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**Report of the centralized in-depth review of
the fourth national communication of Canada**

According to decision 4/CP.8, Parties included in Annex I to the Convention are requested to submit to the secretariat, in accordance with Article 12, paragraphs 1 and 2, of the Convention, a fourth national communication by 1 January 2006. This report presents the results of the in-depth review of the fourth national communication of Canada conducted by an expert review team in accordance with relevant provisions of the Convention and Article 8 of the Kyoto Protocol.

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I. Introduction and summary

A. Introduction

1. Canada has been a Party to the Convention since 1992 and to its Kyoto Protocol since 2002. Under the Kyoto Protocol, Canada committed itself to reducing its greenhouse gas (GHG) emissions by 6 per cent in relation to the 1990 level during the first commitment period from 2008 to 2012.
2. This report covers the centralized in-depth review (IDR) of the fourth national communication (NC4) of Canada, coordinated by the UNFCCC secretariat, in accordance with decision 7/CP.11. The review took place from 11 to 16 May 2009 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: Ms. Eglantina Bruci (Albania), Mr. Ture Hammar (Denmark), Ms. Erika Hasznos (Hungary), Ms. Eva Jernbäcker (Sweden), Ms. Inga Kindsigo (Estonia), Mr. Guy Midgeley (South Africa), Mr. Dennis Rudov (Belarus), Mr. Evren Turkmenoglu (Turkey), Ms. Katalin Zaim (United Nations Development Programme) and Mr. Ji Zou (China). Ms. Bruci and Mr. Hammar were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).
3. During the IDR, the expert review team (ERT) examined each part of the NC4. The ERT also evaluated the information contained in Canada's report demonstrating progress (RDP) in achieving its commitments under the Kyoto Protocol, and the supplementary information provided by Canada under Article 7, paragraph 2, of the Kyoto Protocol.
4. In accordance with the guidelines for review under Article 8 of the Kyoto Protocol (decision 22/CMP.1), a draft version of this report was communicated to the Government of Canada, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Summary

5. The ERT noted that Canada's NC4 complies to a large extent with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications" (hereinafter referred to as the UNFCCC reporting guidelines). As required by decisions 22/CP.7 and 25/CP.8, the RDP provides some information on the progress made by Canada in achieving its commitments under the Kyoto Protocol. Supplementary information required under Article 7, paragraph 2, of the Kyoto Protocol¹ is provided in both the NC4 and the RDP.

1. Completeness

6. The ERT noted that the NC4 covers all of the sections required by the UNFCCC reporting guidelines. The ERT also noted that Canada's RDP contains all parts stipulated by decisions 22/CP.7 and 25/CP.8. Furthermore, the ERT noted that Canada has provided the supplementary information required under Article 7, paragraph 2, except for two reporting elements (see chapter III B below).

2. Timeliness

7. The ERT noted with concern that the NC4 was submitted on 15 March 2007 and the RDP on 15 November 2006. Decision 4/CP.8 requested Parties to submit their NC4 by 1 January 2006; decision 22/CP.7 set the same date for Parties to submit their RDP. The ERT recommends that Canada ensure timely submission of its future national communications.

¹ Decision 15/CMP.1, annex, chapter II.

3. Transparency

8. The ERT noted that Canada's NC4 is, to some extent, comprehensive and transparent. The NC4 provides clear information on many aspects of implementation. Although the reporting on climate change policies and measures (PaMs) is extensive, information on policies that lead to higher levels of GHG emissions remained unclear. The ERT noted that the sectoral split used in the chapter on PaMs in the NC4 is not consistent with the UNFCCC reporting guidelines. The information contained in the NC4 is generally consistent with that contained in the RDP.

9. In the course of the review, the ERT formulated a number of recommendations that could help Canada to further increase the transparency of its reporting, such as a recommendation to highlight and prioritize by sector the PaMs that have had the most significant mitigation impact as well as those that are replicable or innovative. In response to questions raised by the ERT in the context of the review, Canada provided some clarifications and additional background information which helped to increase the transparency. The ERT recommends that Canada include this additional information in its next national communication.

II. Technical assessment of the reviewed elements

A. National circumstances relevant to greenhouse gas emissions and removals

10. In its NC4, Canada has provided a description of its national circumstances, how these national circumstances affect GHG emissions and removals in Canada, and how national circumstances and changes in national circumstances affect GHG emissions and removals over time. The ERT noted that the main drivers of emission trends in Canada include demographic developments (high population growth, and low density and wide distribution of population), overall change in economic activity (growth in gross domestic product (GDP), shift towards emission-intensive economic activities, and energy-intensive industry) and annual variation in precipitation and winter temperatures (number of heating degree days). Table 1 illustrates the national circumstances of the country by providing some indicators relevant to GHG emissions and removals.

11. Canada has provided a summary of information on GHG emission trends for the period 1990–2004. This information is consistent with the 2006 national GHG inventory submission. Summary tables, including trend tables for emissions in carbon dioxide equivalent (CO₂ eq) (given in the common reporting format), are also provided in an annex to the NC4.

12. According to Canada's 2009 GHG inventory submission, total GHG emissions excluding emissions and removals from land use, land-use change and forestry (LULUCF) increased by 26.2 per cent between 1990 and 2007, whereas total GHG emissions including net emissions or removals from LULUCF increased by 46.7 per cent (see table 2). This was mainly attributed to carbon dioxide (CO₂) emissions, which increased by 29.5 per cent over this period. Emissions of methane (CH₄) also increased by 35.4 per cent, while emissions of nitrous oxide (N₂O) decreased by 4.3 per cent. Emissions of fluorinated gases (F-gases) accounted for about 2.0 per cent of total GHG emissions in 1990 and 1.2 per cent in 2007. Table 2 provides an overview of GHG emissions by sector from the base year to 2007 (see also the discussion of sectoral trends in chapter II B).

Table 1. Indicators relevant to greenhouse gas emissions and removals for Canada

	1990	1995	2000	2007	Change 1990–2000 (%)	Change 2000–2007 (%)	Change 1990–2007 (%)
Population (million)	27.70	29.30	30.69	32.84	10.79	7.01	18.56
GDP (2000 USD billion using PPP)	654.63	712.93	872.92	1044.00	33.35	19.6	59.48
TPES (Mtoe)	209.48	231.70	252.10	272.38	20.34	8.04	30.03
GDP per capita (2000 USD thousand using PPP)	23.63	24.33	28.44	31.79	20.35	11.77	34.52
TPES per capita (toe)	7.56	7.91	8.21	8.29	8.62	0.97	9.67
GHG emissions without LULUCF (Tg CO ₂ eq)	591.79	640.99	717.10	747.04	21.17	4.18	26.23
GHG emissions with LULUCF (Tg CO ₂ eq)	540.23	839.38	636.78	792.49	17.87	24.45	46.70
CO ₂ emissions per capita (Mg)	16.46	16.67	18.24	17.97	10.86	-1.48	9.21
CO ₂ emissions per GDP unit (kg per 2000 USD using PPP)	0.70	0.68	0.64	0.57	-7.89	-11.86	-18.81
GHG emissions per capita (Mg CO ₂ eq)	21.36	21.88	23.37	22.75	9.37	-2.65	6.48
GHG emissions per GDP unit (kg CO ₂ eq per 2000 USD using PPP)	0.90	0.90	0.82	0.72	-9.13	-12.19	-20.85

Data sources: (1) GHG emissions data: Canada's 2009 greenhouse gas inventory submission; (2) Population, GDP and TPES data: International Energy Agency.

Abbreviations: GDP = gross domestic product, GHG = greenhouse gas, LULUCF = land use, land-use change and forestry, PPP = purchasing power parity, TPES = total primary energy supply.

