A Climate Change Resource Book for Journalists

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The Institute's Climate Change Program works to design, develop, promote and implement actions that protect the climate through improvements in the efficiency of fossil fuel energy production and use, and through a transition to the renewable energy that will power the world's economy in the 21st century.

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INTRODUCTION TO SECOND QUARTERLY UPDATE, JUNE 2001

Included in this update...

- This page
- A new *Contents* page
- New versions of sections 1.1 and 1.2, updated in light of the new Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), finalized in early 2001
- New pages 3-4 in section 1.3, incorporating new figures for Canada's greenhouse gas emissions by province/territory and updated carbon dioxide emissions (current levels and future projections) for various countries and regions
- A new version of section 2.1, incorporating new developments in international negotiations and updated future events
- A new page 1 in section 2.3, incorporating the latest information about ratification of the Kyoto Protocol
- New pages 7-8 in section 3.1, incorporating federal government climate change policy announcements made in June 2001
- A new version of section 3.8, incorporating a brief summary of the economic findings of the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)
- A new municipal greenhouse gas emission reduction success story to add to section 4.2

Resumption of COP 6, Bonn, July 18-27, 2001

The sixth Conference of the Parties to the UN Framework Convention on Climate Change (COP 6) met in The Hague, Netherlands, from November 13-24, 2000. This critical meeting is referenced throughout this Resource Book, particularly in sections 2.3 and 2.4. Parties failed to reach agreement at COP 6, and the meeting will resume in Bonn, Germany, from July 18-27, 2001. The Bonn meeting is known variously as "COP6, part 2," "COP6bis" or "COP6.5." Its objective will be unchanged, and section 2.4 will remain a largely relevant guide to the issues. See also: a more detailed guide to the issues, prepared by West Coast Environmental Law, available at **http://www.wcel.org/wcelpub/2000/13242.html;** and the Government of Canada's COP 6 website at **http://climatechange.gc.ca/english/whats_new/cop6.shtml**.

A new element in the Bonn meeting will be the position of the US, which announced in March 2001 that it was pulling out of the Kyoto Protocol. It is possible that the US government will table proposals in Bonn for an alternative international agreement on climate change that it would like to see replace the Kyoto Protocol.

The Bush administration's new energy policy

Section 2.5, largely based on the Clinton administration's position on climate change, is now out of date. On May 17, 2001, President George W. Bush unveiled his National Energy Policy. The document (available at **http://www.whitehouse.gov/energy**)contains over 100 recommendations that represent the new administration's priorities and objectives regarding energy. At the time of writing, the Bush administration says it will not make a full statement of its climate change policy until a cabinet-level review is completed (for a preliminary statement,

see **http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html**). Its Energy Policy, however, while barely mentioning climate change, gives many clues as to the administration's position on the subject, with chapters on increasing domestic energy supplies (with a majority of the recommendations relating to oil and gas); energy conservation and efficiency; and renewable and alternative energy.

INTRODUCTION TO FIRST QUARTERLY UPDATE, JANUARY 2001

Included in this update...

- This page
- A new *Contents* page
- A new version of section 1.3, incorporating new figures for Canada's inventory of greenhouse gas emissions and for Canada's highest-emitting industrial entities
- A new version of section 2.1, incorporating new developments in international negotiations and updated future events
- A new version of section 3.1, incorporating developments in Canadian climate change policy during the second half of 2000
- A new version of section 3.2, incorporating developments in Canadian climate change policy during the second half of 2000
- A new version of section 3.3, summarizing the latest information on provincial government action to address climate change
- Five new industry greenhouse gas emission reduction success stories to add to section 4.1

A note on COP 6, The Hague, November 2000

The sixth Conference of the Parties to the UN Framework Convention on Climate Change (COP 6) met in The Hague, Netherlands, from November 13-24, 2000. This critical meeting is referenced throughout this Resource Book, particularly in sections 2.3 and 2.4. Parties failed to reach agreement at COP 6, suspending it until May 21, 2001 at the earliest. The objective of the resumed meeting will be unchanged, and section 2.4 will remain a relevant guide to the issues. Two new resources to add to those in section 2.4 are: a more detailed guide to the issues, prepared by West Coast Environmental Law, available at **http://www.wcel.org/wcelpub/2000/13242.html**, and the Government of Canada's COP 6 website at **http://climatechange.gc.ca/english/whats_new/cop6.shtml**.

Climate change science: the new IPCC report

As noted in section 1.1, the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (1996) has, for the past five years, provided the closest thing to a definitive, comprehensive assessment of climate change science. Its key findings, summarized in section 1.2, formed the scientific basis for the Kyoto Protocol.

Between late January and early March 2001, the IPCC will be finalizing its Third Assessment Report. The *Summary for Policymakers* from IPCC Working Group 1 (climate change science), released on January 22, 2000, contained stronger statements about the severity of climate change and humans' responsibility for it than in the Second Assessment Report. The *Summary* is available at **http://www.ipcc.ch**. The Third Assessment Report can be expected to be a key driver for further policy action worldwide to address climate change over the next several years. Its conclusions will be summarized in a revised version of section 1.2 in the second quarterly update to this Resource Book.

1 THE SCIENCE AND IMPACTS OF CLIMATE CHANGE

1.1 Assessing Climate Change Science

The science of climate change, like most environmental issues, is a complex subject. This means there is considerable scope for uncertainty, doubt and debate. On the other hand, climate change is well-studied. Hundreds of scientific papers on this subject are published every year in scholarly journals. In addition, opinions about climate change science are expressed constantly by laypeople, business people, politicians and advocacy organizations, outside the scholarly scientific process. This can be a confusing situation.

The Scientific Process

Fortunately, scientists are nearly unanimous on the legitimate process for advancing scientific knowledge. It consists of publishing articles in journals that have a good reputation in the scientific community and that subject articles to peer review (revision by other members of the community) before accepting them for publication. In this sense, scholarly journals are the sole location for legitimate scientific debate and for resolving differences of opinion on the scientific facts. In the same sense, the only legitimate experts on a scientific subject are those who regularly publish on that subject in the scholarly journals. All of this applies to climate change.

Science Assessment and the IPCC

Just as one unusually hot summer does not necessarily mean there is global warming, one scientific paper can easily be taken out of context and give a misleading impression of the current state of knowledge. Instead, complex issues like climate change require a process of science assessment to sift through everything that is published in the scholarly journals and determine those areas where firm conclusions can be reached, and those areas where they cannot.

Climate change is rare among environmental issues in that it has a single science assessment body that stands out in terms of prestige. This is the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established in 1988 by the World Meteorological Organization and the UN Environment Programme to bring together leading scientists from all over the world to conduct rigorous surveys of the latest technical and scientific literature on climate change. Since the establishment of the UN Framework Convention on Climate Change in 1992 (see section 2.2), the IPCC has acted as the source of technical advice to the Conferences of the Parties to the Convention (governments who have ratified the Convention), via the Convention's Subsidiary Body for Scientific and Technological Advice (SBSTA). The IPCC is named in the text of the Convention and in that of the Kyoto Protocol, a legal instrument linked to the Convention (see section 2.3).

Approximately every five years, the IPCC produces an Assessment Report that comprehensively reviews the science and economics of climate change, its impacts and measures to address it. The science volume of the Third Assessment Report (2001) is the closest thing to a definitive, comprehensive assessment of climate change science. It involved 123 lead authors and 516 more contributing authors drawn mostly, and in roughly equal numbers, from government and academic research institutions. The key findings are summarized in section 1.2. The previous Second Assessment Report (1996) formed the scientific basis for the Kyoto Protocol.

The full version of the IPCC's Third Assessment Report will be published by Cambridge University Press in August 2001. Summaries for Policymakers for each of the three volumes – climate change science; impacts of, and adaptation to climate change; and impacts of measures to address climate change – were released respectively in January, February and March, 2001.

The IPCC also publishes Special Reports on specific subjects such as greenhouse gas "sinks" (absorption of greenhouse gases, by forestry or agriculture, for example) and regional impacts of climate change.

In Canada, federal government departments, particularly Environment Canada and Natural Resources Canada, conduct basic scientific research on the climate system and climate change impacts, as well as science assessment. Considerable work is also done in Canadian universities. Federal government, university and private sector climate experts support and actively participate in the work of the IPCC.

Climate Change Skeptics

Some scientists, particularly in the US, have contested the findings of the IPCC. This is what Henry Hengeveld, Environment Canada's Senior Science Advisor on Climate Change has to say about them:

> "The small group of dissident scientists are primarily based in the USA, although there are also a few in Australia, Canada, Germany and the UK. Several of them are atmospheric scientists or climatologists. Of the rest, most have science backgrounds in nuclear physics, oceanography and earth sciences, and cannot be considered experts in atmospheric sciences. With a few exceptions, most of their critiques are not published in the peer-reviewed literature. Some also receive considerable funding from fossil fuel companies. The primary focus of their arguments is that the observed changes in climate do not agree adequately with model projections. Therefore, they maintain, the evidence for discernible human influence on the climate system does not yet exist, and models exaggerate the effects of humans on climate. Many of their arguments are out of context with the larger body of related science and are based on misinterpretation of selective information."

Before and for some time after the adoption of the Kyoto Protocol in December 1997, there was much public debate about the science of climate change, but controversy today tends to focus much more on what should be done about climate change and what the economic costs of addressing climate change may be (see section 3.8).

Resources

Description	Location	Date
Intergovernmental Panel on Climate Change (IPCC), including summaries of the Third Assessment Report	http://www.ipcc.ch/	
The IPCC's Summary for Policymakers on the science of climate change	http://www.ipcc.ch/pub/spm22-01.pdf	01/2001
Other IPCC reports including the Special Report on Land-Use Change and Forestry ("sinks") (summaries available online)	http://www.ipcc.ch/pub/reports.htm	frequent updates
Guide to the international climate change negotiation process, including an explanation of the role of the IPCC	http://www.unfccc.de/resource/process/index.html	
Leading climate change "skeptics" websites	http://www.greeningearthsociety.org/ http://www.co2science.org/ http://www.sepp.org/	
Questions and answers on climate change science (Environment Canada)	http://www.msc-smc.ec.gc.ca/cd/climate/toc_e.cfm	frequent updates
Frequently asked questions about the science of climate change – includes Environment Canada's position on the IPCC and climate change skeptics	http://www.msc-smc.ec.gc.ca/saib/docs/C02_98-2_eng.pdf	1998
Index of Environment Canada's downloadable publications on the science of climate change – includes comprehensive reviews of the scientific literature	http://www.msc-smc.ec.gc.ca/saib/climate/ccsci_e.cfm	frequent updates
Environment Canada (Meteorological Service of Canada) spokespersons on climate change science and impacts	Henry Hengeveld, Senior Science Advisor on Climate Change: (416) 739-4323 John Stone, Executive Director, Climate Change, Policy and Corporate Affairs: (819) 997-3805 Roger Street, Director, Adaptation and Impacts Research Group: (416) 739-4271	

1.2 Current and Future Climate Change and its Impacts

Current and projected future climate change is summarized in this section. Almost all the information has been compiled from the science assessment publications of the Intergovernmental Panel on Climate Change (IPCC), Environment Canada (EC) and Natural Resources Canada (NRCan). Temperature changes can be put into context by noting that during the last ice age, when Canada was covered with an ice sheet several kilometres thick, the average global temperature was only about 5 °C lower than today.

Current Warming

- During the 20th century, the average temperature has increased by about 0.4-0.8 °C globally (IPCC), and by about 1°C in Canada (EC).
- The 20th century global warming is likely to have been the largest of any century during the past 1000 years. (IPCC)
- Globally, every year in the 1990s ranked among the 20th century's 15 warmest years, and 1997 and 1998 were the warmest on record. The year 2000 was the sixth warmest on record. (US National Oceanic and Atmospheric Administration)
- The ice covering the Arctic Ocean in late summer to early autumn has likely become about 40% thinner since the 1950s. (IPCC)
- Among the impacts observed in Canada (Canadian Climate Program Board; see "Resources" at the end of this section):
    - there has been a significant reduction in late-winter to early-spring snow depths over much of the country since 1950;
    - parts of the boreal forest are showing signs of climatic stress; and
    - prairie grasslands are moving northwards.

The Cause of Current Warming (IPCC)

- Greenhouse gases in the atmosphere create a "greenhouse effect" that keeps the Earth's surface much warmer than it would otherwise be. High levels of emissions from human activities have caused concentrations of greenhouse gases in the atmosphere to increase markedly since the beginning of the industrial era, adding an extra "human-induced greenhouse effect." Carbon dioxide has increased by 31%, methane by 151% and nitrous oxide by 17%.
- Part of the observed global warming may have been due to natural causes (such as the amount of sunlight the Earth receives) but "most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations."

Future Projections – Global (IPCC)

To stabilize the amounts of greenhouse gases in the atmosphere—and therefore remove the human cause of climate change—emissions must fall by more than 50% from their 1990 levels. Under "business as usual" scenarios in which emissions continue to rise:

- The global average temperature will rise by 1.4-5.8 °C between 1990 and 2100, and the speed of the rise will very likely be greater than any seen during at least the past 10,000 years. (Slightly more than one half of the 1.4-5.8 °C range is due to different scenarios of economic and population growth and energy use, and the remainder is due to differences among computer models of climate.)
- This projected global warming will be accompanied by a rise in global average sea level of 9 to 88 cm between 1990 and 2100. (This is mostly because water expands when it warms, but if global warming is sustained, melting of the Greenland and Antarctic ice sheets could cause a rise in global average sea level of several metres over the next 1000 years.)
- It is very likely that there will be more intense rain- and snowfall events over many areas.

Future Projections – Canada (EC, NRCan)

Under "business as usual" scenarios of rising greenhouse gas emissions:

- Canada's average **temperature** could increase by 5-10 °C over the 21st century.
- Dramatic increases are projected in the number of **deaths due to heatwaves** in Toronto and Montreal.
- **Sea-level rise** could have major impacts in the Maritimes and British Columbia.
- More intense rainstorms are likely to lead to more severe **river flooding**, particularly on the Atlantic coast and the Great Lakes - St. Lawrence basin.
- Major changes to the levels and flow rates of Canada's **rivers and lakes** are projected; for example, the outflow of the St. Lawrence River could be reduced by 20%.
- The Prairies and the southernmost regions of Ontario are expected to suffer from **more severe droughts.** Part of the southern Prairies is projected to become semi-desert.
- Canada's **forests** are likely to undergo major changes. Canada's boreal forest is expected to be reduced extensively in size. Forest fires will likely become more frequent.
- Widespread **permafrost melting** could lead to the collapse of buildings, electric utility lines and tailings dams, along with the rupture of pipelines.
- Many of Canada's **National Parks** will be at risk: "Climate change has the potential to undermine decades of notable conservation efforts in Canada."
- Canada's polar bears will be at risk of **extinction**.
- A mix of positive and negative impacts are projected for Canada's **agricultural production**, with the positive effect of higher temperatures balanced by the negative effect of drier soils.
- Like agriculture, **fisheries** are expected to experience mixed impacts.
- Winter heating costs will be reduced.

Resources

Description	Location	Date
Environment Canada factsheet on the science of climate change	http://www.ec.gc.ca/climate/fact/science.html	
Website by the Pembina Institute on the science and impacts of climate change, including complete references to information sources	http://www.climatechangesolutions.com/english/science/	2000
The IPCC's Summary for Policymakers on the science of climate change	http://www.ipcc.ch/pub/spm22-01.pdf	01/2001
The IPCC's Summary for Policymakers on the impacts of climate change	http://www.ipcc.ch/pub/wg2SPMfinal.pdf	02/2001
The Canadian Climate Program Board's recent findings on the science and impacts of climate change in Canada and adaptation to it. The CCPB is a body mandated to advise Canada's governments.	http://www.nccp.ca/html/tables/pdf/options/IA-OR-11-1999.pdf	11/1999
Summary of Environment Canada's *Canada Country Study* on the projected impacts of climate change	http://www.ec.gc.ca/climate/ccs/policysummary_e.htm	1997
Sensitivities to Climate Change in Canada – maps of projected climate change impacts (Natural Resources Canada)	http://sts.gsc.nrcan.gc.ca/adaptation/sensitivities/	2000
US government website with detailed information on the latest global temperature trends	http://www.ncdc.noaa.gov/ol/climate/climateresearch.html	frequent updates
Questions and answers on climate change science (Environment Canada)	http://www.msc-smc.ec.gc.ca/cd/climate/toc_e.cfm	frequent updates
Frequently asked questions about the science of climate change (Environment Canada) – address concerns raised by climate change skeptics	http://www.msc-smc.ec.gc.ca/saib/docs/C02_98-2_eng.pdf	1998
Index of Environment Canada's downloadable publications on the science of climate change (Environment Canada)	http://www.msc-smc.ec.gc.ca/saib/climate/ccsci_e.cfm	frequent updates
World Health Organization website on climate and health	http://www.who.int/peh/climate/climate_and_health.htm	frequent updates
Report by Environment Canada and Parks Canada on the impacts of climate change on Canada's National Parks	http://www.msc-smc.ec.gc.ca/airg/pubs/parks/full_report.pdf	05/2000
Canadian Institute for Climate Studies, University of Victoria	http://www.cics.uvic.ca/climate/	

Description	Location	Date
Canadian Centre for Climate and Global Change Research, McGill University	http://www.mcgill.ca/ccgcr/index.php3	
Environment Canada (Meteorological Service of Canada) spokespersons on climate change science and impacts	Henry Hengeveld, Senior Science Advisor on Climate Change: (416) 739-4323 John Stone, Executive Director, Climate Change, Policy and Corporate Affairs: (819) 997-3805 Roger Street, Director, Adaptation and Impacts Research Group: (416) 739-4271	

1.3 Greenhouse Gas Emission Sources and Trends

Greenhouse gases from human activities are building up in the atmosphere, causing a "human-induced greenhouse effect." The balance of evidence suggests this is already causing climate change, and there is broad scientific agreement that if emissions continue to rise, they will cause further, major climate change during the 21st century (see section 1.2).

