unfccc.int/resource/docs/2015/idr/can06.pdf.

"UNFCCC biennial reporting guidelines for developed country Parties". Annex I to decision 2/CP.17. Available at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Hilary Hove (ECCC), including additional material.