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.

Table 2. Greenhouse gas emissions by sector in Canada, 1990–2007

	GHG emissions (Tg CO ₂ eq)						Change (%)		Shares ^a by sector (%)	
	1990	1995	2000	2005	2006	2007	1990–2007	2006–2007	1990	2007
A. Energy	469 467.7	509 831.2	586 941.9	593 053.5	580 805.2	614 266.4	30.8	5.8	79.3	82.2
A1. Energy industries	146 816.1	154 965.0	198 892.5	191 074.9	183 317.0	196 086.1	33.6	7.0	24.8	26.2
A2. Manufacturing industries and construction	63 078.7	62 328.8	64 848.1	64 614.8	65 116.7	72 519.3	15.0	11.4	10.7	9.7
A3. Transport	145 340.3	159 340.2	178 210.5	192 283.4	191 432.5	199 840.5	37.5	4.4	24.6	26.8
A4–A5. Other	71 578.7	76 187.4	80 296.3	80 424.0	75 138.9	80 971.7	13.1	7.8	12.1	10.8
B. Fugitive emissions	42 653.9	57 009.9	64 694.4	64 656.4	65 800.1	64 848.8	52.0	-1.4	7.2	8.7
2. Industrial processes	54 827.1	56 638.8	51 139.6	55 056.2	54 608.7	51 426.6	-6.2	-5.8	9.3	6.9
3. Solvent and other product use	174.9	208.0	241.9	179.0	322.4	319.4	82.6	-0.9	0.0	0.0
4. Agriculture	48 463.7	54 509.9	58 596.6	61 582.5	60 828.0	59 650.7	23.1	-1.9	8.2	8.0
5. LULUCF	-51 565.5	198 387.8	-80 320.5	41 413.2	41 367.5	45 453.3	188.1	9.9	-8.7	6.1
6. Waste	18 859.2	19 806.6	20 181.5	21 095.7	21 613.7	21 378.2	13.4	-1.1	3.2	2.9
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GHG total with LULUCF	540 227.1	839 382.4	636 780.9	772 380.2	759 545.4	792 494.6	46.7	4.3	91.3	106.1
GHG total without LULUCF	591 792.6	640 994.6	717 101.4	730 967.0	718 178.0	747 041.3	26.2	4.0	100.0	100.0

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry, NA = not applicable.

Note: The changes in emissions and the shares by sector are calculated using the exact (not rounded) values and may therefore differ from values calculated with the rounded numbers provided in the table.

^a The shares of sectors are calculated relative to GHG emissions without LULUCF; for the LULUCF sector, the negative values indicate the share of GHG emissions that was offset by GHG removals through LULUCF.

B. Policies and measures

13. Canada has established a multitude of climate change PaMs in all sectors and across its provinces and territories, and this comprehensiveness is reflected in its NC4. The ERT noted that the description of Canada's domestic PaMs is extensive and similar to the description in Canada's NC3. In addition, general information has been listed in the NC4 on PaMs that are no longer in place. In response to questions raised by the ERT during the review, Canada provided a comprehensive update on the status of PaMs reported in the NC4. This included information about "terminated programmes".

The ERT noted, however, that Canada did not report on policies and practices which encourage activities that lead to greater levels of GHG emissions than would otherwise occur. The ERT encouraged Canada to report, in line with paragraph 16 of the UNFCCC reporting guidelines, on “action taken to implement commitments under Article 4.2 (e) (ii) of the Convention, which requires that Parties identify and periodically update their own policies and practices which encourage activities that lead to greater levels of anthropogenic GHG emissions than would otherwise occur. Parties should also provide the rationale for such actions in the context of their national communications.”

Table 3. Summary of information on policies and measures

Major policies and measures	Examples/comments
Framework policies and cross-sectoral measures	
Integrated climate programmes	Climate Change Plan for Canada (2002); Project Green – Moving Forward on Climate Change: A Plan for Honouring our Kyoto Commitment (2005); Turning the corner: Action plan to reduce greenhouse gas emissions and air pollution (2007); Aboriginal and Northern Community Action Program, 2001–2008; Opportunities Envelope (2003).
Regional partnerships/agreements	Federal House in Order – agreement among 11 federal departments (that account for 95 per cent of the Government’s greenhouse gas (GHG) emissions) to reduce the Government’s emissions to 31 per cent below 1990 levels by 2010; the Energy Technology Centre of the Canada Centre for Mineral and Energy Technology works with private and other public sector partners; Methane to Markets – international initiative that advances cost-effective, near-term methane recovery and its use as a clean energy source.
Taxation instruments	Gas Tax Fund.
Emissions trading	Participation in clean development mechanism and joint implementation; Pilot Emission Removals, Reductions and Learnings Initiative; Canada’s domestic offset system; Credit for Early Action Program; inter-firm trading.
Energy	
Renewable energy sources	Hydrogen Early Adopters Initiative; Wind Power Production Incentive; tax incentives – capital costs.
Energy efficiency improvements	Schemes in the industrial processes and energy sectors for the improvement of energy efficiency include, among others, energy conservation, emissions benchmarking, energy efficiency audits, and research and development; development and application of cleaner fuel standards for new facilities, from the beginning of 2010.
Residential and commercial buildings – new buildings and retrofit schemes	Encouragement to adopt more energy-efficient and less GHG-intensive houses and buildings; retrofit scheme for residential buildings.
Energy efficiency standards	Strengthening of energy efficiency standards for a number of products (2007 Action Plan on GHG Emissions and Air Pollution), and implementing a new regulation on stand-by power.
Other	Carbon capture and storage.
Transport	
Integrated transport planning	Improvements in efficiency of transport system; reduction of demand for transport by development of alternatives for transporting passengers and urban forms of transport that reduce the dependency on cars.
Voluntary agreement on improvement of fuel efficiency	Promotion and encouragement of the use of energy-efficient vehicles, 2005–2010.
Regulations on fuel efficiency of cars and light-duty vehicles	Planned to be implemented beginning with the 2011 vehicle models.
Alternative fuels	Increase of the availability and market acceptance of lower-carbon alternative fuels, such as cellulosic and grain-based ethanol, hydrogen, hydroelectricity and biodiesel; Canadian Transportation Fuel Cell Alliance.
Industry	
Regulatory framework for industrial GHG emissions	Planned regulatory framework for industrial GHG emissions (in all sectors, emissions will have to be reduced by 18 per cent in relation to 2006 levels by the beginning of 2010, with a further 2 per cent reduction every year thereafter); Climate Change Technology Fund (2007 Action Plan on GHG Emissions and Air Pollution).
Agriculture	
	Greenhouse Gas Mitigation Program for Canadian Agriculture; Shelterbelt Enhancement Program – contributes to carbon dioxide sequestration through establishment of approx. 8,000 km of riparian buffer strips.
Waste management	
	Waste Prevention Program – measures targeted to address emissions from landfill, which account for about 95 per cent of the emissions from the waste sector.
Land use, land-use change and forestry	
	Feasibility Assessment of Afforestation for Carbon Sequestration; Forest 2020 Plantation Demonstration Assessment.