The most important of these gases is carbon dioxide, which comes mainly from the burning of fossil fuels such as oil, gasoline, natural gas and coal, but also from deforestation. The other important gases are listed in the table below.

Principal Greenhouse Gases

Greenhouse gas	Chemical symbol	Contribution to human-induced greenhouse effect in dry air (approx.)[1]		Contribution to Canada's inventory of greenhouse gas emissions	Covered by	Main human sources in Canada
Carbon dioxide	CO_2	57 %		76 %	Kyoto Protocol	Burning of coal, oil, gasoline, natural gas ("fossil fuels") and wood
Methane	CH_4	17 %		13 %	Kyoto Protocol	Fossil fuel production, farm animals, landfills
Ozone	O_3	11 %		not included		Burning of fossil fuels, particularly in motor vehicles
Halocarbons	various	10 %	CFCs[2] and HCFCs[3]	not included	Montreal Protocol	Coolants in refrigeration and air conditioning
			PFCs[4]	0.9 %	Kyoto Protocol	Aluminum production
			HFCs[5]	0.1 %	Kyoto Protocol	Coolants in refrigeration and air conditioning
Nitrous oxide	N_2O	5 %		9 %	Kyoto Protocol	Agricultural soils, nylon and adipic acid production, vehicle emissions
Sulphur hexafluoride	SF_6	small		0.2 %	Kyoto Protocol	Magnesium production

[1] Contribution to radiative forcing resulting from total changes in concentrations of gases since pre-industrial times

[2] chlorofluorocarbons; [3] hydrochlorofluorocarbons; [4] perfluorocarbons; [5] hydrofluorocarbons

Canada's national inventory of greenhouse gas emissions is regularly compiled by Environment Canada and submitted to the secretariat of the UN Framework Convention on Climate Change (see section 2.2). The next table presents the most recent numbers, which are for 1998. It shows that Canada's emissions increased by 13% between 1990 and 1998. The inventory does not include the emission or absorption of greenhouse gases from forestry and land-use change (e.g., conversion of forest to agricultural land), although it does include emissions from agriculture. It is not yet clear to what extent these greenhouse gas "sinks" activities will be accounted for under the Kyoto Protocol (see sections 2.3 and 2.4). But if they were all included in the inventory, Canada's net emissions would have risen by 17% between 1990 and 1998—according to the current method for calculating the inventory—because the sinks shrank during this period. Both Canada's inventory and the international legal instrument on climate change,

the Kyoto Protocol (see section 2.3), exclude CFCs and HCFCs (hydrochlorofluorocarbons) because they are dealt with by the Montreal Protocol on ozone-depleting substances. (Source: *Canada's Greenhouse Gas Inventory, 1990-1998: Final Submission to the UNFCCC Secretariat*, http://www.ec.gc.ca/pdb/ghg/english/eDocs.html; and Chia Ha, Greenhouse Gas Division, Pollution Data Branch, Environment Canada, personal communication.)

Canada's Greenhouse Gas Emissions in 1998

	Emissions (Mt CO_2E,[1] nearest Mt)	Proportion of total for Canada	Increase since 1990
ENERGY PRODUCTION AND DISTRIBUTION			
Public electricity and heat generation (fuel combustion)	125	18.0 %	31 %
Fossil fuel production and distribution (fuel combustion)	60	8.6 %	18 %
Fossil fuel production and distribution (non-combustion emissions)[2]	52	7.6 %	38 %
Total for energy production and distribution	237	34.2 %	29 %
OTHER FUEL USE IN INDUSTRY[3]			
(fossil fuels)	66	9.5 %	2 %
(biomass)[4]	0	0.0 %	31 %
Total for other fuel use in industry	66	9.6 %	2 %
FUEL USE IN TRANSPORTATION			
Road vehicles (gasoline)	88	12.7 %	12 %
Road vehicles (diesel)	38	5.4 %	46 %
Off-road vehicles	20	2.8 %	20 %
Aircraft	13	1.9 %	21 %
Railways	6	0.9 %	–14 %
Ships	5	0.7 %	2 %
Road vehicles (other fuels)	2	0.3 %	–19 %
Total for transportation	171	24.8 %	17 %
FUEL USE IN BUILDINGS			
Residential (fossil fuels)	38	5.5 %	–7 %
Commercial/institutional	27	3.9 %	5 %
Residential (wood)[4]	5	0.8 %	–6 %
Total for buildings	71	10.2 %	–3 %
NON-ENERGY SECTOR[5]			
Industrial processes (non-combustion emissions)	51	7.4 %	–3 %
Agricultural soils[6]	41	6.0 %	–4 %
Livestock[7]	28	4.1 %	13 %
Landfills (biogas)[8]	21	3.1 %	15 %
Forest fires caused by humans[4]	2	0.3 %	–29 %
Municipal sewage treatment	1	0.2 %	9 %
Use of HFCs (mainly in refrigeration and air conditioning)	1	0.1 %	v. large
Use of nitrous oxide (mainly in anaesthesia)	0	0.1 %	9 %
Waste incineration	0	0.0 %	9 %
Total for non-energy sector	147	21.3 %	2 %
TOTAL FOR CANADA			
All sources	692	100 %	13 %

Notes:

1 Mt CO_2E stands for megatonnes [millions of tonnes] of carbon dioxide-equivalent. Carbon dioxide makes up 76% of the total; other greenhouse gases have been converted into carbon dioxide terms using their "global warming potential"—a measure of how much more powerful they are as greenhouse gases than carbon dioxide.

2 This category is mainly "fugitive" emissions of methane that escape from equipment during the production and distribution of oil, gas and coal. It also includes emissions from flaring, and carbon dioxide removed from raw natural gas during processing.

3 Industry here includes mining, agriculture, forestry and fisheries.

4 Only the methane and nitrous oxide from burning wood and other biomass fuels are included; the carbon dioxide is assumed to be re-absorbed by growing trees or other plants.

5 This sector covers other greenhouse gas emissions that do not come from fuel combustion. These are byproducts of chemical processes used in the production of metals and chemicals.

6 The vast majority of emissions from agricultural soils are of nitrous oxide, which originates from a variety of natural and synthetic nitrogen fertilizers.

7 This category is mainly methane released through eructation (belching) and flatulence, and from manure.

8 The rotting of biological material in garbage, such as food scraps and garden waste, in the absence of air leads to the production of methane. Many landfills do not capture this landfill gas.

The table below shows Canada's greenhouse gas emissions by province/territory, and how these have changed since 1990. (Source: Chia Ha, Greenhouse Gas Division, Pollution Data Branch, Environment Canada, personal communication; and Statistics Canada for the population figures.)

Canada's Greenhouse Gas Emissions by Province/Territory

	1998 emissions (Mt)[1]	1998 population	1998 per capita emissions (t)[1]	1998 emissions (% of Canada's total)	1990 emissions (Mt)[1]	Increase in emissions, 1990-1998
Alberta	200	2,907,000	68.8	29.2	168	19 %
Ontario	197	11,386,100	17.3	28.8	183	8 %
Québec	89.7	7,323,500	12.2	13.1	88.8	1 %
British Columbia	61.1	3,997,500	15.3	8.9	51.0	20 %
Saskatchewan	59.5	1,024,900	58.1	8.7	46.6	28 %
Manitoba	22.1	1,137,900	19.4	3.2	20.8	6 %
New Brunswick	20.4	753,400	27.1	3.0	16.1	27 %
Nova Scotia	20.1	936,100	21.5	2.9	19.6	3 %
Newfoundland	9.80	545,400	18.0	1.4	9.55	3 %
Yukon and North-west Territories	2.22	99,100	22.4	0.3	1.73	28 %
Prince Edward Island	2.01	136,900	14.7	0.3	1.97	2 %

[1] Mt stands for megatonnes [millions of tonnes] of carbon dioxide-equivalent; t stands for tonnes.

The next table shows emissions of carbon dioxide (representing about three-quarters of greenhouse gas emissions from human activities) by country/region for 1999. It also shows US government projections of increases in emissions over the 20-year period 1990-2010. (2010 is the mid-way point in the five-year period during which countries committed in the Kyoto Protocol to reduce their average greenhouse gas emissions from 1990 levels (see section 2.3).) There is reasonable agreement with the most recent projections of Government of Canada economists, which predict an increase of 27% in Canada's greenhouse gas emissions if government policy remains unchanged. The projection drops to 23% if economic growth is 0.5% per year less than forecast, but rises to 35% if economic growth is 1% more per year than currently expected. (For sources, see the resources listed after the tables.)

Carbon Dioxide Emissions and Emission Projections (1990-2010) by Country/Region

Country/region	Total emissions, 1999 (megatonnes)	Projected increase, 1990-2010 (according to US government)		
		Low economic growth case	"Reference" case	High economic growth case
India	887	106 %	129 %	154 %
Central and South America	913	94 %	121 %	152 %
Middle East	1210	74 %	95 %	119 %
China	2453	47 %	83 %	104 %
Mexico	370	60 %	73 %	85 %
Africa	799	47 %	64 %	83 %
Australasia	422	40 %	48 %	56 %
United States	5540	30 %	34 %	40 %
Canada	**550**	**24 %**	**31 %**	**39 %**
Japan	1126	15 %	23 %	31 %
Italy	444	15 %	22 %	30 %
France	400	12 %	18 %	25 %
United Kingdom	554	3 %	8 %	13 %
Germany	843	–11 %	–7 %	–2 %
Former Soviet Union	2226	–35 %	–31 %	–20 %
Total developing[1]	**7913**	**72 %**	**100 %**	**123 %**
Total industrialized[1]	**11,447**	**22 %**	**27 %**	**34 %**
Total world	**22,334**	**23 %**	**35 %**	**46 %**

[1] These categories both exclude the former Soviet Union and Eastern Europe.

The following table shows the greenhouse gas emissions of Canada's highest-emitting industrial entities, and how they have changed since 1990. The figures have been taken from submissions filed by companies at the Voluntary Challenge and Registry Inc. (VCR). The VCR, originally created by the federal government, exists to encourage private and public sector organizations to voluntarily limit their net greenhouse gas emissions (see sections 3.1 and 3.2). A few of Canada's top greenhouse gas emitters do not report to the VCR and will therefore be missing from the table.

Canada's Industrial Entities with Greenhouse Gas Emissions Exceeding 5 Mt CO_2E[1]

Company	Sector	1990 emissions (Mt CO_2E)[1]	1998 emissions (Mt CO_2E)[1]	% change 1990-98
Amoco Canada Petroleum	Oil and gas production	6.3	6.6	6
ATCO Electric	Electricity generation	7.7	9.5	23
DuPont Canada	Chemicals	11.2	5.4	-52
EPCOR	Electricity generation	3.5	8.6	149
Husky Oil Operations	Oil and gas production and refining	3.8	6.5	70
Imperial Oil	Oil and gas production and refining; chemicals	10.8	10.8	0
New Brunswick Power	Electricity generation	6.3	9.7	54
Nova Scotia Power	Electricity generation	6.8	8.0	17
Ontario Hydro	Electricity generation	26.0	31.0	19
Petro-Canada	Oil and gas production and refining	6.9	6.9	0
SaskPower	Electricity generation	10.6	14.7	39
Shell Canada	Oil and gas production and refining	7.6	7.3	-4
Suncor Energy	Oil and gas production and refining	5.0	6.2	24
Syncrude Canada	Oil and gas production	7.2	8.9	23
TransAlta	Electricity generation	25.8	23.4	-10
TransCanada	Pipelines; electricity generation	10.4	17.3	66
Westcoast Energy	Pipelines; natural gas utility; electricity generation	4.1	5.2	26

[1] Mt CO_2E stands for megatonnes [millions of tonnes] of carbon dioxide-equivalent.

Resources

Description	Location	Date
Website by the Pembina Institute on the science and impacts of climate change, including complete references to information sources	http://www.climatechangesolutions.com/english/science/	2000
Environment Canada's greenhouse gas emissions inventory website	http://www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm	annual updates
Canada's latest greenhouse gas emissions report	http://www.ec.gc.ca/pdb/ghg/ghg_docs/CGHGI_00Vol1_Web_Eng.pdf http://www.ec.gc.ca/pdb/ghg/ghg_docs/CGHGI_00Vol2_Web_Eng.pdf	10/2000
International Energy Outlook 2000 – US government projections for worldwide energy and emission trends	http://www.eia.doe.gov/oiaf/ieo/index.html	
The latest official projections of Canada's future greenhouse gas emissions	http://www.nrcan.gc.ca/es/ceo/update.htm	12/1999
Industrialized countries' greenhouse gas emissions, 1990-98	http://www.unfccc.de/resource/docs/2000/sbi/11.pdf http://www.unfccc.de/resource/docs/2000/sbi/11c01.htm	09/2000
Key facts about Canada's energy industries	http://www.eia.doe.gov/emeu/cabs/canafull.html	
Voluntary Challenge and Registry Inc. – submissions by private and public sector corporate entities on their greenhouse gas emissions	http://www.vcr-mvr.ca/home_e.cfm	frequent updates
Compilation of publicly-available information on greenhouse gas emissions by Canadian industrial entities, 1990-98	http://www.pembina.org/pubs/ggas98.htm	10/2000

1.4 Climate Change, Air Pollution and Ozone Depletion

Climate change, air pollution and ozone depletion are three major atmospheric environmental issues that are often confused. The three are distinct but there are important links between them.

Three Distinct Issues

1. **Climate change** refers to changes to the climate system, including a rapid global warming trend caused by emissions of greenhouse gases that create a "human-induced greenhouse effect." The most important of these gases is carbon dioxide (CO_2), which comes mainly from the burning of fossil fuels such as oil, gasoline, natural gas and coal, but also from deforestation. In order of their contribution to the greenhouse effect, the other important greenhouse gases are methane (CH_4), ozone (O_3), chlorofluorocarbons (CFCs) and other chemicals containing carbon plus chlorine, fluorine or bromine (halocarbons), and nitrous oxide (N_2O) (see section 1.3).

2. **Air pollution** is a general term but it most often refers to emissions of substances that cause (i) urban smog, and (ii) acid rain. The two main ingredients of smog are ground-level ozone and fine particles. Ground-level ozone is produced in a chemical reaction involving hydrocarbons, carbon monoxide (CO) and oxides of nitrogen (NO_x), all of which are generated mainly by burning fossil fuels, particularly in motor vehicles. Fine particles, often referred to as particulate matter (PM), have many sources, but heavy diesel vehicles are an especially important source in urban areas. The main culprits in acid rain are emissions of sulphur dioxide (SO_2) and, again, oxides of nitrogen (NO_x). The two main sources of sulphur dioxide are burning of fossil fuels and metal smelting.

3. **Ozone depletion** refers to the destruction of the ozone layer in the stratosphere, 10 to 40 km above the earth's surface, by emissions of long-lived, chlorine-containing substances such as CFCs (chlorofluorocarbons) and HCFCs (hydrochlorocarbons). CFCs and HCFCs were commonly used for many years in refrigeration and air conditioning. Chlorine destroys ozone (O_3) by changing it back to the most common form of oxygen (O_2). The main consequence at the earth's surface is an increase in the level of life-threatening ultraviolet (UV) radiation that would normally be filtered out by the stratospheric ozone layer.

The Links Between Them

- The burning of fossil fuels, the main cause of greenhouse gas emissions and human-induced climate change, is also a principal source of air pollution, particularly urban smog. A number of measures to reduce air pollution (such as reducing car use or replacing coal with natural gas) will also reduce greenhouse gas emissions. Likewise, most measures to reduce greenhouse gas emissions will also reduce air pollution. This means there are immediate health co-benefits from greenhouse gas emission reductions.

- Air pollution by fine particles (referred to as "aerosols") exerts a moderate cooling effect that "masks" part of the global warming caused by greenhouse gases. In other words, the underlying warming is greater than it appears to be, and desirable reductions in air pollution will tend to increase the observed warming.

- Ozone is a moderately important greenhouse gas (see section 1.3). The increase in ground-level ozone from air pollution has strengthened the greenhouse effect about four times more than the decrease in stratospheric ozone from ozone depletion has weakened it.

- Ozone-depleting substances such as CFCs and HCFCs are also moderately important greenhouse gases (see section 1.3). The direct contribution they make to the greenhouse effect is about twice as large as the indirect reduction in the greenhouse effect they cause by destroying ozone. They are being replaced in many instances (e.g., new North American refrigerators) by HFCs (hydrofluorocarbons). While HFCs do not damage the ozone layer, they are still powerful greenhouse gases.

- The healing of ozone layer damage caused by past emissions of CFCs and HCFCs is expected to be delayed by emissions of greenhouse gases. This is because greenhouse gases trap heat near the earth's surface, cooling down the stratosphere, which increases the rate of ozone destruction.

Resources

Description	Location	Date
Environment Canada's clean air website, with links to sub-sites on smog, acid rain and ozone depletion	http://www.ec.gc.ca/air/introduction_e.cfm	frequent updates
Emissions of key air pollutants, by source and province	http://www.ec.gc.ca/pdb/ape/cape_home_e.cfm#CAC	12/1998
Today's Ontario air quality readings by city	http://www.airqualityontario.com/reports/summary.cfm	daily updates
Website on Arctic ozone depletion, including the connection to climate change	http://www.msc-smc.ec.gc.ca/arcticozone/contents_e.cfm	
Map of stratospheric ozone levels over Canada	http://www.cmc.ec.gc.ca/cmc/images/ozone/ozweek.gif	weekly updates

1.5 Glossary: Climate Change Science and Impacts

This section briefly explains terms that are commonly used in accounts of climate change science intended for non-specialists. An asterisk denotes a cross-reference to another term in the glossary.

Adaptation. Change in society and the economy to adapt to a changing climate.

Aerosols. Fine solid airborne particles. Aerosol emissions from human activity are thought to partly mask the *greenhouse effect by roughly canceling out the *human-induced *greenhouse effect of *methane.

Anthropogenic. Caused by human activity.

Biomass. Living or recently living material, e.g., wood. Biomass energy is generated by burning biomass.

Carbon dioxide (CO_2). *Greenhouse gas responsible for about 57% of the *human-induced *greenhouse effect. Most emissions from human activity are from burning *fossil fuels and from deforestation.