14. Canada has provided in its NC4 little or no quantitative estimates of the impacts of the adopted and implemented PaMs for any particular years. The ERT noted that this shortcoming had also been identified during the previous in-depth reviews of Canada's NC2 and NC3. While many individual PaMs have been outlined in appendix 1 to the NC4, Canada could highlight and prioritize even more, in its reporting, those PaMs that have had the most significant impact on GHG emissions and those that are effectively replicable or innovative. In response to questions raised by the ERT during the review, Canada provided quantitative estimates for priority PaMs, based on the publication *A Climate Change Plan for the Purposes of the Kyoto Implementation Act 2009*. According to this information, the total mitigation effects of these priority PaMs are estimated at 86.6 Mt CO₂ eq in 2010 and 104.8 Mt CO₂ eq in 2012, largely attributed to regulations for industrial air emissions (49–58 Mt CO₂ eq) and the Climate Change and Clean Air Trust Fund (16 Mt CO₂ eq). The ERT recommends that Canada follow the UNFCCC reporting guidelines (para. 14) more closely and give priority to the PaMs, or combinations of PaMs, which have the most significant impact on GHG emissions and removals, as well as indicate those which are innovative and/or effectively replicable by other Parties. Not every policy or measure which affects GHG emissions needs to be included in the national communication.

15. During the review, Canada indicated that a substantial amount of the information that is missing from its NC4 will be included in its next national communication. Table 3 provides a summary of the reported information on the PaMs of Canada. Performance indicators and a trend analysis have been presented for all sectors of the Canadian economy. The ERT noted that these descriptions are useful for the reader, and recommends that Canada include them in the chapter on GHG emission inventory information in its next national communication. The ERT felt that including more detailed information on performance indicators, including on their impact on the development of domestic PaMs, would help to increase transparency of Canada's future national communications.

16. The ERT noted that the sectoral split used in the chapter on PaMs in Canada's NC4 is not consistent with the UNFCCC reporting guidelines. The ERT recommends that Canada consider organizing the chapter of its next national communication along the following sectors: energy, transport, industry, agriculture, forestry and waste management.

1. Policy framework and cross-sectoral measures

17. Canada is a federation, with powers divided between the federal state, provinces and territories. Environment Canada is responsible for the overall coordination of domestic PaMs in the field of climate change. Prior to the ratification of the Kyoto Protocol, Canada's domestic climate policies had been developed in several steps through extensive consultations with all orders and levels of the Government and a wide variety of external stakeholders from industry, non-governmental organizations and the general public. In the "post-Kyoto Protocol ratification 2003–2005 period", the national climate change process shifted towards a bilateral approach in which the provincial and territorial initiatives advanced. Five memorandums of understanding (MOUs) were negotiated and signed with the federal government between 2003 and 2005. In 2005, "Moving forward on Climate Change: A Plan for Honouring our Kyoto Commitment" was released, accompanied by a notice of intent to regulate GHG emissions through the Canadian Environmental Protection Act.

18. The preamble to the NC4 describes the development of the **climate change strategy of the new Government**, which came to power in 2006. The new Government takes an integrated approach to the reduction of both GHG emissions and air pollutants. This new approach means a shift away from a voluntary and incentive-based approach towards a regulatory approach. For the 2007–2010 period, new regulations in major sectors, including industry, transport and energy products, were planned to be implemented. Options under examination included: an industry-led emissions trading system; a technology investment fund that would support the development of transformative technologies for emission reductions, to which companies, and potentially governments, could contribute; opt-in

mechanisms that would enable entities not covered by any regulation to voluntarily assume emission targets; incentives that could see companies receive credit for investment in technologies, such as CO₂ capture and storage (CCS), which are expected to lead to significant emission reductions in the future; mechanisms to recognize early action; and domestic offsets, in which so-called ‘verified emission reductions’ outside the regulated system are recognized as eligible for compliance with the regulated system. According to this new approach, the emission intensity of all industrial sectors (including electricity, oil and natural gas production) was required to be reduced by 18 per cent in relation to 2006 levels by 2010, with a further 2 per cent reduction every year thereafter.

19. In response to questions raised by the ERT during the review, Canada informed the ERT that many of the above listed elements of this new legislation were still in the process of being adopted or implemented. These include the domestic framework for industrial GHG emissions, an offset system for GHG emissions based on tradable credits (also encompassing new sinks in agriculture and forestry), programmes to increase the share of ethanol and biodiesel in the national fuel supply, projects to increase energy efficiency in housing and incentives for the production of wind power.

20. Across sectors, a number of funds have been established, providing support for cross-cutting emission reduction programmes, for instance: the Aboriginal and Northern Community Action Program; the Federal House in Order initiative; the Pilot Emission Removals, Reductions and Learnings Initiative; Opportunities Envelope (national offsetting programmes); the Green Municipal Fund; and a Greenhouse Gas Verification Centre (for offset projects). The Clean Air and Climate Change Trust Fund, for example, is expected to provide incentives to deliver GHG emission reductions of 16 Mt CO₂ eq by 2010.

2. Policies and measures in the energy sector

21. Between 1990 and 2007, GHG emissions from **energy industries** increased by 31 per cent (145 Gg CO₂ eq). This was mainly due to a 30 per cent increase in demand for electricity, with power continuing to be generated using fossil fuels, mainly domestic coal. Emissions from the **fossil fuel industries, and fugitive emissions**, also increased substantially. Total emissions associated with the production, processing and transmission of oil and gas increased by about 44 Gg CO₂ eq during the 1990–2007 period.

22. Emissions of CO₂ from fuel combustion in the **manufacturing industries** decreased by 13 per cent between 1990 and 2007, owing mainly to structural changes and large emission reductions following fuel switches (to biomass waste) in the pulp and paper industries.

23. The level of emissions from **energy use in buildings** was 15 per cent higher in 2007 than in 1990, owing mainly to an increase in the total floor space in commercial and institutional buildings and an increase in the numbers of dwellings. This increase in emissions was to some extent offset by energy efficiency improvements, which were mainly the result of thermal insulation and fuel switching, and to some extent the use of more energy-efficient equipment and appliances.

24. The trend in GHG emissions from transport showed an increase of 39 per cent over the 1990–2007 period. The main driver for this rise in emissions was the increasing number of passenger and freight-vehicle kilometres travelled. In the case of light-duty trucks (sport-utility vehicles and pick-up trucks), passenger-vehicle kilometres increased, while for passenger cars they decreased. GHG emissions from road freight transport rose by 94 per cent between 1990 and 2007, as a result of the increase in road freight transport activity owing to free trade and the deregulation of the truck market.

25. **Energy supply** is within the competencies of the provincial governments, which also make the decisions on power generation. PaMs to promote **renewable energy sources** (RES) have been introduced by most provinces and territories. Nonetheless, only a minor share of the electricity produced in 2004 was from emerging RES, as electricity prices were relatively low, owing to sufficient access to

hydropower and low-cost electricity from conventional power stations. As demand for electricity rose, the share of electricity produced from fossil fuels increased from 22 to 26 per cent between 1990 and 2004. The ERT encouraged Canada to provide quantitative estimates of the effectiveness of its PaMs to promote RES in its next national communication.

26. Among all RES in Canada, small hydropower shows the largest (economic feasible) technical potential. However, wind power has been the fastest-growing source of electricity from RES in the country. A major share of Canada's electricity from RES is already generated from the combustion of forest waste. Federal policy initiatives to promote electricity production from RES include overall tax exemptions for investments in RES; a programme to reduce barriers to interprovincial trade and transmission of electricity (terminated); and an initiative to provide financial incentives for the development of wind energy. Electricity production from RES is also part of the Large Final Emitters (LFE) programme and the 2006 initiative to regulate GHG emissions and emissions of air pollutants from key industrial sectors.

27. Emissions from **oil production** have increased substantially, owing to the conditions of oil exploitation becoming more difficult and the large and growing share of heavy oil production. Several PaMs have been or are expected to be introduced to address these emissions, including the expansion of the voluntary Canadian Industry Program for Energy Conservation, of the CCS initiative and of the LFE System, including the introduction of a regulation on GHG emissions. The ERT noted that Canada did not provide quantitative estimates of the mitigation effects of these PaMs in its NC4 and encourages the Party to do so in its next national communication.

28. **Energy demand.** There is a large number of PaMs in place to promote **energy efficiency** in all end-use sectors. Energy efficiency improvements also played an important role in limiting the growth of overall energy demand and the related GHG emissions in the country between 1990 and 2004. According to the NC4, ongoing energy efficiency improvements in all end-use sectors limited the increase in energy demand to 23 per cent over this period. Canada has estimated that, in the absence of these energy efficiency improvements, by 2004 energy demand would have increased by 36 per cent and the level of related GHG emissions would have been higher by about 53.6 Gg CO₂ eq. The ERT noted that although these PaMs have certainly contributed to this increase in energy efficiency, an assessment of to what degree these energy efficiency improvements would have occurred even in the absence of such PaMs has not been provided in the NC4.

29. In the **industrial sector**, there are several programmes in place to support energy efficiency improvements and fuel switches through information, financial incentives and voluntary commitments. In response to questions raised by the ERT during the review, Canada indicated that it is developing a comprehensive regulatory regime for GHG emissions from major industrial sources, to be implemented under the Canadian Environmental Protection Act 1999. Canada provided a preliminary estimate for expected reductions that could result from this regulatory framework of 46.6 Mt CO₂ eq in 2010. Furthermore, during 2009, Canada has been reviewing this proposed regime to align it with the emerging cap and trade programme in the United States of America. Canada intends to announce the full suite of specific policies to deal with all major sources of emissions before the Conference of the Parties will take place in December 2009. The ERT encourages Canada to provide more detailed information on these programmes in its next national communication.

30. In the **buildings sector**, PaMs are directed at existing buildings, new buildings, appliances and targeted clientele. There are tools to evaluate energy demand for existing residential, commercial and institutional buildings, and incentive schemes for retrofits. There are also programmes to encourage the construction of new buildings which are at least 25 per cent more energy-efficient than the current minimum standard of the Model National Energy Code for Buildings.

31. More than 30 product classes of appliances are now covered by **minimum energy performance standards**. These standards set a minimum energy efficiency for a given product class. These products consume 80 per cent of the energy used in the residential sector and 50 per cent of the energy used in the commercial/institutional sector. It is estimated that the minimum energy performance standards as at 2004 will result in aggregate energy savings of 178 PJ in 2010. These standards were planned to be strengthened for a number of products as part of the 2007 Action Plan on GHG emissions and Air Pollution. It remained unclear to the ERT whether these plans were implemented. The ERT encourages Canada to report on these plans in its next national communication.

32. The Renewable Energy Deployment Initiative is a small programme that promotes **renewable energy systems** by providing information on, and financial incentives for, space and water heating and cooling within the business, industrial and institutional sectors.

33. **Transport sector.** In 2004, the transport sector was the second largest source of GHG emissions and accounted for 24.0 per cent of the total GHG emissions. PaMs in this sector include infrastructure modernization and adaptation; the upgrading of urban planning for the development of efficient and integrated transport systems; technology development; and activities to promote behavioural change.

34. The **Motor Fuel Efficiency Initiative** is based on a 2005 MOU between the Government of Canada and the Canadian Automotive Industry to take action to reduce emissions from new light-duty vehicles, so that, by 2010, the annual reduction in emissions will have reached 5.3 Mt CO₂ eq. This will be achieved by technological improvements and behavioural change. The ERT noted that the further development of this commitment has not been followed up in the NC4.

35. For freight transportation, **voluntary performance agreements** are being established between the federal government and industry associations as part of the Freight Efficiency and Technology Initiative. The Canadian strategy also includes an Off-Road Vehicles and Equipment Initiative.

36. The Government plans to introduce **mandatory requirements for the fuel efficiency** of cars and light-duty trucks, starting with the 2011 vehicle models, once the voluntary agreement with the car manufacturers has expired.

37. In order to promote the use of **alternative fuels**, several initiatives have been undertaken to promote fuel cell vehicles, natural gas vehicles and the expansion of the use of ethanol. In addition, lower-carbon fossil fuels and biofuels are exempt from excise tax. The ERT noted that, according to the NC4, PaMs for the mitigation of GHG emissions in the transport sector have been introduced only recently and, therefore, a substantial shift from vehicles using gasoline to those using alternative fuels was not yet visible. Furthermore, gains in the energy efficiency of passenger cars have so far been offset by the increased market share of vans and sport-utility vehicles. The ERT encourages Canada to provide follow-up information on PaMs in the transport sector, including quantitative estimates of mitigation effects, in its next national communication.

3. Policies and measures in other sectors

38. Emissions of GHGs from the non-energy sectors accounted for 20.7 per cent of the total GHG emissions in 1990 and 17.8 per cent in 2007. Between the base year and 2007, GHG emissions from industrial processes (including solvent and other product use), agriculture and waste increased by 8.5 per cent, mainly driven by the increase in emissions in the agriculture and waste sectors.

39. **Industrial processes.** Between the base year and 2007, GHG emissions from industrial processes decreased by 6.2 per cent. This decrease was mainly due to the reduction of emissions from the production of adipic acid, aluminium and magnesium. Canada promotes the use of supplementary and less CO₂-intensive cementing materials to substitute cement in the production of concrete. Also,

Canada is planning to recycle more materials, which will result in a reduction of GHG emissions from the manufacturing industries.² Canada has identified further potential for reducing GHG emissions through electricity cogeneration using off-gas (e.g. in steel production) and by replacing the lime in mine effluent treatment with cement kiln dust.

40. **Agriculture.** Between the base year and 2007, GHG emissions from agriculture increased by 23.1 per cent, which was mainly as a result of the expansion of the beef cattle and swine populations since 1990, as well as of the increase in the use of synthetic nitrogen fertilizers. Canada implemented the GHG Mitigation Program for Canadian Agriculture, which works towards reducing GHG emissions from agriculture and making the industry sustainable. The programme's measures, covering the 2001–2006 period, were targeted at soil, nutrient and livestock management, as well as at increasing carbon sinks. Meanwhile, the Shelterbelt Enhancement Program was designed to reduce GHGs through increased shelterbelt plantings on agricultural lands across the prairies (8,000 km of shelterbelt in addition to the existing annual planting commitments by 2006).

41. **Forestry.** Canada's net emissions and removals of GHGs from LULUCF display high inter-annual variability over the reporting period. In 1990, LULUCF was a net sink, removing 51,565.5 Gg CO₂ eq from the atmosphere, while in 2007, LULUCF was a net source, emitting 45,453.3 Gg CO₂ eq or 6.1 per cent of total GHG emissions (without LULUCF). A Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS), mentioned in the NC3 and NC4, was completed in March 2005. Building upon the work of the FAACS initiative, the Forest 2020 Plantation Demonstration and Assessment Initiative explored the use of fast-growing tree plantations to help Canada achieve its goals in relation to climate change and fibre production. It analysed the investment potential of the plantations, assessed options to attract private investment in the plantations and demonstrated the potential of these plantations to help Canada reduce its GHG emissions.

42. In response to a question raised by the ERT in the context of the review, Canada clarified that it has not planned, adopted or implemented any new agricultural or LULUCF activities since the publication of the NC4. However, Canada has continued to increase the implementation of existing agricultural and LULUCF activities, such as no-till and reduced tillage practices and reduced frequency of summer fallow practices.

43. **Waste.** GHG emissions from the waste sector increased by 13.4 per cent during the 1990–2007 period. The increasing trend in emissions from waste management was related to the increase in the rate of CH₄ generation from municipal solid waste. The National Office of Pollution Prevention administers the Waste Prevention Program, which focuses on the sustainable management of solid non-hazardous waste by developing, implementing and coordinating national programmes that promote waste prevention and sustainable waste management.