Carbon dioxide equivalent. Amount of *greenhouse gases converted into *carbon dioxide terms by using *global warming potentials.

Carbon cycle. Movement of carbon between the earth's crust (where it is found in *fossil fuels, carbonate rocks), atmosphere (mainly *carbon dioxide), land-based ecosystems (*biomass, soils) and the oceans.

CFCs (chlorofluorocarbons). Manufactured *halocarbon chemicals used mainly as coolants in refrigeration and air conditioning. CFCs damage the *stratospheric ozone layer and are *greenhouse gases.

CH_4. Chemical symbol for *methane.

Climate. An average of day-to-day weather—and its variability—over several decades or more. Usually the average is taken over 30 years.

CO_2. Chemical symbol for *carbon dioxide.

El Niño. A weather disruption in the tropical Pacific, during which the water temperature off the coast of South America rises sharply for a period of 12 to 18 months.

Emission scenario. Description of possible future trends in *greenhouse gas and *aerosol emissions based on trends in economic and population growth and energy use.

Feedback, climate. Additional changes to climate caused by global warming itself. Example of a positive feedback: a warmer atmosphere is expected to contain more *water vapour, which is a *greenhouse gas, thereby reinforcing the warming. Other climate feedbacks may be negative, countering the warming.

Fossil fuels. Carbon-based fuels that produce *carbon dioxide when they are burned. The main fossil fuels are coal, petroleum (oil), refined petroleum products like gasoline, and natural gas.

Global warming. One aspect of climate change. If emissions of *greenhouse gases continue to rise, the global average temperature is projected to rise rapidly. But scientists also project changes in temperature that will vary widely from region to region, rises in sea level, and changes in patterns of rainfall, wind and ocean currents, among many other aspects of climate change.

Global warming potential (GWP). Factor used to convert an amount of a given *greenhouse gas into *carbon dioxide-equivalent terms; for example, over a 100-year timeframe, *methane is 21 times more powerful a *greenhouse gas than *carbon dioxide, so its GWP is 21.

Greenhouse effect. Twenty percent of the sun's energy that enters the atmosphere, mainly as visible sunlight, is absorbed on the way through, but about 50% passes through to warm the earth's surface. The surface and lower atmosphere then re-emit the energy in the form of infra-red rays. Because *greenhouse gases in the atmosphere absorb infra-red radiation much more strongly than visible rays, the atmosphere warms up.

Greenhouse gas. Gas in the atmosphere that absorbs infra-red radiation. See *Greenhouse effect.

Halocarbons. Chemical substances (mostly manufactured) that contain carbon as well as chlorine, fluorine or bromine. Halocarbons are *greenhouse gases, responsible for about 10% of the *human-induced *greenhouse effect. *CFCs, *HCFCs, *HFCs and *PFCs are all halocarbons.

HCFCs (hydrochlorofluorocarbons). Manufactured *halocarbon chemicals used mainly as coolants in refrigeration and air conditioning. HCFCs damage the *ozone layer and are *greenhouse gases.

HFCs (hydrofluorocarbons). Manufactured *halocarbon chemicals used mainly as coolants in refrigeration and air conditioning. Because they do not contain chlorine, they do not damage the *ozone layer, but they are *greenhouse gases.

Human-induced. Describes the part of the *greenhouse effect that is due to emissions of *greenhouse gases from human activities (as opposed to *greenhouse gases naturally present in the atmosphere). See *radiative forcing and *anthropogenic.

Hydrocarbons. Chemical substances that contain carbon and hydrogen. *Fossil fuels such as petroleum, gasoline and natural gas are hydrocarbons, as is *methane. Hydrocarbons are also released when *fossil fuels are incompletely burned.

Ice core. Long vertical column of ice removed from an ice cap and analyzed to deduce prehistoric temperatures and *greenhouse gas concentrations.

Interglacial. Period between two ice ages (as at present).

Kilotonne (kt). Thousand tonnes.

La Niña. A weather disruption in the tropical Pacific, during which the water temperature off the coast of South America falls by up to 4 ºC for several months.

Megatonne (Mt). Million tonnes.

Methane (CH_4). *Greenhouse gas responsible for about 17% of the *human-induced *greenhouse effect. In Canada, the main sources are *fossil fuel production, farm animals and landfills. Natural gas is mainly methane.

Mitigation. Limiting climate change by reducing *greenhouse gas emissions.

N_2O. Chemical symbol for *nitrous oxide.

Nitrous oxide (N_2O). *Greenhouse gas responsible for about 5% of the *human-induced *greenhouse effect. In Canada, the main sources are agricultural soils, nylon and adipic acid production, and motor vehicles.

Offsets. *Greenhouse gas emission reductions or *sink enhancements that a corporate entity invests in but that take place outside the entity's own operations.

Ozone (O_3). A rare form of oxygen. Ground level or *tropospheric ozone is one of the two main ingredients of urban smog. *Stratospheric ozone (the "ozone layer") is essential to life because it filters out harmful ultraviolet radiation. Ozone is also a *greenhouse gas responsible for about 11% of the average *human-induced *greenhouse effect. See sections 1.3 and 1.4.

Perfluorocarbons (PFCs). A class of *halocarbon *greenhouse gases emitted principally from aluminum production.

PFCs. See *perfluorocarbons.

Precipitation. Rain, snow and other forms of water that fall on the earth's surface.

Radiative forcing. The contribution of different gases or *aerosols to the *greenhouse effect. The natural *greenhouse effect is a forcing of 125 watts per square metre of the earth's surface; the forcing due to *greenhouse gases from human activities is about 2.25 watts per square metre.

Reservoir. See *sinks.

Sequestration, carbon. Storage or absorption of *carbon dioxide in/by *sinks/*reservoirs.

Sinks. Mechanisms by which *carbon dioxide can be absorbed, stored or injected (e.g., the growth of forests, certain agricultural soil management practices, and possibly injection underground or in the deep ocean). The place where the carbon dioxide is stored (wood, soils, etc.) is more correctly described as a *reservoir.

SF_6. Chemical symbol for *sulphur hexafluoride.

Stratosphere. Layer of the atmosphere about 10 to 40 km above the earth's surface.

Sulphur hexafluoride (SF_6). Manufactured *greenhouse gas making up less than 1% of *greenhouse gas emissions from human activity. In Canada, the main source is magnesium production.

Troposphere. The lowest layer of the atmosphere (several kilometres thick).

Water vapour. Water that has evaporated. Up to 2% of the atmosphere is water vapour, and, as a greenhouse gas, it causes about 60% of the total *greenhouse effect. But because water vapour is rapidly eliminated from the atmosphere in the form of clouds, it is not considered to be part of the *human-induced part of the *greenhouse effect. Instead, as global warming brings about a long-term increase in the amount of water vapour in the atmosphere, the additional *greenhouse effect caused by the extra water vapour is classed as a climate *feedback.

Resource

Description	Location	Date
US National Library for the Environment collection of climate change glossaries	http://www.cnie.org/nle/clim-7/ebgccglo.html	

2 INTERNATIONAL ACTIVITY ON CLIMATE CHANGE

2.1 A Chronology of International Negotiations on Climate Change

1988. The Intergovernmental Panel on Climate Change (IPCC) is established by the World Meteorological Organisation and the UN Environment Programme.

June 27-30, 1988. The Toronto Conference on the Changing Atmosphere, convened by the Government of Canada, brings together over 300 scientists and policy makers from 46 countries and organizations. The Conference calls for a "comprehensive international framework that can address the interrelated problems of the global atmosphere"; states that "humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war"; and recommends the reduction of carbon dioxide emissions by 20% from 1988 levels by 2005.

December 6, 1988. The UN General Assembly takes up climate change for the first time, adopting resolution 43/53 on the "Protection of global climate for present and future generations of mankind."

1990. The IPCC's First Assessment Report is published. The report finds that 60 - 80% cuts in CO_2 emissions would be needed to stabilize the level of greenhouse gases in the atmosphere. It recommends the launch of negotiations on a global climate change agreement. The Ministerial Declaration of the Second World Climate Conference, held in Geneva, also calls (November 7) for the launch of negotiations.

1990. The UN General Assembly formally launches negotiations on a framework convention on climate change (resolution 45/212).

May 9, 1992. The UN Framework Convention on Climate Change (see section 2.2) is adopted in New York. It commits industrialized country (Annex I) signatories to the non-legally binding "aim" of returning their greenhouse gas emissions to 1990 levels by 2000.

June 4, 1992. The Convention is opened for signature at the Earth Summit in Rio de Janeiro, Brazil.

December 4, 1992. Canada ratifies the Convention.

March 21, 1994. The Convention enters into force, after receiving 50 ratifications.

March 28-April 7, 1995. At the first Conference of the Parties to the Convention (COP 1) in Berlin, governments decide that the commitments in the Convention for industrialized (Annex I) countries are not adequate to fulfill the Convention's objective. They agree (the "Berlin mandate") to launch a new round of negotiations on a "protocol or another legal instrument" to be concluded by the third Conference of Parties (COP 3), to be held in Kyoto, Japan.

December 11-15, 1995. The IPCC approves its Second Assessment Report, including a volume on the science of climate change (see section 1.2). Its findings underline the need for strong policy action.

December 1-11, 1997. The third Conference of the Parties (COP 3) in Kyoto adopts the Kyoto Protocol to the UN Framework Convention on Climate Change. The Protocol (see section 2.3) commits all but two Annex I (industrialized country) Parties to legally-binding targets to limit their greenhouse gas emissions, adding up to a total reduction of at least 5% from 1990 levels on average during the five-year period 2008-2012.

March 16, 1998. The Kyoto Protocol is opened for signature at UN headquarters in New York. Over a one-year period, it receives 84 signatures. In order to enter into force, the Protocol must

now be ratified by 55 Parties to the Convention, including Annex I (industrialized) countries accounting for 55% of carbon dioxide emissions from this group in 1990. Most of these countries have chosen to await the outcome of negotiations on the operational details of the Protocol at the sixth Conference of the Parties (COP 6) (see section 2.4) before ratifying.

November 2-14, 1998. The fourth Conference of the Parties (COP 4) in Buenos Aires adopts the "Buenos Aires Plan of Action" to strengthen the implementation of the Convention and prepare for the Kyoto Protocol's entry into force. The Plan of Action sets COP 6 as the deadline for adopting many important decisions.

November 13-24, 2000. The sixth Conference of the Parties (COP 6) meets in The Hague, Netherlands, with the goal of making key decisions on the implementation of the Convention and operational details of the Kyoto Protocol (see section 2.4). However, Parties fail to reach agreement, with a major cleavage separating the "Umbrella Group" countries, including the United States and Canada, from the European Union. The extent to which countries' emissions can be offset by credits for "sinks" (absorption of carbon dioxide by growing forests, agricultural soil management practices, etc.) is particularly contentious. Parties agree to suspend COP 6 and resume it in 2001.

January-March, 2001. Summaries for Policymakers for each of the three volumes – climate change science; impacts of, and adaptation to climate change; and impacts of measures to address climate change – of the IPCC's Third Assessment Report are released. The science Summary states that "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

March 2001. The new US administration announces it is pulling out of the Kyoto Protocol. On March 13, in a letter to four senators, President George W. Bush states his opposition to the Protocol. On March 27, Environmental Protection Agency Administrator Christine Whitman states that the administration "has no interest in implementing that treaty."

May 2001. The European Union plus 185 governments are Parties to the Convention. Most Annex I (industrialized) countries, including Canada, have signed the Kyoto Protocol, but Romania is the only one to have ratified it. Thirty-two developing countries plus Mexico have ratified the Protocol.

July 18-27, 2001. *Resumption of the sixth Conference of the Parties (COP 6, see November 2000 entry) in Bonn, Germany. The objective of the resumed meeting will be unchanged.*

October 29 - November 9, 2001. *The seventh Conference of the Parties (COP 7) is due to meet in Marrakech, Morocco.*

September 2-11, 2002. *"Rio + 10" or "Earth Summit 2002," is due to be held in Johannesburg, South Africa, ten years after the 1992 "Earth Summit." (See* ***http://www.johannesburgsummit.org****.) Many Parties have expressed an intention to ratify the Kyoto Protocol in time for this anniversary.*

200?. *Entry into force of the Kyoto Protocol?*

2005. *According to terms of the Kyoto Protocol, Annex I (industrialized country) Parties must have made "demonstrable progress in achieving [their] commitments" under the Protocol. Talks are expected to be launched for the next round of commitments post-2012.*

2008-12. *The Kyoto Protocol's first commitment period, during which Annex I (industrialized country) Parties must meet legally-binding targets to limit their greenhouse gas emissions.*

2013-?? *Second Kyoto Protocol commitment period?*

2.2 The UN Framework Convention on Climate Change

The UN Framework on Climate Change is the global legal framework for international action to address climate change. The Convention was adopted on May 9, 1992 in New York and opened for signature on June 4, 1992 at the Earth Summit in Rio de Janeiro, Brazil. Canada ratified the Convention on December 4, 1992. The Convention entered into force on March 21, 1994, after being ratified by 50 countries. By May 2000, 183 countries had ratified the Convention.

Key features of the Convention

- **Stabilization of greenhouse gas concentrations**. "The ultimate objective of this Convention... is to achieve... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-caused] interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." (article 2)

- **Stabilization of greenhouse gas emissions**. Industrialized country (Annex I) parties accept the "aim of returning individually or jointly to their 1990 levels these anthropogenic [human-caused] emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol" by 2000. (article 4.2(b))

- **Precautionary principle**. "The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." (article 3.3)

- **Developed countries lead**. "The developed country Parties should take the lead in combating climate change and the adverse effects thereof." (article 3.1)

- **Industrialized countries take action**. Each industrialized country (Annex I) Party "shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic [human-caused] emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs." (article 4.2(a))

- **Rich help the poor**. Developed country (Annex II) parties "shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations..." (article 4.3); "shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects" (article 4.4); and "shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention." (article 4.5)

- **Institutions, amendments, protocols**. The text of the Convention defines the institutions required to administer it: the Conference of the Parties, the Secretariat, the Subsidiary Bodies, and a Financial Mechanism (articles 7 to 11). The text also provides for adopting amendments (article 15) and protocols such as the Kyoto Protocol (article 17). See the glossary below for more details.

Glossary of Convention Terminology

An asterisk denotes a cross-reference to another term in the glossary.

Activities Implemented Jointly. Pilot program established by the first *Conference of the Parties in 1995 to encourage emission reduction or greenhouse gas absorption ("sinks") activities carried out through partnerships to implement specific projects between an investor from a developed country and a counterpart in a host country.

Adoption. An intergovernmental agreement is adopted by the negotiating countries when they agree on the text. The agreement can then be opened for *signature. The Convention was adopted on May 9, 1992.

Amendment. The *Conference of the Parties can change the Convention text through consensus or, if consensus cannot be reached, by a three-quarters majority vote by all *Parties present and voting.

Annex I. Lists 40 industrialized countries that agreed to aim to stabilize their greenhouse gas emissions at 1990 levels by 2000. The 40 are: the US, Canada, Australia, New Zealand, Japan, the 15 members of the European Union, Switzerland, Monaco, Liechtenstein, Norway, Iceland, Turkey and almost all of the European ex-Soviet bloc: the three Baltic states, Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania, Bulgaria, Belarus, Ukraine and Russia.

Annex II. Lists 24 developed countries among those in *Annex I that are additionally required to help developing countries with financial and technological resources. The 24 are: the US, Canada, Australia, New Zealand, Japan, the 15 members of the European Union, Switzerland, Norway, Iceland and Turkey.

AOSIS. The Alliance of Small Island States, an ad hoc coalition of low-lying and island countries that are particularly vulnerable to sea-level rise.

Berlin Mandate. Agreement at the first *Conference of the Parties to the Convention (COP 1) that the commitments in the Convention for *Annex I parties were not adequate to fulfill the Convention's objective. The mandate launched the negotiations that led to the adoption of the *Kyoto Protocol.

Conference of the Parties (COP). The supreme body of the Convention. It currently meets once a year to review the Convention's progress. The *Kyoto Protocol was adopted at the third Conference of the Parties (COP 3), and key remaining decisions on the details of the Protocol are to be made at COP 6 (November 13-24, 2000, The Hague, Netherlands; see section 2.4).

COP. *Conference of the Parties.

Entry into force. Intergovernmental agreements become legally binding on countries that have *ratified them only after they have also been *ratified by a certain number of other countries. The Convention entered into force after receiving 50 *ratifications; it enters into force for new *Parties 90 days after they *ratify.

Financial Mechanism. Process set up by the Convention to transfer funds and technologies to developing countries. The Global Environment Facility (established in 1990 by the World Bank and the UN Development and Environment Programmes) is operating the mechanism on an interim basis.

Group of 77 (G-77). A group of 133 developing countries founded in 1964. It seeks to harmonize its negotiating positions on intergovernmental agreements.

Intergovernmental Panel on Climate Change (IPCC). Established in 1988 by the World Meteorological Organisation and the UN Environment Programme, the IPCC brings together leading scientists from all over the world to conduct rigorous surveys of the latest technical and scientific literature on climate change. The IPCC acts as the source of technical advice to the *Conference of the Parties via the *Subsidiary Body for Scientific and Technological Advice.

Kyoto Protocol. Additional instrument adopted under the Convention in December 1997. The Protocol commits *Annex I *Parties to legally-binding targets to limit their greenhouse gas emissions, adding up to a total reduction of at least 5% from 1990 levels in the five-year period 2008-2012. For more details, see section 2.3.

National Communications. The Convention requires each *Party to provide the others (via the *Secretariat) with an inventory of its greenhouse gas emissions and detailed information about its activities to address climate change.

Non-governmental organizations (NGOs). Environmental groups, research institutions, business groups, local government associations, etc. can attend negotiations as observers in order to interact with delegates and the media and provide information.

Party. A state (or regional economic integration organization such as the European Union) that agrees to be bound by an intergovernmental agreement and for which the agreement has *entered into force.

Protocol. Linked to an existing convention, a protocol is a separate and additional agreement that must be *signed and *ratified by *Parties to the convention. The *Kyoto Protocol is the only existing protocol to the UN Framework Convention on Climate Change.

Ratification. After *signing an intergovernmental agreement, a country must ratify it in order to become a *Party. Typically this requires the approval of the national parliament. In the case of the Convention, the instrument of ratification is deposited with the UN Secretary-General and the country becomes a *Party 90 days later. See *entry into force.

Secretariat. Institution established by the Convention to make arrangements for meetings, prepare reports, and coordinate with other relevant international bodies. The secretariat is administered under UN Rules and Regulations. Since August 1996, it has been located in Bonn, Germany.

Signature. By signing an intergovernmental agreement, a senior state or government representative indicates his or her country's agreement with the text that countries have *adopted and its intention to become a *Party. The next stage is *ratification.

Subsidiary Bodies. Institutions established by the Convention and open to participation by all *Parties. The two Bodies meet in parallel at least twice a year. See *Subsidiary Body for Implementation and *Subsidiary Body for Scientific and Technological Advice.

Subsidiary Body for Implementation (SBI). Makes recommendations on policy and implementation issues to the *Conference of the Parties. See *Subsidiary Bodies.

Subsidiary Body for Scientific and Technological Advice (SBSTA). Provides the *Conference of the Parties (COP) with advice on scientific, technological and methodological matters. It serves as the link between expert sources (such as the *Intergovernmental Panel on Climate Change) and the COP. See *Subsidiary Bodies.

Umbrella Group. This informal negotiating bloc's members include the US, Canada, Australia, New Zealand, Japan, Norway, Iceland, Russia and Ukraine. It emerged following the adoption of the Kyoto Protocol.

Resources

Description	Location	Date
Website of the Convention secretariat (also the secretariat of the Kyoto Protocol)	http://www.unfccc.de/	frequent updates
Early history of international activity on climate change	http://www.unep.ch/iucc/fs215.htm	
Guide to the international climate change negotiation process	http://www.unfccc.de/resource/process/index.html	frequent updates
History and explanation of international climate change negotiations	http://www.iisd.ca/climate/fcccintro.html	frequent updates
Fuller glossary of UN Framework Convention on Climate Change and Kyoto Protocol terminology	http://www.unfccc.de/siteinfo/glossary.html	
Full text of the Convention	http://www.unfccc.de/resource/conv/index.html	
List of states that have ratified the Convention	http://www.unfccc.de/resource/conv/ratlist.pdf	frequent updates
Alliance of Small Island States (AOSIS)	http://www.sidsnet.org/aosis/	
Global Environment Facility	http://www.gefweb.org/	
Group of 77	http://www.g77.org/	
Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc.ch/	
Full text of the Kyoto Protocol	http://www.unfccc.de/resource/docs/convkp/kpeng.html	
List of states that have signed or ratified the Protocol	http://www.unfccc.de/resource/kpstats.pdf	frequent updates

Description	Location	Date
Daily reports on past and current international climate change negotiations (*Earth Negotiations Bulletin* or ENB)	http://www.iisd.ca/climate/	daily updates
Canada's Perspective on Climate Change – materials prepared by the Government of Canada for the fifth Conference of the Parties (COP 5), October 1999	http://www.ec.gc.ca/cc/CoP5/index_e.htm	10/1999

2.3 The Kyoto Protocol

The Kyoto Protocol is a legal instrument adopted under the UN Framework Convention on Climate Change (see section 2.2) on December 11, 1997. The Protocol subjects the industrialized countries listed in its Annex B (containing all countries listed in Annex I to the Convention except Belarus and Turkey) to legally-binding targets to limit their greenhouse gas emissions—in contrast to their weaker "aim" to stabilize emissions under the Convention itself. The targets add up to a total reduction of 5% from 1990 levels in the five-year period 2008-2012.

The Protocol was opened for signature on March 16, 1998 and Canada signed it on April 29, 1998. By January 2000, 84 countries had signed, including all Annex B countries except Hungary and Iceland. In order to enter into force, the Protocol will have to be ratified by 55 Parties to the Convention, including Annex I Parties accounting for 55% of total Annex I carbon dioxide emissions in 1990.

If the Protocol enters into force, countries will be legally bound, during the five-year period 2008-2012, referred to as the "first commitment period," to limit their average annual greenhouse gas emissions from human activity by the following amounts relative to 1990 levels: (article 3.1/annex A)

Australia	+8 %	Hungary	-6 %	Poland	-6 %
*Austria	-13 %	Iceland	+10 %	*Portugal	+27 %
*Belgium	-7.5 %	*Ireland	+13 %	Romania	-8 %
Bulgaria	-8 %	*Italy	-6.5 %	Russian Federation	0 %
Canada	-6 %	Japan	-6 %	Slovakia	-8 %
Croatia	-5 %	Latvia	-8 %	Slovenia	-8 %
Czech Republic	-8 %	Liechtenstein	-8 %	*Spain	+15 %
*Denmark	-21 %	Lithuania	-8 %	*Sweden	+4 %
Estonia	-8 %	*Luxembourg	-28 %	Switzerland	-8 %
*Finland	0 %	Monaco	-8 %	Ukraine	0 %
*France	0 %	*Netherlands	-6 %	*United Kingdom	-12.5 %
*Germany	-21 %	New Zealand	0 %	United States	-7 %
*Greece	+25 %	Norway	+1 %		

*These 15 member states of the European Union (EU) agreed on June 16, 1998 to redistribute the EU's overall Kyoto Protocol target of -8 % between themselves, as allowed by article 4.

By May 2001, 34 countries had ratified the Protocol, but of these, only Romania is in Annex B. Most Annex B Parties have chosen to await the outcome of negotiations on the operational details of the Protocol at the sixth Conference of the Parties (COP 6) (see section 2.4) before ratifying.[†] Because of the requirement that countries accounting for 55% of Annex I (industrialized country) emissions ratify the Protocol before it can enter into force, large emitters, especially the US, have a particularly large say. It is, however, possible for the Protocol to enter into force without ratification by the US. For example, if all European countries plus Russia ratify, then the Protocol could enter into force with additional ratifications by Japan, or by both Australia and Canada.

[†] However, on July 11, 2000, France adopted a law to ratify the Protocol.

Other Key Features of the Protocol

- **"Kyoto mechanisms" or "Flexibility mechanisms."** The Protocol allows for three ways in which countries can "buy" either emission reductions or a right to emit from other countries. In this way they can, in effect, adjust their national emission limitation targets. Two project-based mechanisms allow the transfer of emission reductions generated by specific projects, either:
  - "joint implementation" projects between two Annex I (industrialized) countries that lead to net emission reductions "additional to any that would otherwise occur" and "supplemental to domestic actions" (article 6); or
  - "clean development mechanism" projects between an industrialized (Annex I) country and a developing country (not in Annex I) that "assist [developing countries] in achieving sustainable development," have "real, measurable and long-term benefits related to the mitigation of climate change" and lead to net emission reductions that are "additional to any that would otherwise occur." Emission reductions obtained from these projects between 2000 and 2007 can be transferred to the period 2008-2012 (article 12).

  A third mechanism, "emissions trading," allows for the transfer between Annex B (industrialized) countries of parts of their "assigned amounts" of emissions corresponding to the emission limitation targets set by the Protocol. Emissions trading must be "supplemental to domestic actions" (article 17).

  The Protocol leaves it to the Conference of the Parties to establish further details of how these three mechanisms will be implemented, covering matters such as verification of emission reductions and the interpretation of terms such as "additional" and "supplemental." These issues are to be resolved at the sixth Conference of the Parties (COP 6) (see section 2.4).

- **Sinks**. Emission and absorption of greenhouse gases by human-caused "afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks" during 2008-2012, will be counted in evaluating whether countries have met their targets (article 3.3). The Conference of the Parties must also decide how, and which, other human-induced activities since 1990 related to emissions and absorptions of greenhouse gases in the "agricultural soils and land-use change and forestry categories" will additionally be counted in evaluating whether countries have met their targets (article 3.4). The scope of the Protocol's two sinks provisions and details of their implementation are to be resolved at the sixth Conference of the Parties (COP 6) (see section 2.4).

- **Compliance**. The Protocol leaves it to the Conference of the Parties to establish the details of how non-compliance (e.g., failure to meet emissions reduction targets) will be dealt with and what the consequences might be. Binding consequences would require an amendment to the Protocol (article 18). These issues are to be resolved at the sixth Conference of the Parties (COP 6) (see section 2.4).

- **Gases covered**. There are six: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (article 3.5/annex A). CFCs and HCFCs, which are also important greenhouse gases, are not included because they are already covered by the Montreal Protocol (see section 1.3).

- **Subsequent commitment periods**. The Protocol envisages further emission reduction targets post-2012, but does not specify them; this would require an amendment to the Protocol (article 3.9).

See section 2.4 for further discussion of views about the features of the Protocol and the several issues that are to be resolved at the sixth Conference of the Parties (COP 6) in The Hague, Netherlands, November 13-24, 2000.

Glossary of Protocol Terminology

See the glossary in section 2.2 for other terms that apply more generally to the UN Framework Convention on Climate Change.

An asterisk denotes a cross-reference to another term in the glossary.

Activities Implemented Jointly. Pilot program established by the first *Conference of the Parties in 1995 to encourage emission reduction or *sinks activities carried out through partnerships to implement specific projects between an investor from a developed country and a counterpart in a host country. A precursor to the *Clean Development Mechanism and *Joint Implementation.

Additionality. The extent to which emissions reduction or *sinks activities are "additional to any that would otherwise occur"; a condition the Protocol applies to *Joint Implementation and the *Clean Development Mechanism. Activities that are additional must go beyond *business as usual.

Adoption. An intergovernmental agreement is adopted by the negotiating countries when they agree on the text. The agreement can then be opened for *signature. The Protocol was adopted on December 11, 1997 in Kyoto.

Afforestation, reforestation and deforestation (ARD). *"Sinks" activities that can be counted in evaluating whether countries have met their emissions targets, according to article 3.3 of the Protocol. The scope of this provision and details of its implementation are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Amendment. The *Conference of the Parties to the Convention can change the Protocol text through consensus or, if consensus cannot be reached, by a three-quarters majority vote by all *Parties present and voting.

Annex I. Annex I of the Convention (see section 2.2). See *Annex B.

Annex B. Lists 38 industrialized countries that agreed to legally-binding targets with the overall effect of reducing their greenhouse gas emissions by 5% from 1990 levels in the five-year period 2008-2012. The 38 are: the US, Canada, Australia, New Zealand, Japan, the 15 members of the European Union, Switzerland, Monaco, Liechtenstein, Norway, Iceland and almost all of the European ex-Soviet bloc: the three Baltic states, Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania, Bulgaria, Ukraine and Russia. These are the same countries listed in Annex I to the Convention except for Belarus and Turkey.

Article 3.3. See *Afforestation, reforestation and deforestation.

Article 3.4. States that the *Conference of the Parties must decide how, and which, other human-induced *"sinks" activities since 1990 related to emissions and absorptions of greenhouse gases in the "agricultural soils and land-use change and forestry categories" will, over and above *article 3.3, be counted in evaluating whether countries have met their targets. The scope of this provision and details of its implementation are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Assigned amount. Maximum amount of emissions an *Annex B country is allowed during the five-year period 2008-2012, as set by the Protocol's emission limitation targets.

Buenos Aires Plan of Action. Agreement reached at the fourth *Conference of the Parties (COP 4) to strengthen the implementation of the Convention and prepare for the Kyoto Protocol's entry into force. The Plan of Action set COP 6 as the deadline for adopting many important decisions (see section 2.4).

Business as usual. Term used in discussions about *additionality. Emission reduction activities that are "*additional to any that would otherwise occur" are said to go beyond business as usual. Business as usual is typically taken to refer to future emission levels based on current trends plus future actions that have been committed to or are extremely likely to happen.

Clean Development Mechanism. One of the Protocol's *flexibility mechanisms. Ownership of emission reductions from specific projects can be transferred between an *Annex I country and a developing country (not in Annex I) if those projects "assist [developing country parties] in achieving sustainable development," have "real, measurable and long-term benefits related to the mitigation of climate change" and lead to net emission reductions that are "*additional to any that would otherwise occur." Emission reductions obtained from these projects between 2000 and 2007 can be transferred to the period 2008-2012. Details of implementation are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Commitment period. The five-year period 2008-2012, during which *Annex B countries must, on average, meet their emission limitation targets, is the first commitment period. The Protocol envisages subsequent commitment periods, but does not specify them (this would require an amendment to the Protocol).

Compliance. The extent to which *Parties meet their obligations under the Protocol, including the question of consequences for failing to do so. These questions are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Conference of the Parties (COP). The supreme body of the Convention. The Conference of Parties is currently focused on work to bring the Kyoto Protocol into force. Key remaining decisions on details of the Protocol are to be made at the sixth Conference of the Parties (COP 6) (November 13-24, 2000, The Hague, Netherlands) (see section 2.4). Once the Protocol has *entered into force, the Conference of Parties will also serve as the meeting of *Parties to the Protocol. See *COP/MOP.

COP. *Conference of the Parties.

COP/MOP. *Conference of the Parties (COP) to the Convention serving as the Meeting of the Parties to the Protocol. COP/MOP 1 refers to the first COP after the Protocol *enters into force.

Economies in transition. Term used to describe former members of the Soviet bloc, "in transition" to market economies. See *hot air.

Emissions Trading. One of the Protocol's *flexibility mechanisms to allow the transfer between *Annex B countries of parts of their *assigned amounts of emissions. Emissions trading must be "supplemental to domestic actions." Details of implementation are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Entry into force. Intergovernmental agreements become legally binding on countries that have *ratified them only after they have also been *ratified by a certain number of other countries. The Protocol will enter into force when it has been ratified by 55 *Parties to the Convention, including *Annex I Parties accounting for 55% of carbon dioxide emissions from this group in 1990; it will enter into force for new *Parties 90 days after they *ratify.

Flexibility mechanisms. Also known as *Kyoto mechanisms. Three ways in which the Protocol allows countries to "buy" either emission reductions or a "right to emit" from other countries. In this way they can, in effect, adjust their national emissions limitation targets. See *Clean Development Mechanism, *Emissions Trading and *Joint Implementation.

Fungibility. The extent to which emission reduction units transferred under the three *flexibility mechanisms will be interchangeable. This is to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Hot air. Term used to described parts of *assigned amounts sold under *Emissions Trading by certain countries with *economies in transition without their actually having to carry out emission reduction activities. This may be possible for several countries whose emissions have been sharply reduced since 1990 as a result of economic recession and are unlikely to require their entire *assigned amounts to meet their emission limitation targets. Purchasers would be allowed to increase their emissions even though no actions had been taken to reduce emissions, thereby reducing the total net emission reductions achieved by the Protocol.

Joint Implementation. One of the Protocol's *flexibility mechanisms. Ownership of emission reductions from specific projects can be transferred between two *Annex I parties if those projects lead to net reductions "*additional to any that would otherwise occur" and "*supplemental to domestic actions." Details of implementation are to be resolved at the sixth *Conference of the Parties (COP 6) (see section 2.4).

Kyoto mechanisms. See *flexibility mechanisms.

Leakage. Occurs when an emissions reduction or *sinks activity simply displaces activities that produce emissions to another location or time, therefore doing nothing to reduce overall emissions to the atmosphere. This is of particular concern under the *Clean Development Mechanism (CDM), because the developing countries where CDM projects will be carried out are not subject to national emission targets. The requirement for *additionality ought to remove the danger, but in practice might not. The Protocol as a whole may be subject to leakage if it causes activities that produce emissions to migrate from countries with emission targets to countries without such targets.

Liability. The question of who should be held responsible (that is, the buyer, the seller or both) if a country sells too much of its *assigned amount under *Emissions Trading, thereby missing its emission limitation target, or if it fails to deliver the emission reductions claimed for a *Clean Development Mechanism or *Joint Implementation project. Related to the issue of *compliance.

LULUCF. Land-use, land-use change and forestry. Official name for the *sinks issue.

Mechanisms. See *flexibility mechanisms.

Party. A state (or regional economic integration organization such as the European Union) that agrees to be bound by an intergovernmental agreement and for which the agreement has *entered into force.

Ratification. After *signing an intergovernmental agreement, a country must ratify it in order to become a *Party. Typically this requires the approval of the national parliament. In the case of the Protocol, the instrument of ratification is deposited with the UN Secretary-General and the country becomes a *Party 90 days later. See *entry into force.

Secretariat. The secretariat to the Convention also serves as the secretariat to the Protocol.

Signature. By signing an intergovernmental agreement, a senior state or government representative indicates his or her country's agreement with the text that countries have *adopted and its intention to become a *Party. The next stage is *ratification.

Sinks. Term applied to greenhouse gas-absorbing land-use change, forestry and agricultural activities addressed in *article 3.3 and *article 3.4 of the Protocol. See *LULUCF.

Subsidiary Bodies. The subsidiary bodies to the Convention (see section 2.2) also serve as the subsidiary bodies to the Protocol.

Supplementarity. The extent to which emissions reduction or *sinks activities are "supplemental to domestic actions"; a condition the Protocol applies to *Emissions Trading and *Joint Implementation.

Resources

- For general resources on the Kyoto Protocol, see section 2.2.
- For resources relating to the issues that are likely to be most contentious at the sixth Conference of the Parties (COP 6), see section 2.4.
- For the climate change websites of national governments, intergovernmental organizations, international environmental non-governmental and business organizations, many of which may present positions on the international negotiations, see section 2.6.

2.4 Key Decision Points at COP 6, The Hague, November 13-24, 2000

The sixth Conference of the Parties to the UN Framework Convention on Climate Change (COP 6) could make or break the Kyoto Protocol, which commits industrialized countries to legally-binding targets to limit their greenhouse gas emissions (see section 2.3). This crucial intergovernmental meeting will likely shape international—and Canadian—efforts to address climate change for the next several years.