C. Projections and the total effect of policies and measures

1. Projections

44. The GHG emission projections provided by Canada in the NC4 comprised a single 'with measures' scenario until 2020. Projections are presented on a sectoral basis, but the sectoral categories used do not entirely correspond with those used in the PaMs section. In addition, projections are provided in an aggregated format for each sector, except for LULUCF, as well as for a national total, using global warming potential values. However, the ERT noted that Canada did not provide the following reporting elements required by the UNFCCC reporting guidelines: emission projections presented relative to actual inventory data for the preceding years (para. 31), projections presented on a gas-by-gas basis for the following GHGs: CO₂, CH₄, N₂O, perfluorocarbons (PFCs), hydrofluorocarbons

² <www.recycle.nrcan.gc.ca>.

(HFCs) and sulphur hexafluoride (SF₆) (treating PFCs and HFCs collectively in each case) (para. 35), projections in an aggregated format for each sector as well as for a national total, using global warming potential values agreed upon by the Conference of the Parties (para. 35), and emission projections related to fuel sold to ships and aircraft engaged in international transport reported separately and not included in the totals (para. 36). The ERT recommends that Canada follow the UNFCCC reporting guidelines more closely and provide these reporting elements in its next national communication. Table 4 and the figure below provide a summary of GHG emission projections for Canada.

45. The projections were, for the most part, prepared using the Model for the Analysis of Policies Linked to Energy-Canada (Maple-C), a model based on the United States National Energy Modelling System, which was originally used for the analysis presented in the document entitled “Canada’s Energy Outlook”. The projections were prepared using a market-based approach to energy supply and demand that concerned each fuel and energy-consuming sector. Key assumptions included steady growth in economic activity (2.7 per cent GDP growth per year until 2010 and 2.3 per cent GDP growth per year between 2010 and 2020) and an increase in real disposable income. Crude oil prices were assumed to remain constant at USD 45 per barrel. The PaMs which were included in the projections under the ‘with measures’ scenario are summarized in annex 5.2 to the NC4 under the headings residential and commercial equipment standards, transportation, alternative transportation fuels, industry, electricity and upstream. The ERT noted that only a subset of the PaMs described in NC4 chapter on PaMs was also included in the projections under the ‘with measures’ scenario and recommends that Canada, in its next national communication, explain the rationale for this.

Table 4. Summary of greenhouse gas emission projections for Canada

	Greenhouse gas emissions (Tg CO ₂ eq per year)	Changes in relation to base year level (%)
Inventory data 1990 ^a	591.79	0.0
Inventory data 2007 ^a	747.04	26.2
Kyoto Protocol base year ^b (revised value)	594.00	0.0
Kyoto Protocol target ^b	558.36	-6.0
‘With measures’ projections for 2010 ^c	828.00	39.9 ^d
‘With additional measures’ projections for 2010 ^e	682.00	14.8

^a Data source: Canada’s 2009 greenhouse gas inventory submission; the emissions are without land use, land-use change and forestry.

^b Based on the initial review report contained in document FCCC/IRR/2007/CAN.

^c Data source: Canada’s fourth national communication (NC4).

^d 38.2 per cent, if based on NC4 estimate of base year emission level.

^e Data source: Environment Canada: *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act 2009*.

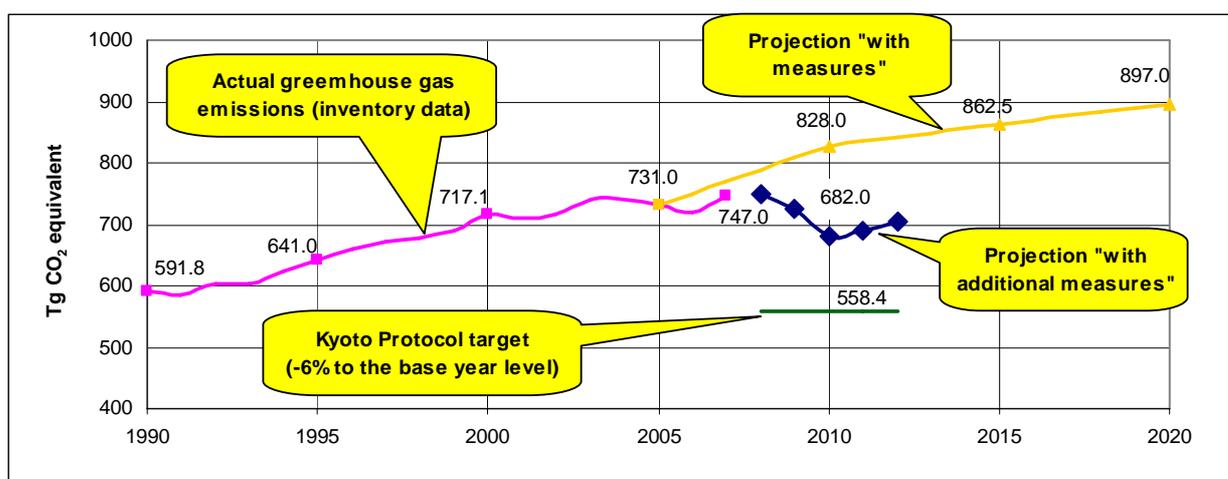
46. Since the NC3, projection methods and assumptions have been revised considerably. According to the NC4, the combined effect of the changes in methodologies and the changes in assumptions is an increase in the projected emission level for 2010 by 58 Mt CO₂ eq, which equals 9.8 per cent of the base year level. According to the NC4 projections, GHG emissions under the ‘with measures’ scenario are projected to increase to 828.0 Mt CO₂ eq in 2010. The ERT noted that this is 39.9 per cent above the 1990 emission level. The ERT calculated the difference between Canada’s emission level projected for 2010 and its emission target under the Kyoto Protocol (6 per cent below the 1990 level) as 269.6 Mt CO₂ eq or 45.9 per cent of the base year emission level.³

47. The ERT noted that a ‘with additional measures’ scenario, with a reduced Kyoto Protocol gap, has not been provided in the NC4. However, in response to a question raised by the ERT during the

³ Note: The projections do not include GHG emissions/removals from LULUCF.

review, Canada provided a new set of projections, as published in the report *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act 2009*, which could be considered as ‘with additional measures’ scenarios (see table 4). According to this plan, total GHG emissions under the reference case scenario (including Government measures) are projected to reach 691.0 Mt CO₂ eq by 2010. Under an alternative scenario, based on assumptions for higher energy prices and slower GDP growth than in the reference case scenario, total GHG emissions (including Government measures) are projected to reach 682.0 Mt CO₂ eq by 2010. However, Environment Canada clarified that it was premature to estimate the resulting emission reductions in the context of this plan. The ERT calculated the difference between Canada’s emission level under the “alternative scenario” projected for 2010 and its emission target under the Kyoto Protocol (6 per cent below the 1990 level) as 123.64 Mt CO₂ eq or 20.8 per cent of the base year emission level.⁴

Greenhouse gas emission projections



Data sources: (1) Inventory data for the years 1990–2007: Canada’s 2009 greenhouse gas inventory submission; the emissions are without land use, land-use change and forestry (LULUCF). (2) Projection “with measures” for the years 2008–2020: Canada’s fourth national communication; the emissions are without LULUCF. (3) Projection “with additional measures” for the years 2008–2012: Environment Canada: *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act 2009*; the emissions are without LULUCF.

48. In contrast to the NC3, which contained three different scenarios (business as usual, with measures, and with additional measures), the NC4 only presents a ‘with measures’ scenario. In order to increase the transparency of Canada’s reporting under the Kyoto Protocol, the ERT encourages Canada to return to its earlier practice and provide also a ‘without measures’ and a ‘with additional measures’ scenario in the chapter on GHG emission projections of its next national communication.