It was two years earlier, at the fourth Conference of the Parties (COP 4) in Buenos Aires (November 2-14, 1998) that countries agreed to the "Buenos Aires Plan of Action." The Plan of Action set COP 6 as the deadline for deciding on the operational details of many of the key features of the Protocol. Until these details are specified, it will remain unclear precisely what implementing the Protocol will involve. Many countries, particularly the industrialized countries subject to emission limitation targets under the Protocol, are therefore awaiting the outcome of COP 6 before considering ratifying it. The Protocol can only enter into force when 55 Parties to the Convention, including industrialized (Annex I) countries accounting for 55% of carbon dioxide emissions from this group in 1990, have ratified the Protocol.

The five issues that are likely to be most contentious at COP 6 are outlined below. Under the Buenos Aires Plan of Action, decisions on the first four of them are to be reached at COP 6. For more detailed background information on these issues, see section 2.3. Note that we are not attempting to give a comprehensive listing of which countries are for or against certain positions.

- **Kyoto (flexibility) mechanisms**. The Protocol allows industrialized countries to "buy" emission reductions or "rights to emit" from other countries. In this way they can, in effect, adjust their national emissions limitation targets. The clean development mechanism (CDM) is perhaps most contentious because it allows acquisition of emissions reductions via investment in projects in developing countries not subject to targets themselves. Emissions trading between industrialized countries is also contentious because of the possible sale of surplus rights to emit from the ex-Soviet bloc that are simply the result of economic recession ("hot air") and not generated by actual emission reduction activities. Points of contention also include:
    - Will sinks projects be allowed in the CDM? (US and Canada in favour, EU against)
    - Will nuclear power projects be allowed in the CDM? (Canada in favour, many against)
    - How will it be decided that CDM projects lead to emission reductions that are "additional to any that would otherwise occur"?
    - Will there be limits on the amount of emissions reductions or rights to emit that countries can buy abroad? (EU in favour, US and Canada against)
    - In emissions trading, will the seller of emissions reductions or the right to emit be solely liable for over-selling (US and Canada in favour) or will the buyer have some liability?
    - Will the CDM be as attractive to industrialized countries as emissions trading and joint implementation? (Developing countries, who want to attract CDM investment, are worried that it might not be.)

- **Sinks**. The Protocol allows countries to offset their emissions with credits for the absorption of greenhouse gases by forestry activities and possibly by additional activities such as agricultural soil management. Countries with large forestry and agriculture sectors, such as the US, Canada and Australia, are pushing for maximum credit from these greenhouse gas "sinks." Others, such as the Alliance of Small Island States (AOSIS), are concerned that use of sinks could seriously weaken the effectiveness of the Protocol. Points of contention also include:
    - How will reforestation and deforestation be defined: Will countries earn debits for logging or credits for replanting after logging or both?
    - Will a perverse incentive be created to log before 2008 and then gain credits for regrowth during 2008-2012?
    - Which additional sinks activities (agricultural, etc.) will be eligible for credits?
    - Can the amounts of greenhouse gases absorbed by sinks be accounted for fairly?
    - Will there be limits on the amount of sinks credits countries can use?

- **Compliance**. It remains to be decided how it will be ensured that countries actually meet their emission limitation targets. For example:
    - To what extent will compliance be "facilitated" rather than "enforced"?
    - Which countries and organizations will be eligible to participate in enforcing compliance and how?
    - What will be the consequences of non-compliance?

- **"Adverse Effects."** The Protocol mandates the Conference of the Parties to "consider what actions are necessary to minimize the adverse effects of climate change and/or the impacts of response measures" on developing countries that are (i) most vulnerable to climate change, and (ii) highly dependent on the production or consumption of fossil fuels. In relation to this requirement,
    - OPEC countries are demanding compensation for the economic impacts of reduced demand for oil caused by implementing the Protocol.
    - Developing countries vulnerable to climate change want developed countries to provide assistance in the form of financial and technological resources.

- **Technology transfer/"capacity building."** The participation of developing countries in global environmental agreements invariably depends on transfer of resources from developed countries, and the UN Framework Convention on Climate Change is no exception. The Convention requires developed countries to provide developing countries with money and technology both to deal with the impacts of climate change and, by implication, to control their emissions (see section 2.2). Continued cooperation from developing countries will depend on progress on transfer of resources. In particular, developing countries insist that the CDM cannot replace developed countries' obligations to transfer technology under the Convention.

Resources

See section 2.6 for the climate change websites of national governments and intergovernmental, environmental non-governmental, and business organizations, many of which may present positions on COP 6.

Description	Location	Date
Website of the Secretariat of the UN Framework Convention on Climate Change and the Kyoto Protocol	http://www.unfccc.de/	frequent updates
The Secretariat's special website for COP 6	http://cop6.unfccc.int/	
Guide to the international climate change negotiation process	http://www.unfccc.de/resource/process/index.html	frequent updates
History and explanation of international climate change negotiations	http://www.iisd.ca/climate/fcccintro.html	frequent updates
Glossary of UN Framework Convention on Climate Change and Kyoto Protocol terminology	http://www.unfccc.de/siteinfo/glossary.html	
Full text of the Kyoto Protocol	http://www.unfccc.de/resource/docs/convkp/kpeng.html	
List of states that have signed or ratified the Protocol	http://www.unfccc.de/resource/kpstats.pdf	frequent updates
Daily reports on past and current international climate change negotiations (*Earth Negotiations Bulletin* or ENB)	http://www.iisd.ca/climate/	daily updates
The Government of Canada's Clean Development Mechanism and Joint Implementation Office	http://www.dfait-maeci.gc.ca/cdm-ji/menu-e.asp	
Final report on the Kyoto flexibility mechanisms from the national climate change consultation process – useful background on the issues and concepts	http://www.nccp.ca/html/tables/pdf/options/Integrated_Final_Report_October.pdf	10/1999
Negotiating the CDM, a North-South Perspective – a presentation of the debate and different points of view on the clean development mechanism	http://www.pembina.org/pubs/cop6.htm	06/2000
Intergovernmental Panel on Climate Change (IPCC) Special Report on sinks (summary for policy makers)	http://www.ipcc.ch/pub/SPM_SRLULUCF.pdf	05/2000
Final report on sinks from the national climate change consultation process – useful introduction to sinks issues in Canada	http://www.nccp.ca/html/tables/pdf/options/Sinks_OR-Sep-23-1999_en.pdf	09/1999
Intergovernmental Panel on Climate Change (IPCC) Special Report on technology transfer (summary for policy makers)	http://www.ipcc.ch/pub/SPM_SRTT.pdf	05/2000

2.5 What are the Americans Doing on Climate Change?

US policy on climate change is of particular interest to Canada because of the high degree of integration between the US and Canadian economies. Significant measures to address climate change taken in the US will have repercussions in Canada; to a lesser extent, the reverse is also true. US climate policy is also of special importance because the US emits almost half the developed world's greenhouse gas emissions and nearly a quarter of global emissions (see section 1.3). The Kyoto Protocol, which commits industrialized countries to emission limitation targets, can only enter into force when countries representing 55% of emissions by industrialized countries (a larger group than developed countries) have ratified it. Although this is possible without ratification by the US, US non-ratification would threaten the Protocol's viability.

The Clinton Administration was one of the parties that negotiated the Kyoto Protocol, and continues to support it. The Procotol commits the US to a 7% reduction in emissions below the 1990 level during 2008-2012 (compared with 6% for Canada). However, the Administration has been pushing for maximum use of the Protocol's flexibility mechanisms (allowing purchase of emission reductions or rights to emit from other countries) and "sinks" provisions (credits for the absorption of greenhouse gases by forestry and, possibly, agriculture). It has also been trying to get developing countries to commit to emission limitation targets.

This reflects the opposition of the Republican-led Congress to the Kyoto Protocol, which is based largely on the fact that the Protocol exempts developing countries from legally-binding emission limitation targets. On July 25, 1997, in the lead-up to the Kyoto conference, the US Senate voted 95-0 to oppose any agreement containing such an exemption. The Senate resolution also contains a strong expression of concern about impacts on the US economy from mandatory emissions reductions, demanding that any agreement be accompanied by a detailed analysis of such impacts.

The two leading candidates for the November 2000 presidential election have starkly differing views on the Kyoto Protocol. Al Gore personally led the US delegation at Kyoto, and favours "a strong international treaty to begin combatting global warming—in a way that is market-based and realistic, and does not lead to economic cooling." The position of George W. Bush, on the other hand, is to "oppose the Kyoto Protocol because it is ineffective, inadequate and unfair to America." The 2000 Republican Platform complains that the "[Kyoto conference's] deliberations were not based on the best science; its proposed agreements would be ineffective and unfair inasmuch as they do not apply to the developing world; and the current administration is still trying to implement it, without authority of law."

It is true that the US Government has been relatively active in addressing climate change domestically, arguably more so than Canada. Significant domestic US actions include:

- President Clinton's **2001 budget proposal** (February 2000): spending of US$4.3 billion covering research on and deployment of clean energy technology, climate change science, and an initiative to reduce vehicle emissions; and tax incentives worth US$4 billion over five years for energy-efficient homes and vehicles and for clean energy.
- Approved **funding for budget year 2000**: US$3.3 billion in spending and over US$1 billion in tax incentives.
- Administration **pledge to implement domestic emissions trading** as the key measure to achieve emissions reductions, pending ratification of the Kyoto Protocol.

- **Official goals** to triple biomass energy in the US by 2010, supply 5% of US electricity through wind power by 2020, and reduce emissions from federal operations by 30% from the 1990 level by 2010.
- Action by **state government**s, including: US$540 million trust fund for renewable energy in California; New Jersey commitment to reduce emissions by 3.5% below the 1990 level by 2005; restrictions on greenhouse gas emissions from new power plants in Oregon.
- **Legislative activity**: Over 20 bills related to climate change were in committee in Congress in March 2000.

Resources

Description	Location	Date
US State Department – major source of information on international negotiations	http://www.state.gov/www/global/global_issues/climate/index.html	
US – Environmental Protection Agency	http://www.epa.gov/globalwarming/	
US greenhouse gas emissions inventory, 1990-98	http://www.epa.gov/globalwarming/publications/emissions/us2000/index.html	02/2000
Key facts about US energy industries	http://www.eia.doe.gov/emeu/cabs/usa.html	frequent updates
Daily reports on international climate change negotiations, including many references to US positions (*Earth Negotiations Bulletin* or ENB)	http://www.iisd.ca/climate/	daily updates
US Congress – full information on current and past legislative activity	http://thomas.loc.gov/	daily updates
George W. Bush's position on the environment (including the Kyoto Protocol)	http://georgewbush.com/issues/environment.html	2000
2000 Democrat Platform	http://www.democrats.org/index.html	08/2000
Actions Undertaken to Address Climate Change – Environment Canada compilation of government action in various countries	Contact Wayne Moore, Environment Canada: (819) 994-1659	03/2000

2.6 Climate Change Resources of National Governments and Intergovernmental, Environmental Non-Governmental, and Business Organizations

National Governments

Description	Location	Date
Australia	http://www.greenhouse.gov.au/	
Canada	http://www.climatechange.gc.ca/	
Canada's Perspective on Climate Change – materials prepared by the Government of Canada for the fifth Conference of the Parties to the UN Framework Convention (COP 5), October 1999	http://www.ec.gc.ca/cc/CoP5/index_e.htm	10/1999
France (in French only)	http://www.environnement.gouv.fr/actua/cominfos/dosdir/DIRPPR/dosdppr.htm#Climat	
Germany	German: http://www.bmu.de/ (then choose "Klimaschutz" under "Aktuelle Themen H-O") English: http://www.bmu.de/english/index_e.htm	English site limited
India – Ministry of Environment and Forests (responsible for India's participation in the UN Framework Convention on Climate Change)	http://envfor.nic.in/	
Italy (in Italian only)	http://www.minambiente.it/Sito/settori_azione/pia/Home_PIA.asp (then click on "Cambiamenti climatici")	
Japan	http://www.eic.or.jp (in Japanese only)	
New Zealand	http://www.mfe.govt.nz/issues/climate.htm	
United Kingdom	http://www.environment.dtlr.gov.uk/ga/	
US State Department – major source of information on international negotiations	http://www.state.gov/www/global/global_issues/climate/index.html	
US Environmental Protection Agency	http://www.epa.gov/globalwarming/	

Intergovernmental Organizations

Description	Location	Date
Alliance of Small Island States (AOSIS)	http://www.sidsnet.org/aosis/	
European Union	http://europa.eu.int/comm/environment/climat/home_en.htm	
Global Environment Facility	http://www.gefweb.org/	
Group of 77 and China – most recent statement on climate change	http://www.g77.org/Speeches/042800.htm	04/2000
G8 2000 Summit Statement (see para. 65 for climate change)	http://www.g8kyushu-okinawa.go.jp/e/documents/commu.html	07/2000
Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc.ch/	
International Energy Agency (linked to the OECD) – Climate Change Issues	http://www.iea.org/envissu/index.htm	
International Energy Agency – Greenhouse Gas R&D Programme	http://www.ieagreen.org.uk/	
Inter-Agency Committee on the Climate Agenda	http://www.msc-smc.ec.gc.ca/iacca/iacca_e.cfm	
OECD – Climate Change and Environmentally-Sustainable Transport	http://www.oecd.org/env/cc/index.htm	
OPEC – main page	http://www.opec.org/	
UN Commission on Sustainable Development – Energy	http://www.un.org/esa/sustdev/enr.htm	
UN Conference on Trade and Development – Greenhouse Gas Emissions Trading	http://www.unctad.org/en/subsites/etrade/	
UN Framework Convention on Climate Change secretariat (also the secretariat of the Kyoto Protocol)	http://www.unfccc.de/	
UN Development Program – Climate Change and Sustainable Development	http://www.undp.org/seed/eap/Climate_Change/CC_and_SD.html	
UN Environment Program – Energy and OzonAction Unit	http://www.unepie.org/hp_oa.html	
UN Industrial Development Organization – Kyoto Protocol Branch	http://www.unido.org/doc/310797.htmls	
World Bank – Global Climate Change	http://www-esd.worldbank.org/cc/	
World Health Organization – Climate and Health	http://www.who.int/peh/climate/climate_and_health.htm	

Environmental Non-Governmental Organizations (NGOs) active in international climate change negotiations

Description	Location	Date
Climate Action Network – a global network of over 287 NGOs and seven regional offices that regularly speaks on behalf of NGOs at international negotiations	http://www.climatenetwork.org/	
Greenpeace International	http://www.greenpeace.org/~climate/index.html Bill Hare, Climate Policy Director: +31 6 2129 6899	
International Institute for Sustainable Development – publisher of the *Earth Negotiations Bulletin*	http://iisd.ca/climatechange.htm	
Pembina Institute – spokespersons for the sixth Conference of the Parties to the UN Framework Convention (COP 6), November 2000	http://www.pembina.org/climate/ Andrew Pape: call (613) 235-6288 to obtain number in The Hague Robert Hornung: (613) 235-6288	
World Wide Fund for Nature (WWF) International	http://www.panda.org/climate/ Jennifer Morgan, Director, Climate Change Campaign: (201) 873-0034	

Business Organizations active in international climate change negotiations

Description	Location	Date
Business Council for Sustainable Energy – coalition of US natural gas, energy efficiency, electric utility and renewable energy industries	http://www.bcse.org/	
Business Council on National Issues (Canada) – voice for the CEOs of many of Canada's largest companies	http://www.bcni.com/	
Global Climate Coalition – "an organization of business trade associations... [that] represents virtually every sector of the U.S. business sector"	http://www.globalclimate.org/	
International Chamber of Commerce	http://www.iccwbo.org/	
International Climate Change Partnership – coalition of 30 major international companies and trade associations "committed to constructive and responsible participation in the international policy process"	http://www.iccp.net/	
Pew Center on Global Climate Change – focal point for 21 major US companies that state qualified support for the Kyoto Protocol	http://www.pewclimate.org/	
World Business Council for Sustainable Development – coalition of 140 international companies, including Noranda, Ontario Power Generation, Petro-Canada, Suncor Energy and TransAlta	http://www.wbcsd.ch/	

3 CANADA'S POLICY FRAMEWORK ON CLIMATE CHANGE

3.1 A Chronology of Climate Change Policy in Canada

June 27-30, 1988. The Toronto Conference on the Changing Atmosphere, convened by the Government of Canada, brings together over 300 scientists and policy makers from 46 countries and organizations. The Conference calls for a "comprehensive international framework that can address the interrelated problems of the global atmosphere"; states that "humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war"; and recommends the reduction of carbon dioxide emissions by 20% from 1988 levels by 2005.

January 1990. The City of Toronto establishes itself as a world leader in addressing climate change with a commitment to reduce CO_2 emissions by 20% from 1998 levels by 2005.

May 1990. At a UN meeting in Bergen, Norway, Canada commits to stabilize its greenhouse gas emissions at the 1990 level by 2000.

November 1990. The federal-provincial *National Action Strategy on Climate Change* is published. It outlines a "strategic framework" for addressing climate change. It states that "The limitation of emissions must begin now," and outlines some measures that governments might take; however, "Measures to be introduced by various levels of government to implement elements of the strategy will be announced independently."

March 1991. The House of Commons Standing Committee on Environment publishes a report entitled *Out of Balance: The Risks of Irreversible Climate Change*, in which it suggests that Canada's objective of stabilizing greenhouse gas emissions at the 1990 level by 2000 is not sufficient.

May 9, 1992. The UN Framework Convention on Climate Change (see section 2.2) is adopted in New York. Under the Convention, industrialized countries, including Canada, commit to the "aim" of returning their greenhouse gas emissions to 1990 levels by 2000.

June 1992. At the Earth Summit in Rio de Janeiro, Canada announces it is "pursuing a 'quick-start' agenda on climate change."

December 4, 1992. Canada ratifies the UN Framework Convention on Climate Change.

November 17, 1993. At a joint meeting, federal and provincial energy and environment ministers announce they have instructed officials "to proceed with the development of options to meet Canada's current commitment to stabilize net greenhouse gases (GHG) emissions by the year 2000, and to further develop sustainable options to achieve further progress in the reduction of emissions by the year 2005."

Early 1994. *Canada's National Report on Climate Change* is released, "to provide a snapshot of action currently being taken... to meet domestic and international climate change commitments." The Report projects that with current policies, programs and measures, Canada's energy-related greenhouse gas emissions (88% of the total) will be 11% above the 1990 level in 2000. The Report concludes that "additional measures are needed."

Early 1994. After the release of the *National Report*, and in response to the instruction from joint ministers (see November 17, 1993), federal and provincial officials charge a multistakeholder Climate Change Task Group with "the development of a National Action Program to enable Canada to reach its climate change goals." Following deliberations, the Group puts forward 88 measures to reduce Canada's greenhouse gas emissions.

February 1995. *Canada's National Action Program on Climate Change* is released by federal and provincial energy and environment ministers. The document contains a revised projection that Canada's greenhouse gas emissions will be 13% above the 1990 level in 2000. It acknowledges the measures put forward by the Climate Change Task Group, saying that "[they have] been used to identify strategic directions in the *Action Program*" but that "Further analytical work will be undertaken to assess [their] applicability... to the *National Action Program.*" The Plan describes many approaches to reducing emissions and announces a few specific new measures. Notable among these is the Voluntary Challenge and Registry (see Summer 1995 below).

April 1995. The Climate Change Task Group completes an environmental and economic assessment of packages drawn from the 88 measures it put forward. The macroeconomic assessment concludes that: "In the period 1995 to 2010, the overall size of the Canadian economy, and its growth, are unlikely to be significantly changed by initiatives designed to reduce emissions of greenhouse gases." However, significant shrinkage is projected for some industries, and even the most ambitious package of measures modelled falls short of stabilization of Canada's emissions at the 1990 level by 2000 (see also September 1996).

Summer 1995. The Voluntary Challenge and Registry (VCR) is established as a key element of the *National Action Program on Climate Change*. The VCR encourages private and public sector organizations to voluntarily limit their net greenhouse gas emissions. Organizations submit publicly accessible action plans and progress reports. Initially run by Natural Resources Canada, the VCR later becomes a stand-alone not-for-profit organization.

1995. The Cities of Ottawa, Toronto, Regina, Edmonton and Vancouver become the founding members of the Federation of Canadian Municipalities' 20% Club. Municipal governments that are members of the Club publicly commit to reduce their greenhouse gas emissions by 20% below 1990 levels by 2005 or within ten years of joining. The Club later evolves into the Partners for Climate Protection Program, a joint initiative with the International Council for Local Environmental Initiatives.

September 1996. The Canadian Climate Action Network publishes a *Rational Energy Program* including an economic assessment similar to that conducted by the Climate Change Task Group (see April 1995). The Program includes 30 measures selected from the 88 put forward by the Task Group plus tax measures post-2000 to achieve projected 2010 emissions 8% lower than the 1990 level with a less than 1% impact on GDP compared to business as usual.

November 1996. The *Review of Canada's National Action Program on Climate Change* states that actions taken under the Program have reduced Canada's projected emissions in 2000 to only 8% above the 1990 level (compared to 13% projected in the *Action Program* itself). However, it acknowledges that "Canada cannot achieve stabilization [of 2000 emissions at the 1990 level] without significant additional actions."

December 12, 1996. The federal ministers of Natural Resources and Environment announce "new initiatives and improvements to existing programs designed to engage all Canadians in a strengthened and expanded National Action Program on Climate Change." New initiatives include government purchase of "green power" in Ontario and Alberta, a Canadian Home Energy Efficiency Rating System, and new energy efficiency regulations to cover equipment in the commercial sector.

February 18, 1997. The 1997 federal budget includes new spending of $20 million per year for three years "to promote investments in both energy efficiency and renewable energy for new and existing commercial buildings." According to the 1998 *Budget Plan*, "prior to the 1997 budget, the government was investing over $100 million in direct spending each year to combat climate change."

April 1997. *Canada's Second National Report on Climate Change* again states that government initiatives have reduced Canada's projected emissions in 2000 to only 8% above the 1990 level, compared to 13% projected in the *National Action Program* (see February 1995). The difference is attributed to 272 policies and programs among federal, provincial, territorial and municipal governments, plus 235 corporate action plans submitted to the Voluntary Challenge and Registry (VCR). Of the government policies and programs, 168 are educational, 56 research and development programs, 36 regulations and 12 financial incentives. The report notes that "the small number of regulatory measures along with VCR commitments account for a large percentage of the total impact of [National Action Program] initiatives."

April 1997. Information on Canada's emissions in the *Second National Report* is based on two separate federal reports published this month. Natural Resources Canada's *Canada's Energy Outlook: 1996-2020* projects that although emissions will only be 8% higher than the 1990 level in 2000, they will be 19% higher in 2010 and 36% higher in 2020 if government policies remain unchanged. And Environment Canada's greenhouse gas emissions inventory report shows that Canada's emissions in 1995 were already 9% higher than the 1990 level.

Mid-late 1997. Media coverage of, and political and public debate on, climate change in Canada intensifies in the run-up to the third Conference of the Parties to the UN Framework Convention on Climate Change (COP 3). COP 3 will be held in Kyoto, where a Protocol is due to be adopted defining legally-binding greenhouse gas emissions reductions for industrialized countries.

November 12, 1997. Federal, provincial and territorial energy and environment ministers meeting in Regina "agreed that it is reasonable to seek to reduce aggregate greenhouse gas emissions in Canada back to 1990 levels by approximately 2010. Ministers further recognized the desirability to move beyond this basic stabilization of greenhouse gases..."

November 24, 1997. Environment Canada officially releases the *Canada Country Study*, an eight-volume scientific assessment of projected impacts of climate change on Canada if greenhouse gas concentrations in the atmosphere continue to rise. Some of the impacts projected over the next several decades are severe (see section 1.2 for a summary).

December 1, 1997. The Government of Canada announces its position for COP 3 in Kyoto: to reduce greenhouse gas emissions to 3% below the 1990 level by 2010, and a further 5% by 2015.

December 11, 1997. COP 3 in Kyoto adopts the Kyoto Protocol (see section 2.3), under which Canada agrees to the legally-binding target of reducing its greenhouse gas emissions by 6% from 1990 levels on average during the five-year period 2008-2012.

December 12, 1997. At their meeting in Ottawa, Canada's First Ministers "agreed that climate change is an important global issue and that Canada must do its part and must do so in such a way that no region is asked to bear an unreasonable burden." "They also agreed to establish a process, in advance of Canada's ratification of the Kyoto Protocol, that will examine the consequences of Kyoto and provide for full participation of the provincial and territorial governments with the federal government in any implementation and management of the Protocol." First Ministers "directed their Ministers of the Environment and Energy to work together to consider jointly the appropriate courses of action."

February 1998. The federal Climate Change Secretariat is established by the Prime Minister. It reports to the Deputy Ministers of Natural Resources Canada and Environment Canada, and will be closely integrated with the national (federal-provincial) Climate Change Secretariat (see April 24, 1998).

February 24, 1998. The 1998 federal budget includes new spending of $50 million per year for three years, which will be used to establish and run the Climate Change Action Fund. The Fund will have four components: Public Education and Outreach; Technology Early Action Measures; Science, Impacts and Adaptation; and Foundation Analysis. This last component will be used to support the National Climate Change Process (see April 24, 1998).

April 24, 1998. At their joint meeting in Toronto, federal, provincial and territorial ministers of energy and environment approve "a process to develop the National Implementation Strategy on Climate Change," and "the creation of a national climate change secretariat" to oversee this National Climate Change Process. Under this process, 16 multistakeholder Issue Tables are soon established and mandated to produce "options" for the National Implementation Strategy. Ministers also "agreed to... develop immediate actions consistent with the guiding principles that can be taken to provide early reductions in emissions," and "agreed to establish by early 1999 a system for crediting verifiable early action to reduce greenhouse gas emissions against any future obligations."

April 29, 1998. Canada signs the Kyoto Protocol.

May 26, 1998. Canada's Commissioner of the Environment and Sustainable Development publishes his findings on Canada's response to climate change. The Commissioner states, "So far, there has been little concrete action." He finds that the *National Action Program on Climate Change* has been "inadequately implemented. Many of the key elements necessary to manage the implementation of Canada's response to climate change are missing or incomplete."

October 20, 1998. At their joint meeting in Halifax, federal, provincial and territorial ministers of energy and environment "asked officials to propose a process, by Spring 1999, which will lead to a strategy to be reviewed by Ministers in late 1999. ... Ministers reaffirmed the two-track approach governments were taking to address climate change—taking actions that have clear benefits now, while systematically assessing options for measures for sustained reductions." Ministers "reinforce their interest in establishing a system for providing credit for early action in 1999."

February 16, 1999. New climate change initiatives in the 1999 federal budget are a tax change to encourage reduced flaring from crude oil production; and funds to help municipalities identify opportunities for energy savings in their operations.

October 12, 1999. The Speech from the Throne opening the second session of Parliament following the 1997 General Election reiterates that "[T]he Government will work with other governments and citizens to meet our country's commitment under the Kyoto Protocol to reduce greenhouse gas emissions."

October 1999. The federal government publishes a *Compendium of Canadian Initiatives* in which it states it is "currently investing $200 million a year to address climate change," of which $50 million goes to the Climate Change Action Fund (see February 24, 1998).

November 1999 - March 2000. Final "options reports" are published from 15 of the 16 Issue Tables established under the National Climate Change Process (see April 24, 1998). (The 16th table, the Analysis and Modelling Group, is charged with analyzing the options put forward by the other tables and will submit its report shortly before the October 2000 Joint Ministers' Meeting.)

December 1999. Environment Canada releases Canada's latest greenhouse gas emissions inventory report, which shows that Canada's emissions in 1997 were 13% higher than the 1990 level. The Analysis and Modelling Group (see previous item) also releases the latest official projections of future emissions, which replace those made in April 1997. They show that if government policies remain unchanged, Canada's emissions are now expected to be 15% higher than the 1990 level in 2000, 27% higher in 2010 and 41% higher in 2020 (see section 1.3 for more details).

January 12, 2000. Federal, provincial and territorial ministers of energy and environment announce a "Baseline Protection initiative" to ensure that corporate entities that are taking early action to reduce greenhouse gas emissions will not be penalized if future programs (domestic emissions trading, for example) allocate emissions reductions on the basis of emissions levels.

February 28, 2000. The 2000 federal budget includes new spending of over $500 million on climate change over the four fiscal years 1999-2003: $140 million to renew the Climate Change Action Fund (see February 24, 1998 item) and energy efficiency and renewable energy programs; $125 million to set up Green Municipal Investment and Enabling Funds (see section 3.4); $100 million to establish a Sustainable Development Technology Fund; $100 million for the Canadian International Development Agency for climate change-related technology transfer; $60 million for the Canadian Foundation for Climate and Atmospheric Sciences to conduct basic scientific research; $15 million for federal green energy procurement; and $15 million for the World Bank's Prototype Carbon Fund.

March 24, 2000. The Pembina Institute releases a study showing that of the 88 measures put forward by the Climate Change Task Group in 1994, only 33% have been implemented (taking into account partial implementation), and that the implementation rate for measures involving financial incentives or regulation has been only 15%.

March 28, 2000. Federal, provincial and territorial ministers of energy and environment, meeting in Vancouver for the first time in 17 months, agree on "key elements" of Canada's National Implementation Strategy on Climate Change, but delay "final consideration" of the Strategy, including a "first business plan" of specific measures, until their next meeting in October. The first three-year business plan will "draw upon the extensive work of experts, including the wide range of ideas and options put forward by the Issue Tables..." Ministers also direct officials to draft a Federal-Provincial-Territorial Framework Agreement on Climate Change "that formalizes the nature of the partnership [between governments]." Ministers again "asked officials to consider a system to credit verifiable early action [to reduce greenhouse gas emissions]"—a year later than the deadline they had earlier set to establish such a system (see April 24, 1998). The Government of Québec walks out of the meeting, complaining that "By refusing to face the true challenges raised by the fight against climate change, the federal government has squashed every hope of quick progress towards implementation of concrete measures for [greenhouse gas] reductions."

Early October, 2000. The federal government and the governments of Québec and British Columbia release plans outlining (but with relatively few details) a large number of new measures they intend to take to address climate change. The *Government of Canada Action Plan 2000 on Climate Change* commits to new spending of "up to" $500 million over five years on measures in all major greenhouse gas emitting sectors, and states that these will achieve annual net emissions reductions in 2010 equivalent to about one-third of the gap between Canada's Kyoto target and the projected level of emissions in the absence of the measures. Of these reductions, 55% are attributed to domestic emissions reductions, up to 20% to "sinks" (absorption of carbon dioxide by growing forests, agricultural soil management practices etc.) and 25% to projects undertaken in other countries. For more information, see section 3.2. Québec's *Action Plan on Climate Change 2000-2002* and British Columbia's *Climate Change Business Plan 2000/01-2002/03* also include new (or recently announced) measures in all major sectors, with an emphasis on transportation. The Québec plan includes a major investment in public transit in Montréal and Québec City ($215 million in the period 2000-2002); most of the other measures are not costed. The British Columbia plan includes an investment of $780 million over three years to expand the SkyTrain network, and a total of "more than" $13 million of new spending in sectors other than transportation. For more information on these provincial plans, see section 3.3.

October 16-17, 2000. One year later than they had intended (see October 28, 1998), federal, provincial and territorial ministers of energy and environment meeting in Quebec City adopt *Canada's National Implementation Strategy on Climate Change* and *Canada's First National Climate Change Business Plan*. They also agree to submit a draft Federal-Provincial-Territorial Framework Agreement on Climate Change (see March 28, 2000) for approval by their respective governments. However, Ontario ministers refuse to participate in these three items in the absence of agreement on their demands for "tough national air quality and climate change standards" and a "co-ordinated North American (Canada, U.S. and Mexico) approach for negotiations and protocol implementation planning". The *National Implementation Strategy* describes the general approach that governments will adopt, while the *First National Business Plan* details specific measures, both "approved and underway" and "under consideration". The *Plan* contains a large number of measures originating in all jurisdictions except Ontario and Québec, but appears to contain no new government measures likely to achieve nationally-significant emission reductions* other than those already announced in the federal, British

* i.e., more than about one megatonne of carbon dioxide equivalent per year (per measure)

Columbia and Québec plans. (For more information on the *Strategy* and the *Plan*, see section 3.2.) Ministers (excluding Ontario) also agree to initiate analytical work to examine "possible provincial/territorial or sectoral allocation of any Canadian [emissions reduction] target", a decision considered crucial to obtaining Québec's participation in the other decisions. All ministers agree to meet again in 2001 to approve a new, updated national business plan.

October 18, 2000. The federal government releases an *Economic Statement and Budget Update* that confirms $500 million of new spending on the environment to fund the *Action Plan 2000 on Climate Change* (see early October, 2000).

October 2000. Canada's latest greenhouse gas emissions inventory shows that Canada's emissions in 1998 were 13% higher than the 1990 level. Using newly adjusted figures for previous years, emissions in 1997 were 12% higher than in 1990, and year-on-year emissions growth slowed from 1.6% in 1996-97 to 0.7% in 1997-98.

November 2000. The Analysis and Modelling Group, a group of federal and provincial government officials charged with analyzing options for greenhouse gas emission reductions under the National Climate Change Process (see April 24, 1998) releases a report entitled *An Assessment of the Economic and Environmental Implications for Canada of the Kyoto Protocol.* The report concludes that attainment of Canada's Kyoto target would result in a 0-3% impact on GDP compared to business as usual. (A 3% impact means that Canada's economy would grow by about 26% in the first decade of the 21st century instead of 30%.) In a partial analysis of benefits to human health from reduced air pollution resulting from measures to meet the Kyoto target, the report values those benefits at $300 to $500 million per year.

June 2001. The federal government announces details of measures included in *Action Plan 2000 on Climate Change* (see early October 2000) relating to transportation and to its own emissions. It announces a target of reducing these to 31% below the 1990 level by 2010.