49. In the absence of numerical data, it remained unclear to the ERT whether the projections were presented relative to actual inventory data for the preceding years. The ERT recommends that Canada provide in its next national communication data on projections also in table form, and use the same sectors for the projections as are used in the section on PaMs, as required by the UNFCCC reporting guidelines (para. 34). The ERT also encourages Canada to separately report emission projections related to fuel sold to ships and aircraft engaged in international transport and to not include these in the totals.

2. Total effect of policies and measures

50. The ERT noted that Canada did not provide the following reporting elements required by the UNFCCC reporting guidelines: the estimated and expected total effect of implemented and adopted

⁴ Note: The projections do not include GHG emissions/removals from LULUCF.

PaMs (para. 39), an estimate of the total effect of its PaMs, in accordance with the ‘with measures’ definition, compared with a situation without such PaMs, presented in terms of GHG emissions avoided or sequestered, by gas (on a CO₂ eq basis) in 1995 and 2000 (para. 40), and relevant information on factors and activities for each sector for the years 1990 to 2020 (para. 48). The ERT recommends that Canada follow the UNFCCC reporting guidelines more closely and include these reporting elements in its next national communication.

51. Canada has not provided in its NC4 quantitative information on how it plans to close its ‘Kyoto Protocol gap’ (see paragraphs 44 and 47 above). The ERT noted that the PaMs included in the ‘with measures’ scenario are not sufficient to close this gap. In response to a question raised by the ERT during the review, Canada clarified that it has invested 23 million Canadian dollars in the World Bank’s Prototype Carbon Fund, its Community Development Carbon Fund and its BioCarbon Fund, and that it estimates that this investment will result in credits corresponding to about 1.8 Mt CO₂ eq by 2012. The ERT felt that Canada could provide more information on the PaMs adopted, implemented or planned, and on the planned use of the Kyoto Protocol mechanisms, in order to reach its Kyoto Protocol target, in its next national communication.

D. Vulnerability assessment, climate change impacts and adaptation measures

52. In its NC4, Canada has provided the required information on the expected impacts of climate change in the country and on adaptation options. However, Canada did not provide an explicit indication of the range of models and scenarios used. Although an increase in the number of research projects and activities has been reported, relative to the number reported in the NC3, the ERT found it difficult to gain an overall understanding of the adverse and possible positive impacts across the sectors of the projected climate change. Adverse impacts have been described qualitatively, but are generally not quantified in socio-economic terms. Certain key projections, such as those of sea-level rise and the responses of biodiversity, have not received attention. Possible impacts, such as the impact on summer tourism, have also not been fully considered. Adaptation responses have not been considered in a consistent way and lack institutional coherence, particularly in the case of integrated planning and disaster risk reduction. Table 5 summarizes the main information on vulnerability and adaptation to climate change presented in the NC4.

53. Canada has substantively broadened and deepened its understanding of climate risks and its adaptive capacity, through increased research. Noteworthy efforts to optimize adaptation and to improve awareness through communication and capacity-building have been described. Efforts to integrate indigenous knowledge into impact and adaptation assessments are under way. The ERT noted that the biodiversity and conservation sectors have not been explicitly considered in the NC4, although additional information provided by Canada during the review highlighted national research and implementation actions which are under way. The vulnerability of hydropower generation to constraints on the water supply, which was highlighted in the NC3, was not elaborated upon in the NC4. The ERT further noted that quantitative socio-economic information on climate change impacts has not been reported in the NC4, although Canada did indicate actions under way to address this, during the review process.

Table 5. Summary of information on vulnerability and adaptation to climate change

Vulnerable area	Examples/comments/adaptation measures reported
Food supply (agriculture and fisheries)	Potential gains in crop production owing to higher temperatures and extended growing seasons, and higher survival rate of livestock. Adverse impacts from increased winter damage of forage crops, increased insect pest infestations, heat stress in livestock, and water shortages. <i>Adaptation:</i> Crop insurance programmes; increased resilience of livestock operations thanks to buildings designed to withstand extreme climate events; promotion of best management practices to reduce vulnerability to changes in water supply, extreme climate events and crop disease; more efficient use of water in crop and livestock operations.
Forestry	Species expected to migrate northwards and to higher altitudes. Complex positive and negative impacts on trees owing to changing seasonal temperatures and precipitation; increased over-winter survival of some insect pests; and the impact of the insects combined with more frequent droughts to result in more frequent and intense forest fires. <i>Adaptation:</i> Initiatives to alter forest fuels in boreal forests (e.g. FireSmart); several provincial forest-related initiatives, such as Action Plan for Mountain Pine Beetle (British Columbia) and Forest Fire Management Strategy (Saskatchewan).
Communities and infrastructure	Location-dependent impacts and vulnerabilities (e.g. southern Prairie communities particularly sensitive to decreasing water supply; indigenous and other Arctic communities vulnerable to impacts of warming, snowmelt and thawing on infrastructure, mobility and wildlife resources; urban centres vulnerable to extreme climate events, increased heat stress and associated issues related to air quality); overall vulnerability to extreme climate events and climate hazards. <i>Adaptation:</i> Subnational legislation on emergency and disaster management planning; Infrastructure Canada – fiscal measures to advance implementation of adaptation projects.
Water resources	Increased winter flows expected in many regions, decreased summer flows and warmer summer water temperatures could lead to a reduction in water quality, especially in the south <i>Adaptation:</i> Refining jurisdictional roles and responsibilities, enabling more integrated management among jurisdictions; enhancing adaptive capacity through existing institutional frameworks (e.g. water licensing systems).
Tourism and recreation	Impact on length and quality of outdoor recreation seasons and on the quality of natural resources. <i>Adaptation:</i> Use of snowmaking technology.
Human health	Adverse impacts are expected to be particularly significant on vulnerable populations, such as the elderly, children, the infirm and the poor; rural residents, those relying on natural resources for their livelihood and food, are also expected to be vulnerable. <i>Adaptation:</i> Your Health and a Changing Climate: Information for Health Professionals (published 2005).
Transportation	Northern ice roads, Great Lakes shipping, coastal infrastructure and infrastructure situated on permafrost are identified as the most vulnerable components of the transport system. Positive impacts include possible lower vehicle maintenance costs and the viable navigability of the north-west passage over the next two decades. <i>Adaptation:</i> Current planning processes must take into consideration the likely impacts of climate change on transport demand and technological advances, and assess what adaptive responses will increase the resilience of the transport system.

54. The ERT acknowledged the need for Canada to provide, in its next national communication, an integrated analysis of the adverse and positive impacts of climate change, in a coordinated vulnerability and impact assessment for Canada as a whole, including the biodiversity sector, using a range of climate models and scenarios and quantitative assessments. Given the advances made in Canada's NC3, its NC4 falls short of reflecting a deeper understanding of climate change impacts and adaptation responses. Furthermore, the ERT noted a clear gap in terms of Canada's reporting on the vulnerabilities of the processes and species of the cryospheric and Arctic ecosystems.

E. Financial resources and transfer of technology

1. Financial resources

55. In its NC4, Canada has provided details of measures taken to give effect to its commitments under Article 4, paragraphs 3, 4 and 5, of the Convention. Canada has also provided detailed information on the assistance it has made available to developing country Parties that are particularly vulnerable to the adverse effects of climate change. Furthermore, Canada has provided information on financial resources related to the implementation of the Convention provided through bilateral, regional and other multilateral channels. However, the ERT noted that Canada did not provide the following reporting elements required by the UNFCCC reporting guidelines: an indication of what 'new and additional'

financial resources it has provided pursuant to Article 4, paragraph 3, and a clarification of how it has determined such resources as being ‘new and additional’ in its NC4. Therefore, the ERT recommends that Canada indicate what ‘new and additional’ financial resources it has provided pursuant to Article 4, paragraph 3, and clarify how it has determined such resources as being ‘new and additional’ in its next national communication. Table 6 summarizes information on financial resources.