Resources

(in chronological order – see text above for details)

Description	Location	Date
Canada's National Action Program on Climate Change	http://www.ec.gc.ca/climate/resource/cnapcc/indexe.html	02/1995
Voluntary Challenge and Registry inc.	http://www.vcr-mvr.ca/home_e.cfm	frequent updates
Partners for Climate Protection Program	http://www.fcm.ca/english/national/programs/club/club.html	
Rational Energy Program (Canadian Climate Action Network)	Available from the Sierra Club of Canada: (613) 241-4611	09/1996
Canada's Second National Report on Climate Change	http://www.ec.gc.ca/press/ccrep2_m_e.htm	04/1997
First Ministers' Meeting Joint Communiqué	http://www.scics.gc.ca/cinfo/80003606_e.html	12/1997
Joint Ministers' Meeting news release (with link to Summary of decisions)	http://www2.ec.gc.ca/press/jmm1_n_e.htm	04/1998

Description	Location	Date
Report of the Commissioner of the Environment and Sustainable Development (see Chapter 3 on climate change)	http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c8menu_e.html	05/1998
Joint Ministers' Meeting Notice to the Media	http://www.scics.gc.ca/cinfo98/83063350_e.html	10/1998
National Climate Change Process Issue Table "options reports"	http://www.nccp.ca/html/table.htm	11/1999-03/2000
Federal *Budget Plan* (2000)	http://www.fin.gc.ca/budget00/bp/bptoce.htm	02/2000
The Pembina Institute's assessment of implementation of the 88 measures put forward by the Climate Change Task Group in 1994	http://www.pembina.org/pubs/fiveyears.htm	03/2000
Baseline Protection initiative announcement and backgrounder	http://www.nccp.ca/html/media.htm	01/2000
Joint Ministers' Meeting communiqué and Records of Decision	http://www.nccp.ca/html/media.htm	03/2000
Québec's communiqué following Joint Ministers' Meeting	http://www.menv.gouv.qc.ca/communiques/2000/c000328b.htm (in French)	03/2000
Government of Canada Action Plan 2000 on Climate Change	http://www.nccp.ca/html/media/GofCdaPlan-en.pdf	10/2000
Québec's *Action Plan on Climate Change 2000-2002*	http://www.menv.gouv.qc.ca/air/changement/plan_action/index-en.htm	10/2000
British Columbia's *Climate Change Business Plan 2000/01-2002/03*	http://www.elp.gov.bc.ca/epd/epdpa/ar/climate/ccbuspln.pdf	10/2000
Joint Ministers' Meeting communiqué and Records of Decision	http://www.nccp.ca/html/jmm.htm	10/2000
Ontario's news release following Joint Ministers' Meeting	http://www.ene.gov.on.ca/envision/news/00711.htm	10/2000
Canada's National Implementation Strategy on Climate Change	http://www.nccp.ca/html_f/media/JMM-fed-fr.pdf	
Canada's First National Climate Change Business Plan	http://www.nccp.ca/html/media/FNBP2-eng.pdf	10/2000
Federal *Economic Statement and Budget Update*	http://www.fin.gc.ca/toce/2000/ec00e.htm	10/2000
Analysis and Modelling Group report	http://www.nccp.ca/NCCP/pdf/AMG_finalreport_eng.pdf	11/2000

3.2 Federal Government and National Programs Related to Climate Change

As of October 2000, Canada's domestic climate change policy framework is set out in *Canada's National Implementation Strategy on Climate Change*. This document describes the general approach that governments are adopting, which includes annually updated three-year business plans detailing specific measures for each three-year period. *Canada's First National Climate Change Business Plan* was also adopted in October 2000.[*]

The federal government's contribution to the *First National Business Plan* is separately described in the *Government of Canada Action Plan 2000 on Climate Change*. *Action Plan 2000* sets out new measures in all major greenhouse gas emitting sectors, and states that these will achieve annual net emissions reductions in 2010 of 65 megatonnes of carbon dioxide equivalent, equivalent to about one-third of the gap between Canada's Kyoto target and the projected level of emissions in the absence of the measures. The Plan provides relatively few details, but some of the measures or objectives with the potential to account for a significant fraction of these emissions reductions are:

- negotiate new vehicle fuel efficiency targets with the automobile industry and the United States;
- triple Canada's ethanol production capacity (for blending with gasoline);
- quadruple use of emerging renewable energy sources by, for example, purchasing 20% of federal electricity requirements from such sources, and by providing financial incentives;
- provide financial incentives for more energy efficient buildings;
- various measures in the agriculture and forestry sectors, to which the Plan attributes 20% of its total emission reductions;[†]
- measures to help Canadian companies implement projects in other countries that would generate emission reduction credits for Canada under the "flexibility mechanisms" of the Kyoto Protocol (see section 2.3). The Plan attributes 25% of its total emission reductions to such projects.

The anticipated date for beginning implementation of most of the measures in *Action Plan 2000* is April 1, 2001, following consultations.

Federal and national programs and measures to address climate change that were in place prior to *Canada's First National Climate Change Business Plan* have been compiled in a *Compendium of Canadian Initiatives*, listing all the main federal departmental programs as well as many provincial/territorial programs that address climate change, along with brief descriptions and contacts (see resources below). One of the most prominent such programs in

[*] The government of Ontario, however, has endorsed neither the *National Implementation Strategy* nor the *First Business Plan*, to which it has contributed no measures. The government of Québec has endorsed both the Strategy and the Plan but has chosen to detail the specific measures it intends to take in its own *Action Plan on Climate Change 2000-2002*. Further details of these and other provincial government measures are provided in section 3.3.

[†] Some of these measures, instead of actually reducing emissions, foster "sinks" that absorb carbon dioxide from the atmosphere. It is not clear to what extent the amount of carbon dioxide absorption attributed to these measures by *Action Plan 2000* is is a direct result of the measures, and how much would occur anyway in their absence.

recent years has been the Voluntary Challenge and Registry (VCR), established in 1995. The VCR encourages private and public sector organizations to voluntarily limit their net greenhouse gas emissions. Participating organizations submit publicly accessible action plans and progress reports. Initially run by Natural Resources Canada, the VCR is now a stand-alone not-for-profit organization.

Another important national initiative pre-dating *Canada's First National Climate Change Business Plan* is the Partners for Climate Protection Program, which encourages municipal governments to undertake greenhouse gas emission inventories and establish targets for reducing emissions from both municipal operations and the wider community. The program is run jointly by the Federation of Canadian Municipalities and the International Council for Local Environmental Initiatives. For more details, see section 3.4.

Federal spending on climate change has recently been rising:

- in October 1999, the federal government estimated its total investment in its departmental programs that address climate change at approximately $150 million per year;
- in addition to its departmental programs, in 1998 the federal government also began spending $50 million annually on the Climate Change Action Fund, which pays for public education projects, technology development, scientific research and policy development and analysis;
- the 2000 federal budget included new spending of over $500 million on climate change over the four fiscal years 1999-2003: $140 million to renew the Climate Change Action Fund and energy efficiency and renewable energy programs; $125 million to set up Green Municipal Investment and Enabling Funds (see section 3.4); $100 million to establish a Sustainable Development Technology Fund; $100 million for the Canadian International Development Agency for climate change-related technology transfer; $60 million for the Canadian Foundation for Climate and Atmospheric Sciences to conduct basic scientific research; $15 million for federal green energy procurement; and $15 million for the World Bank's Prototype Carbon Fund;
- in October 2000, the *Government of Canada Action Plan 2000 on Climate Change* (see above) committed to new spending of "up to" $500 million over five years. This funding was confirmed in the government's *Economic Statement and Budget Update*.

The official position of the federal government is that "the Minister of Natural Resources will take the lead in developing and co-ordinating Canada's domestic implementation strategy, while the Minister of the Environment will lead the development of Canada's international climate change agenda... [and] continue to hold primary responsibility for the development of overall environmental policy in this area."

Resources

Description	Location	Date
Main federal government climate change website	http://www.climatechange.gc.ca/english/	frequent updates
Canada's National Implementation Strategy on Climate Change	http://www.nccp.ca/html/media/JMM-fed-en.pdf	10/2000
Canada's First National Climate Change Business Plan	http://www.nccp.ca/html/media/FNBP2-eng.pdf	10/2000
Government of Canada Action Plan 2000 on Climate Change	http://www.nccp.ca/html/media/GofCdaPlan-en.pdf	10/2000
A Compendium of Canadian Initiatives on climate change	http://www.nccp.ca/html/compendium.htm	10/2000
Voluntary Challenge and Registry Inc.	http://www.vcr-mvr.ca/home_e.cfm	frequent updates
Partners for Climate Protection Program	http://www.fcm.ca/english/national/programs/club/club.html	
Canada's Climate Change Action Fund	http://www.climatechange.gc.ca/english/actions/action_fund/	frequent updates
Federal *Budget Plan* (2000)	http://www.fin.gc.ca/budget00/bp/bptoce.htm	02/2000
Federal *Economic Statement and Budget Update*	http://www.fin.gc.ca/toce/2000/ec00e.htm	10/2000

3.3 What are Provincial Governments Doing on Climate Change?

Provincial governments have at least partial jurisdiction over most of Canada's inventory of greenhouse gas emissions (see section 1.3). For example, provincial governments regulate electric utilities, industrial facilities, public transit, building codes, agricultural practices and solid waste management. It is therefore essential that the provinces be fully involved in any national effort to address climate change. Provincial and territorial ministers of energy and environment participate in regular Joint Ministers' Meetings at which climate change policy is discussed with their federal counterparts.

No comprehensive listing of provincial programs addressing climate change appears to exist. However, in October 2000 governments published *A Compendium of Canadian Initiatives* (see resources below) that lists many such programs, organized by sector and type of activity, along with brief descriptions and contacts. All provinces and territories are represented in the *Compendium* except for Ontario, Manitoba and Newfoundland.

The government of Ontario has published a separate compilation of its own climate change-related actions (see resources below). Information and contacts on provincial governments' activities on climate change are also provided on those governments' websites.

In October 2000, the Pembina Institute published what is, to our knowledge, the only systematic comparison of provincial governments' actions to address climate change. The comparison, which was based on interviews with key provincial government officials, assessed to what extent the governments of Alberta, British Columbia, Ontario, Québec and Saskatchewan (together accounting for 89% of Canada's greenhouse gas emissions) have implemented 38 policy measures in all key sectors. The measures selected for the assessment have been widely discussed for several years, notably in the "options reports" published in late 1999 and early 2000 at the conclusion of the multistakeholder National Climate Change Process (see section 3.5).

Again in October 2000, the governments of Québec and British Columbia released plans detailing a large number of new measures they intend to take to address climate change. Québec's *Action Plan on Climate Change 2000-2002* and British Columbia's *Climate Change Business Plan 2000/01-2002/03* include new (or recently announced) measures in all major sectors, with an emphasis on transportation.

Some of the measures in the Québec plan with the potential to generate the largest emissions reductions are:

- a major investment in public transit in Montréal and Québec City ($215 million in the period 2000-2002);
- subsidies ($10.3 million in the Montréal area during 2000-2005) for the creation of programs under which employers implement measures to reduce car use by their employees;
- new directives to municipal government aimed at fostering urban development with lower associated greenhouse gas emissions;
- mandatory capture and burning of biogas from solid waste landfills.

Notable measures in the British Columbia plan include:

- an investment of $780 million over three years to expand the SkyTrain network;
- $21 million in one year to establish high-occupancy vehicle and transit lanes;
- up to $20 million on increased passenger rail service between Vancouver and Seattle;
- updating regulatory requirements relating to landfill gas;
- reviewing and updating energy efficiency standards for new appliances and equipment.

Resources

Description	Location	Date
A Compendium of Canadian Initiatives on climate change	http://www.nccp.ca/html/compendium.htm	10/2000
The government of Ontario's compilation of its climate change-related actions	http://www.ene.gov.on.ca/envision/airclimate/4072e.pdf (see p.8)	10/2000
The Pembina Institute's report *Provincial Government Performance on Climate Change: 2000*	http://www.pembina.org/pubs/ReportCard.htm	10/2000
Québec's *Action Plan on Climate Change 2000-2002*	http://www.menv.gouv.qc.ca/air/changement/plan_action/index-en.htm	10/2000
British Columbia's *Climate Change Business Plan 2000/01-2002/03*	http://www.elp.gov.bc.ca/epd/epdpa/ar/climate/ccbuspln.pdf	10/2000
Government of Alberta – Climate Change Central	http://www.gov.ab.ca/env/climate	
British Columbia Ministry of Environment, Lands and Parks – climate change	http://www.elp.gov.bc.ca/epd/epdpa/ar/climate/	
British Columbia Ministry of Energy and Mines	http://www.gov.bc.ca/em/	
Manitoba Conservation	http://www.gov.mb.ca/environ/	
Manitoba Conservation – Energy	http://www.gov.mb.ca/natres/energy/	
New Brunswick Department of Environment and Local Government	http://www.gov.nb.ca/elg-egl/index-e.htm	
New Brunswick Department of Natural Resources and Energy	http://www.gnb.ca/0078/	
Newfoundland Department of Mines and Energy	http://www.gov.nf.ca/mines&en/	
Newfoundland Department of Environment and Labour – Environment Branch	http://www.gov.nf.ca/env/Env/	
Northwest Territories Department of Resources, Wildlife and Economic Development – climate change	http://www.gov.nt.ca/RWED/eps/energy.htm	
Nova Scotia Department of Natural Resources – climate change	http://www.gov.ns.ca/natr/climate/	
Nova Scotia Department of Environment and Labour	http://www.gov.ns.ca/enla/	

Description	Location	Date
Government of Nunavut	http://www.gov.nu.ca/sd.htm	
Ontario Ministry of the Environment	http://www.ene.gov.on.ca/	
Ontario Ministry of Energy, Science and Technology – Energy Section	http://www.est.gov.on.ca/english/en/en_intro.html	
Prince Edward Island Department of Fisheries, Aquaculture and Environment – Environmental Protection	http://www.gov.pe.ca/fae/ep-info/index.php3	
Prince Edward Island Department of Development and Technology – Energy and Minerals	http://www.gov.pe.ca/development/eam-info/index.php3	
Québec Environment Ministry – Air (in English)	http://www.menv.gouv.qc.ca/air/index-en.htm	
Québec Ministry of Natural Resources	http://www.mrn.gouv.qc.ca/0/eng/ (in English) http://www.mrn.gouv.qc.ca/ (in French)	
Saskatchewan Environment and Resource Management – climate change	http://www.serm.gov.sk.ca/environment/climatechange/	
Saskatchewan Energy and Mines	http://www.gov.sk.ca/enermine/	
Yukon Department of Economic Development	http://www.economicdevelopment.yk.ca/	
Yukon Department of Renewable Resources – Environment	http://www.renres.gov.yk.ca/environ/	

3.4 Canada's Municipal Governments and Climate Change

There are over 4000 municipal governments in Canada. They have a key role to play in addressing climate change because:

- Activities under their direct control account for about 6% of Canada's total greenhouse gas emissions (see section 1.3). These are attributable to landfills, residential waste management choices; energy use in municipal buildings and operations; and, in some cases, power generation.
- Activities under municipalities' indirect control or influence account for over 50% of Canada's total greenhouse gas emissions (see section 1.3). This category covers energy use in residential, commercial and institutional buildings; use of motor vehicles; industrial, commercial and institutional solid waste management choices; and some industrial operations.
- Of the three levels of government, municipal governments are the quickest to make decisions and act. They are also the closest to the population and can significantly influence the behaviour of individuals.
- Municipal governments are major economic players, with expenditures equivalent to about 5% of Canada's GDP.
- Municipal governments would bear the brunt of the some of the projected impacts of climate change, including any increase in extreme weather events, sea-level rise in coastal communities, impacts on sources of fresh water, and more frequent air pollution episodes resulting from hot weather.

The Federation of Canadian Municipalities (FCM) has been prominent in efforts to reduce the greenhouse gas emissions under the direct or indirect control of municipal governments. In 1995, the FCM established its "20% Club," of which the Cities of Ottawa, Toronto, Regina, Edmonton and Vancouver were the founding members, committing to reduce their greenhouse gas emissions by 20% below 1990 levels by 2005. The Club has since evolved into the Partners for Climate Protection Program, a joint initiative with the International Council for Local Environmental Initiatives.

Partners for Climate Protection members are encouraged to undertake corporate and community-wide greenhouse gas emission inventories and then establish a target of reducing emissions from municipal operations by 20%, and community-wide emissions by a minimum of 6%, within ten years of joining. Members develop and implement "Local Action Plans" that aim first to reduce emissions and energy use in municipal operations, and then expand to reduce emissions in the community. Local Action Plans also incorporate public awareness and education campaigns. Current members of Partners for Climate Protection, listed on the following page, represent 61% of Canada's population.

Internationally, the International Council for Local Environmental Initiatives (ICLEI) founded its Cities for Climate Protection Campaign in 1993, with members making similar commitments to those of Partners for Climate Protection. Nearly 400 local governments are members, including 68 in Canada.

For examples of municipal greenhouse gas emission reduction success stories, see section 4.2. Links to further, similar case studies are provided in the resources below.

Members of the Partners for Climate Protection Program, August 2000

Alberta
Banff
Calgary
Canmore
Cold Lake
Didsbury
Edmonton
Okotoks
Strathcona County

British Columbia
Abbotsford
Anmore
Burnaby
Campbell River
Coquitlam
Delta
District of Central Kootenay
District of North Vancouver
Greater Vancouver Regional District
Hudson's Hope
Kamloops
New Westminister
North Vancouver
Port Alberni
Port Moody
Saanich
Surrey
Vancouver
Victoria
Whistler

Manitoba
The Pas
Town of Swan River
Winnipeg

New Brunswick
Quispamsis

Northwest Territories
Fort Simpson
Fort Smith
Yellowknife

Nova Scotia
Halifax Regional Municipality
New Glasgow

Ontario
Brantford
Collingwood
Dundas
Guelph
Iroquois Falls
Kitchener
London
Mississauga
Ottawa
Perth
Port Hope
Regional Municipality of Hamilton-Wentworth
Regional Municipality of Ottawa-Carlton
Scugog
Sudbury (Region)
Thunder Bay
Toronto

Québec
Boucherville
Chelsea
Laval
Montréal
Montréal-Est
Québec City

Saskatchewan
Regina

Yukon
Whitehorse

In the 2000 federal budget, the administration of two major new funds was assigned to the FCM: the $100-million Green Municipal Investment Fund and the $25-million Green Municipal Enabling Fund. Fund priorities are "improvements in air, water and soil quality and climate protection," through more efficient energy, water, wastewater, transit and solid waste management systems, for example.

The funds are intended to support projects that generate savings in municipal operations, but over five to ten years instead of the traditional one to five years. Projects would aim for energy or process efficiency improvements of, for example, 35 to 50% over current performance. The Enabling Fund will cover up to 50% of the cost of feasibility studies, while municipal governments will be able to apply for interest-bearing loans (generally covering no more than 15% of capital costs of projects) or loan guarantees from the Investment Fund to supplement project financing. Interest and fee income earned by the Investment Fund will be used to support innovative pilot projects with payback periods in excess of ten years.

Resources

Description	Location	Date
Final report on municipalities from the national climate change consultation process – recommended measures for reducing emissions from the municipal sector and useful background information	http://www.nccp.ca/html/tables/pdf/options/MT_OR-12-1999.pdf	12/1999
Partners for Climate Protection Program	http://www.fcm.ca/english/national/programs/club/club.html http://www.iclei.org/co2/canada_pcp.html	
Partners for Climate Protection Program case studies	http://www.fcm.ca/english/national/programs/club/studies.html	
Success stories, tools and resources on how to reduce greenhouse gas emissions from the municipal sector	http://www.climatechangesolutions.com/english/municipal/default.htm	06/2000
International Council for Local Environmental Initiatives	http://www.iclei.org/	
"Successful examples of.... implementing 'sustainable development' at the local level"	http://www.iclei.org/iclei/casestud.htm	
Detailed information on the new Green Municipal Investment and Enabling Funds (Federation of Canadian Municipalities)	http://www.fcm.ca/newfcm/Java/frame.htm	

3.5 What Canada Could Do to Reduce its Greenhouse Gas Emissions

Detailed policies and measures to address climate change and limit greenhouse gas emissions have been under discussion in Canada for several years, and some have already been adopted (see sections 3.2-3.4). But much more needs to be done if Canada is to meet its commitment under the Kyoto Protocol to reduce its greenhouse gas emissions by 6% from 1990 levels on average during the five-year period 2008-2012. The latest official projections of future emissions show that if additional measures are not taken, Canada's emissions will be 27% higher in 2010 than they were in 1990 (see section 1.3 for more details).