Table 6. Summary of information on financial resources and technology transfer

Official development assistance (ODA)	In 2000, the Government of Canada (GoC) established the 100 million Canadian dollars Canada Climate Change Development Fund, managed by the Canadian International Development Agency.
Climate-related aid in bilateral ODA	Including regional and bilateral, up to a total of CAD 283.4 million over eight years (1997–2005), covering several climate-related sectors.
Climate-related support programmes	A series of programmes and projects have been briefed in section 7.3.1 of Canada’s NC4.
Contributions to GEF (CAD million)	First replenishment period: 111.11 Second replenishment period: 122.09 Third replenishment period: 158.94, including 10 to least developed countries (see table 7.2.1 in the NC4)
Activities implemented jointly	NA
JI and CDM under the Kyoto Protocol	Canada’s CDM and JI Office received CAD 28.7 million in funding for the 2001–2006 period.
Other (bilateral/multilateral)	Between 1999 and 2004, various multilateral institutions have been financed by Canada.
Technology transfer	An initiative of the GoC, the Technology Early Action Measures (TEAM) Program has supported 17 international projects in 15 countries, with contributions of CAD 16.4 million since its inception in 1998. TEAM brings together private and public sector partners to identify, develop and support the most promising clean energy and GHG-reducing technology solutions for Canada and abroad, in partnership with Canadian and foreign government programmes.

Abbreviations: CDM = clean development mechanism, GEF = Global Environment Facility, JI = joint implementation, NA = not available, NC4 = fourth national communication.

56. The ERT noted that funded projects and programmes included: the Landfill Gas Project in the Latin American and Caribbean Region; the ARPEL Environmental Project Phase III; the Canada-Ukraine Environment Cooperation Program; Adaptive Policymaking for Agriculture and Water Resources; Making the Clean Development Mechanism Work for Developing Countries; the Communities and the Impact of Climate Change Conference; and NRCan (fuel cell). These projects and programmes were supported by the following three frameworks: The Canada Climate Change Development Fund; the Canadian International Development Agency’s Sustainable Development Programming; and the International Development Research Centre. The ERT acknowledged Canada’s complete and comprehensive reporting in this section.

57. Canada’s CDM and JI Office has facilitated the development of more than 50 clean development mechanism (CDM) and joint implementation (JI) projects involving Canadian entities. These projects are in various stages of the development and approval process. Market studies have been completed for Argentina, Brazil, Bulgaria, the Caribbean, Central America, Chile, China, Costa Rica, El Salvador, Guatemala, Honduras, India, Kazakhstan, Malaysia and South Africa, while CDM project portfolios have been produced or are under development in Chile, China, India, Indonesia, Latin America, Mexico, Nigeria, Russia and South Africa.

2. Transfer of technology

58. In its NC4, Canada has provided details of measures related to the promotion, facilitation and financing of the transfer of, or access to, environmentally sound technologies, and clearly distinguishes

between activities undertaken by the public sector and those undertaken by the private sector. It also reports activities related to technology transfer, including success and failure stories, and its activities for financing access by developing countries to 'hard' or 'soft' environmentally sound technologies. Furthermore, Canada has reported on steps taken by governments to promote, facilitate and finance transfer of technology, and to support development and enhancement of endogenous capacities and technologies of developing countries. However, the ERT noted that Canada did not provide the following reporting elements required by the UNFCCC reporting guidelines: its activities for financing access by developing countries to 'hard' or 'soft' environmentally sound technologies (para. 55), and information, in textual format, on steps taken by governments to support development and enhancement of endogenous capacities and technologies of developing countries (para. 56).

59. The ERT noted that various activities and initiatives related to technology transfer have been reported. Most of them are in the form of projects or programmes related to market research policy studies; communication; workshops; and planning and networking among stakeholders, with a view to developing public-private partnerships.

60. Another initiative is the Canadian International Technology Initiative, which consists of two elements: (a) technology transfer and promotion; and (b) analytical support, including market analysis and statistical monitoring of climate change technologies. Canada invested CAD 9.75 million in this initiative over five years, from 2001/2002 to 2005/2006. Canada is also making efforts in technology transfer via the Canada Centre for Mineral and Energy Technology's Energy Technology Centre, a leading federal government science and technology organization. Communication, dialogue and cooperation are also established via a series of MoUs and agreements with international partners.

F. Research and systematic observation

61. Canada has provided information on its actions relating to research and systematic observation, and addressed both domestic and international activities, including its key leadership roles in the World Climate Programme, the International Geosphere-Biosphere Programme, the Global Climate Observing System (GCOS), and the Intergovernmental Panel on Climate Change. The NC4 also reflects action taken to support related capacity-building in developing countries (e.g. Bangladesh, Central America, the Middle East and the Southern African Development Community), though this is limited to the support of hydrological monitoring systems. Furthermore, Canada has provided a summary of information on GCOS and related international systematic observation activities (in accordance with para. 64 of the UNFCCC reporting guidelines).

62. Canada has developed and is building up a significant body of activities relating to research and systematic observation in terrestrial, ocean, cryospheric, atmospheric and space-based fields, leading to substantive advances in the modelling of global and regional climate and impacts, and the regional and local monitoring of trends. These activities are enhanced by efforts to rescue archival material and paleoclimatic research. Trends indicate significant warming of oceans, cryosphere and atmosphere, which is likely to have significant regional and global implications. The monitoring of cryospheric responses, in particular, could allow enhanced reporting on the vulnerabilities of the cryospheric and Arctic ecosystems. Mitigation research has focused mainly on biological sinks. The ERT noted the apparent gap in Canada's reporting in relation to research on the socio-economic impacts of climate change.

63. The ERT noted that potential vulnerabilities in the cryospheric and Arctic ecosystems are of high relevance to the global climate system, and could therefore represent a key reporting topic for Canada in its future national communications.

G. Education, training and public awareness

64. In the NC4, Canada has provided information on its actions relating to education, training and public awareness, as required by the UNFCCC reporting guidelines (para. 65).

65. The Government of Canada offers broad support for the implementation of activities related to education and public awareness through the Climate Change Action Fund (CCAF), for example the public education and outreach (PEO) programme. Phase II of the PEO programme, which undertakes activities to advance national awareness in communities and among young people and educators, business and industry, and the general public, has been described in the NC4. The Science, Impacts and Adaptation component of CCAF aims to advance knowledge of climate change and its impact on Canada.

66. PEO programmes and measures implemented between 2001 and 2004 have been described in the NC4. The Government of Canada invested up to CAD 150 million in CCAF. CCAF continues to support university and government-based Canadian scientists. Ministerial programmes that fund non-profit organizations to carry out community-based projects on education and public awareness have also been described in the NC4. These promote partnerships between government, industry and the community, and involve international collaboration on research (e.g. with Mexico and the United States of America), focusing on individual and organizational energy efficiency issues.

67. Provincial and territorial governments have increased investment in climate change awareness, training and education since 2001, including support for environmental non-governmental organizations, publication of educational documents, awareness-raising events, and inclusion of climate change in the curriculum at all educational levels. CCAF found that a developing national network of regional climate change centres (hubs) has played a significant role in increasing the awareness, motivation and coordination of stakeholders.

68. A government-driven national campaign (the One-Tonne Challenge), launched in March 2004 with CAD 45 million worth of funding approved for 2003–2006, encouraged Canadians to reduce their GHG emissions by one tonne per year.

III. Evaluation of information contained in the report demonstrating progress and of supplementary information under Article 7, paragraph 2, of the Kyoto Protocol

A. Information contained in the report demonstrating progress

69. Canada's RDP includes four chapters, which contain most of the information required by decisions 22/CP.7 and 25/CP.8. The ERT noted that the following information requested by these decisions was not provided: an evaluation of how domestic measures, in the light of the emission trends and projections, will contribute to Canada's meeting its commitments under Article 3. The ERT found the information contained in the RDP to be consistent with that provided in the NC4.

70. Environment Canada has been designated the role of sole inventory agency, with overall responsibility for the national inventory and the national inventory report. Procedural arrangements (MoUs and data-sharing agreements) have been established between Environment Canada and other federal departments. Canada has also established an official designated national authority for CDM activities and a focal point for JI activities housed at the Department of Foreign Affairs and International Trade.

71. According to the 'with measures' projections provided in the NC4 and the RDP, Canada's total GHG emissions are forecast to increase by about 1.5 per cent annually between 2004 and 2010, and projected to reach 828 Gg CO₂ eq by 2010 and 897 CO₂ eq by 2020. Canada has established a

medium-term target to reduce GHG emissions by 20 per cent by 2020, and a long-term target to reduce GHG emissions by between 60 and 70 per cent by 2050. Both targets are relative to a 2006 baseline. The ERT noted that Canada has not clarified in its NC4 how it plans to meet its Kyoto Protocol target for the first commitment period.

72. Canada has remained focused on using domestic actions to reduce or remove GHG emissions over the short and medium term, and on implementing transformative change to facilitate reductions in emissions over the longer term. Canada has stated in its NC4 that it does not currently have plans to include international purchases under the Kyoto Protocol mechanisms in its efforts to reduce GHG emissions.

B. Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol

73. Canada has provided most of the supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in its NC4 and RDP. The supplementary information is placed in different sections of the NC4 and RDP. Table 7 provides references to the NC4 and RDP chapters in which supplementary information is provided.

Table 7. Overview of supplementary information under Article 7, paragraph 2, of the Kyoto Protocol

Supplementary information	Reference
Supplementary relating to the mechanisms pursuant to Articles 6, 12 and 17	NC4, p. 66 RDP, p. 11
Policies and measures in accordance with Article 2	NC4, pp. 61–138 RDP, p. 5 and p. 11
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	RDP, p. 6
Information under Article 10	RDP, pp. 12–14
Financial resources	NC4, pp. 169–192 RDP, p. 14

74. Canada has not reported the following elements of the supplementary information required under Article 7, paragraph 2, of the Kyoto Protocol: (a) a description of the national registry; and (b) a description of national legislative arrangements and administrative procedures relating to the implementation of activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. With regard to the description of the national registry, Canada has referred to the supplemental information contained in the Initial Review Report and has provided this information to the ERT. The ERT noted that the national system, along with the implementation of activities under Article 3, paragraphs 3 and 4, is more clearly described in Canada's initial report. The ERT recommends that Canada include these reporting elements and a more detailed description of the national system in its next national communication, following the reporting guidelines (decision 15/CMP.1).

IV. Conclusions

75. Between 1990 and 2007, total GHG emissions excluding emissions and removals from LULUCF increased by 26.2 per cent, whereas total GHG emissions including net emissions or removals from LULUCF increased by 46.7 per cent. These increases were mainly attributed to CO₂ emissions, which grew by 29.5 per cent over this period. This growth took place mainly in the energy sector, where emissions from electricity and heat production, from production, processing and transportation of oil and gas, and from road transport increased substantially.

76. The new Canadian Government, which came into power in 2006, takes an integrated approach to the reduction of both GHG emissions and air pollutants. This has meant a shift away from a voluntary and incentive-based approach towards a regulatory approach. For the 2007–2010 period, new regulations

in major sectors, including industry, transport and energy products, were planned to be implemented. However, many of the elements of these new regulations were still in the process of being adopted or implemented at the time of the review.

77. In the NC4 and RDP, Canada presents GHG projections for the period from 1990 to 2020. These projections include a 'with measures' scenario, which includes the effect of currently implemented and adopted PaMs. According to these projections, Canada's total GHG emissions are forecast to increase by about 1.5 per cent annually between 2004 and 2010, and are projected to reach 828 Gg CO₂ eq by 2010 and 897 Gg CO₂ eq by 2020. The ERT calculated the difference between Canada's emission level projected for 2010 and its emission target under the Kyoto Protocol (6 per cent below the 1990 level) as 269.6 Mt CO₂ eq or 45.9 per cent of the base year emission level (without LULUCF activities).

78. No information has been provided in the NC4 on additional measures that would make it possible to close the Kyoto gap. However, in response to a question raised by the ERT during the review, Canada provided a new set of projections, as published in the report *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act 2009*, which could be considered as 'with additional measures' scenarios. According to this plan, total GHG emissions under the reference case scenario (including Government measures) are projected to reach 691.0 Mt CO₂ eq by 2010. Under an alternative scenario, based on assumptions for higher energy prices and slower GDP growth than in the reference case scenario, total GHG emissions (including Government measures) are projected to reach 682.0 Mt CO₂ eq by 2010. The ERT calculated the difference between Canada's emission level under the "alternative scenario" projected for 2010 and its emission target under the Kyoto Protocol (6 per cent below the 1990 level) as 123.64 Mt CO₂ eq or 20.8 per cent of the base year emission level.

79. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Canada's reporting under the Convention and its Kyoto Protocol. The key recommendations⁵ are that Canada, in its next national communication:

- (a) Highlight and prioritize by sector the PaMs that have had the most significant mitigation effect and those that are replicable or innovative;
- (b) Provide emission projections in an aggregated format for each sector as well as for a national total, projections presented relative to actual inventory data for the preceding years, projections presented on a gas-by-gas basis, and emission projections related to fuel sold to ships and aircraft engaged in international transport reported separately and not included in the totals;
- (c) Provide data on projections also in table form and use the same sectors for the projections as are used in the section in the NC4 on PaMs;
- (d) Include the estimated aggregated effect of implemented PaMs, and provide more information on the PaMs planned and adopted in order to reach or approach the Kyoto target;
- (e) Indicate what 'new and additional' financial resources it has provided pursuant to Article 4, paragraph 3, and clarify how it has determined such resources as being 'new and additional';
- (f) Provide all the supplementary information under Article 7, paragraph 2, of the Kyoto Protocol.

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

80. The ERT also encourages Canada, in its next national communication, to:
- (a) Return to its earlier practice and provide also a 'without measures' and a 'with additional measures' scenario in the chapter in its NC4 on GHG emission projections;
 - (b) Provide an integrated analysis of the adverse and positive impacts of climate change, in a coordinated vulnerability and impact assessment for Canada as a whole, including the biodiversity sector, using a range of climate models and scenarios and quantitative assessments;

Annex

Documents and information used during the review

A. Reference documents

“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 preparation of the information required under Article 7 of the Kyoto Protocol”. Decision 15/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>>.

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Fourth national communication of Canada. Available at <<http://unfccc.int/resource/docs/natc/cannc4.pdf>>.

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2009 greenhouse gas inventory submission of Canada. Available at <http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4771.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Normand Tremblay (Environment Canada), including additional material on updated policies and measures, greenhouse gas projections, the national registry and recent developments in Canada's climate policy. The following document was also provided by Canada:

Environment Canada. 2009. *A Climate Change Plan for the Purposes of the Kyoto Implementation Act 2009*. Available at <<http://www.ec.gc.ca/doc/ed-es/KPIA2009/tm-to-eng.htm>>.