Various comprehensive packages of measures have been proposed to change this situation. For example, in 1994, the Climate Change Task Group established by federal and provincial governments put forward 88 measures addressing all major greenhouse gas-emitting sectors.[*]

In 1998, in light of Canada's Kyoto commitment, federal, provincial and territorial ministers of energy and environment initiated a National Climate Change Process, under which 15 Issue Tables were mandated to produce "options" to address climate change. The Tables involved some 450 experts from governments, industry, environmental non-governmental organizations and universities. Final "options reports" from the Tables were published between November 1999 and March 2000.

The Issue Tables have put forward over 300 measures. For full details on the measures and estimates for the corresponding greenhouse gas emission reductions, costs and other information, the reader is referred to the options reports themselves (see resources below). To give a flavour of the range and nature of the measures that have been put forward, those that were estimated by the Issue Tables to be capable of generating emission reductions of over one megatonne of carbon dioxide equivalent per year (to be compared to Canada's total 1997 emissions of 682 megatonnes) are listed in the table below. Many potentially important measures are not listed here because the Issue Tables did not make corresponding estimates of emission reductions. In some cases, different measures address the same source of emissions, which means that total emission reductions cannot be calculated simply by adding up individual measures.

One measure absent from this table that could potentially achieve enormous emissions reductions is a domestic emissions trading system, under which emitters of greenhouse gases would be required to hold permits (which could be bought and sold) for each tonne of gases they emit. The total number of permits in circulation—accounting for up to 75% of Canada's total emissions[†]—would be controlled by government. Such a system was discussed at the Electricity, Industry, and Tradeable Permits Tables.

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[*] In the Canadian Climate Action Network's *Rational Energy Program* (September 1996), 30 measures selected from the 88 put forward by the Task Group, plus tax measures post-2000, were projected to achieve an emissions level in 2010 8% lower than in 1990. In October 1998, the Pembina Institute and the David Suzuki Foundation published *Canadian Solutions*, a proposal for how to meet Canada's Kyoto Protocol target though 17 policy measures in the areas of transportation, electricity generation, industry, buildings and emissions unrelated to energy.

[†] 75% is the figure estimated by the Tradeable Permits Working Group as representing the "broadest practical" coverage of the economy.

Measures Estimated to Generate Emission Reductions of more than 1 Megatonne of Carbon Dioxide Equivalent per Year[I]

Issue Table	Measure
Agriculture and agri-food	Soil management [e.g., minimum and zero-tillage practices]
	Grazing management [primarily prevention of overgrazing]
	Shelterbelts [tree-planting on agricultural land]
	Manure management [optimization of manure application to land]
Buildings	National energy efficient housing renovation and retrofit program
	National standards program for equipment and appliances [targetting energy efficiency]
	Commercial building [energy efficiency] retrofit program
	Public buildings initiative [energy efficiency improvements to provincial and municipality-owned or funded buildings]
	Energy efficient equipment tax measures
Credit for early action	—
Electricity	Support for emerging, non-GHG [greenhouse gas]-emitting technologies [includes government procurement of electricity from renewable sources; production credits to renewable energy producers; rebates on retail bill premiums paid for electricity from renewable sources; generation quota or portfolio standard to establish a minimum amount of electricity generation from renewable sources]
	Generation quota or portfolio standard [minimum amount of electricity generation from renewable sources during 2008-2012]
Enhanced voluntary action	—
Forest sector	Improved process thermal integration in pulp and paper mills [optimization of the transfer of heat between various mill processes]
	Adopt high energy-efficiency process technologies in the pulp and paper industry
	Increased use of hog-fuel [woodwaste] boilers in the pulp and paper industry
	Increased woodwaste cogeneration [simultaneous generation of heat and power] in the pulp and paper industry
	Fuel-switching in lumber and panelboard mills [replacement of high-greenhouse-gas-emitting fuels by lower-emitting fuels]
	Kraft pulp mill black liquor integrated gasification and combined cycle cogeneration [better use of process wastes to generate heat and power]
	Afforestation: planting of fast-growing [tree] species
Industry Note: the Industry Table was divided into subtables that each produced reports. These reports contain measures that were not included in the National Climate Change Secretariat's compilation from which this table was drawn.	—
Issue Table	**Measure**

[I] These measures were taken directly from the Issue Table reports. The text in square brackets has been added for clarification.

Kyoto mechanisms	—
Municipalities	Regulate new/existing landfill sites over 2.5 Mt [mandating large sites to capture and flare landfill gas]
	Capital infrastructure program for landfill gas capture and flaring
	Establish market value system for landfill gas emission reduction [via a landfill gas emission reduction trading system]
	New municipal specific building codes which promote enhanced energy efficiency
	National buildings energy efficiency securitization fund utilizing municipal governments as a delivery agent [to facilitate financing of energy-efficiency retrofits]
	Increase the share of nodal or compact development [policies to stimulate urban design measures such as transit, pedestrian and cycling access and avoiding urban sprawl]
	Transportation demand management and infrastructure investment [reduce vehicle kilometres travelled using policies and investments in alternative transportation infrastructure]
	Establish a revolving fund to develop and finance viable community energy system projects [community energy systems use locally available fuel sources to provide heat, cooling, and power to clusters of buildings or to large areas in a community]
	Community energy system measure – encourage all new generation to be CHP [combined heat and power generation] with seasonal efficiencies of greater than 70%
Public education and outreach	—
Science, impacts and adaptation	—
Sinks (carbon sequestration)	—
Technology	—
Tradeable permits working group	—
Transportation	Transit infrastructure [projects targetting, for example, commuter rail and separate bus lanes]
	Transit service improvements [such as more frequency, new routes and improvements in convenience]
	Transit pricing [e.g., trip subsidies provided by employers, daily charge on vehicles driven to work]
	Ridesharing programs and incentives – voluntary or mandatory [e.g., employers required to provide carpool matching, preferential parking and a guaranteed ride home]
	Road pricing [per-kilometre charge on all urban highways except in small urban centres]
	Parking pricing [price increases for all commuter parking]
	Driver education and awareness [national drivers' fuel-efficiency awareness program]
	Intercity bus subsidy [per-kilometre basis]
	Enforcement of existing highway speed limit
	Reduction of highway speed limit to 90 km/h
	Short term measures [in air transport, including better air traffic management, replacement of older aircraft and improved routing]
	Limit aviation activity [regulation of all aircraft activity, including a cap on all general aviation and non-airline commercial activity]
Issue Table	**Measure**
Transportation (cont'd)	Fuel cell[-powered] locomotive

	Electrify western [rail] mainlines
	Adopt US NO_x regulations [which require major reductions in nitrogen oxide emissions from locomotives]
	Vehicle speed and use control [maximum speeds reduced by regulation to either 105 km/h or 90 km/h for all trucks]
	Tires – low rolling resistance option [all trucks over 4500 kg equipped with low rolling resistance tires]
	Truck lubricants [shift to synthetic engine lubricants which improve fuel efficiency]
	Accelerated scrappage rates for trucks [decreasing the average age of trucks in the commercial fleet]
	Truck engine retrofit [for vehicles more than 15 years old]
	Improve [truck] driver training in fuel efficient driving practices
	Reduce idling [trucks]
	Fuel economy targets [for the average fuel consumption of light vehicle manufacturers' fleets]
	Vehicle incentive program [rebates on purchases of vehicles with at least 30% lower emissions than their class average]
	Alternative fuels [e.g. ethanol] infrastructure incentives
	Feebate [surtax on higher fuel-consuming vehicles and rebate for lower fuel-consuming vehicles]
	Fuel tax (national)
	Embedded GHG [greenhouse gas] tax [all existing fuel excise taxes increased in proportion to the greenhouse gas emissions for each fuel]
	Urban gas tax
	Road gasoline and road diesel tax
	Fuel efficiency regulations [for off-road vehicles]
	Public awareness campaign [about purchasing energy-efficient off-road equipment and vehicles]
	Voluntary Memorandum of Understanding (MOU) with Manufacturers [on off-road vehicle energy efficiency]

Resources

Description	Location	Date
The Pembina Institute's assessment of implementation of the 88 measures put forward by the Climate Change Task Group in 1994 – provides a convenient summary of the measures	http://www.pembina.org/pubs/fiveyears.htm	03/2000
National Climate Change Process Issue Table "options reports"	http://www.nccp.ca/html/table.htm	11/1999 - 03/2000
Rational Energy Program (Canadian Climate Action Network)	Available from the Sierra Club of Canada: (613) 241-4611	09/1996
Canadian Solutions (Pembina Institute and David Suzuki Foundation)	http://www.pembina.org/pubs/cdnsol.htm	10/1998

3.6 Key Decision Points at the Joint Meeting of Energy and Environment Ministers, Québec, October 16-17, 2000

Federal, provincial and territorial ministers of Energy and Environment typically meet once or twice a year. The October 2000 Joint Ministers' Meeting (JMM) is especially important as ministers have agreed to give "final consideration" there to Canada's National Implementation Strategy on Climate Change.

Two and a half years earlier, at their joint meeting in Toronto (April 24, 1998), the ministers approved "a process to develop the National Implementation Strategy" in light of Canada's commitment under the Kyoto Protocol (see section 2.3). Under the Protocol, Canada agreed to the legally-binding target of reducing its greenhouse gas emissions by 6% from 1990 levels, on average, during the five-year period 2008-2012.

The ensuing National Climate Change Process has involved some 450 experts from governments, industry, environmental non-governmental organizations and universities, meeting at 15 "Issue Tables" to produce "options" for the National Implementation Strategy. Final options reports from the tables were published between November 1999 and March 2000. A sixteenth table, the Analysis and Modelling Group, was charged with analyzing the options put forward by the other 15 and will submit its report shortly before the JMM.

Following completion of the issue table options reports, there was a JMM in Vancouver (March 28, 2000) where ministers agreed on "key elements" or guiding principles of the National Implementation Strategy. But ministers "asked officials to continue analysis and consultations to permit final consideration of the strategy when they meet this fall." Ministers also committed to discuss at the October meeting these further items:

- **A first three-year business plan** "of specific actions" under the National Implementation Strategy. The plan "will draw upon the extensive work of experts, including the wide range of ideas and options put forward by the Issue Tables..." Business and environmental non-governmental organizations, many of whom were engaged for over 18 months in the Issue Table process, are keenly interested in seeing which measures are included in the first business plan, and in assessing their likely impact on Canada's greenhouse gas emissions. Ministers agreed in Vancouver that the five priorities for "Phase One" (prior to Canada's decision on ratification of the Kyoto Protocol) will be:
    - "Enhancing awareness and understanding" (public education)
    - "Promoting technology development and innovation"
    - "Investing in knowledge and building the foundation" (policy analysis and science)
    - "Governments leading by example" (i.e., reducing their own emissions)
    - "Encouraging action"—"catalyze immediate actions to reduce greenhouse gas emissions across sectors and within all key sectors..."

- **A proposed Federal-Provincial-Territorial Framework Agreement on Climate Change** "that formalizes the nature of the partnership [between governments]." Officials were instructed at the Vancouver JMM to draft this "short high-level" document. Federal and provincial governments each have control over major portions of Canada's total greenhouse gas emissions, and as long ago as November 1990, the

National Action Strategy on Global Warming stated that "The principles and elements of the national action strategy should be codified in federal/provincial agreements." However, the Commissioner of the Environment and Sustainable Development found in his May 1998 report that "there are no clear and transparent agreements or arrangements between the federal government and the provinces and territories that specifically define their respective roles and responsibilities in achieving [Canada's international climate change commitments]."

- **Results of modelling the economic and environmental/health impacts** of options put forward by the Issue Tables. These are due to be submitted by the Analysis and Modelling Group, the sixteenth Issue Table, shortly before the JMM. Those who object to major action to reduce greenhouse gas emissions have often claimed that serious economic damage would be caused by such action, while proponents of major action have called attention to health "co-benefits," since many measures to reduce greenhouse gas emissions will also reduce air pollution. The modelling results will shed light on these issues. See also section 3.8.

- **Canada's interests at the sixth Conference of the Parties to the UN Framework Convention on Climate Change** (COP 6, see section 2.4), which will begin just four weeks after the JMM. Many would agree that Canada's negotiating position at COP 6 can be significantly strengthened if Canada is able to demonstrate it is taking significant action to address climate change domestically. This is particularly relevant in relation to developing countries, in light of the Convention's requirement that "The developed country Parties should take the lead in combating climate change and the adverse effects thereof" (see section 2.2).

- **A proposal for engaging the general public on climate change**. Some observers believe that Canada's failure to curb its growth in greenhouse gas emissions is related to insufficient public concern about the issue. Also, the activities of individuals (home heating, personal transportation, etc.) are directly responsible for approximately one-quarter of Canada's emissions (see section 1.3).

At the previous JMM in Vancouver (March 28, 2000), the Government of Québec walked out of the meeting and did not participate in drafting the communiqué or the decision concerning "next steps." The Québec Environment Minister complained that "By refusing to face the true challenges raised by the fight against climate change, the federal government has squashed every hope of quick progress towards implementation of concrete measures for [greenhouse gas] reductions." He particularly insisted on two points: (i) lack of discussion about "equitable sharing" of Canada's emission reduction target under the Kyoto Protocol between different jurisdictions; and (ii) lack of recognition for Québec's avoidance of greenhouse gas emissions via its large-scale use of hydroelectricity. These objections may again loom large at the October JMM.

Resources

Description	Location	Date
Communiqué and Records of Decision from March 2000 Joint Ministers' Meeting, Vancouver	http://www.nccp.ca/html/media.htm	03/2000
Québec's communiqué following March 2000 Joint Ministers' Meeting	http://www.menv.gouv.qc.ca/communiques/2000/c000328b.htm	03/2000
Notice to the Media from October 1998 Joint Ministers' Meeting (Halifax)	http://www.scics.gc.ca/cinfo98/83063350_e.html	10/1998
News release from April 1998 Joint Ministers' Meeting, Toronto (with link to Summary of decisions)	http://www2.ec.gc.ca/press/jmm1_n_e.htm	04/1998
Report of the Commissioner of the Environment and Sustainable Development (see Chapter 3 on climate change)	http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c8menu_e.html	05/1998
National Climate Change Process Issue Table "options reports"	http://www.nccp.ca/html/table.htm	11/1999-03/2000

3.7 The Climate Change Policy Debate in Canada: Environmental Non-Governmental, Business, and Other Organizations, and Politicians

Environmental Non-Governmental Organizations (NGOs) active in the climate change policy debate

Description	Location	Date
Clean Nova Scotia	http://www.clean.ns.ca/programs/Climate%20Change/cchange.html Meinhard Doelle, Executive Director: (902) 420-3476	
Conservation Council of New Brunswick	http://www.web.net/~ccnb/ Dave Coon: (506) 458-8747	
David Suzuki Foundation	http://www.davidsuzuki.org/Campaigns_And_Programs/Climate_Change/ Gerry Scott, Director of Climate Change: (604) 732-4228 ext. 234	
Greenpeace Canada	http://www.greenpeacecanada.org/e/home.html Steven Guilbeault, Climate and Energy Campaigner: (514) 933-0021 or 944-2650	
Nuclear Awareness Project	http://www.cnp.ca/ Dave Martin: (905) 852-0571	
Pembina Institute	http://www.pembina.org/climate/default.htm http://www.climatechangesolutions.com/english/ Robert Hornung, Climate Change Program Director, or Matthew Bramley Ph.D., Senior Policy Analyst: (613) 235-6288	
Pollution Probe	http://www.pollutionprobe.org/ Rick Findlay: (613) 237-8666	
Saskatchewan Environmental Society	http://www.lights.com/ses/projects/climate/index.html Ann Coxworth, Program Co-ordinator: (306) 665-1915	
Sierra Club of Canada	http://www.sierraclub.ca/national/index.html John Bennett, Director, Atmosphere and Energy: (613) 241-4611	
Toronto Environmental Alliance	http://www.torontoenvironment.org/ Lois Corbett, Executive Director: (416) 596-0660	
Union québécoise pour la conservation de la nature (in French only)	http://www.uqcn.qc.ca/atmosphere/index.htm Richard Gendron: (514) 342-7691	
West Coast Environmental Law	http://www.wcel.org/climate/ Chris Rolfe, Staff Counsel: (604) 601-2512	

Business Organizations active in the climate change policy debate

Description	Location	Date
Air Transport Association of Canada	http://www.atac.ca/ (613) 233-7727	
Alliance of Manufacturers and Exporters Canada	http://www.the-alliance.com/amecsite/indexe.html (613) 238-8888	
Aluminium Association of Canada	http://www.aia.aluminium.qc.ca/english/index.html (514) 288-4842	
Business Council on National Issues	http://www.bcni.com (613) 238-3727	
Canadian Association of Energy Service Companies (companies that design and implement energy efficiency retrofits to existing buildings)	http://www.ardron.com/caesco/ (416) 969-9208	
Canadian Association of Petroleum Producers	http://www.capp.ca/ (403) 267-1100	
Canadian Chemical Producers Association	http://www.ccpa.ca/english/ (613) 237-6215	
Canadian Electricity Association	http://www.canelect.ca/connections_online/home.htm (514) 866-6121	
Canadian Energy Pipeline Association	http://www.cepa.com/ (403) 221-8777	
Canadian Federation of Agriculture	http://www.cfa-fca.ca/index_e.htm (613) 236-3633	
Canadian Fertilizer Institute	http://www.cfi.ca/ (613) 230-2600	
Canadian Gas Association (natural gas producers/ distributers)	http://www.cga.ca/ (416) 481-1828	
Canadian Home Builders Association	http://chba.ca/ (613) 230-3060	
Canadian Nuclear Association	http://www.cna.ca/ (613) 237-4262	
Canadian Pulp and Paper Association	http://www.cppa.org/english/ (514) 866-6621	
Canadian Petroleum Products Institute	http://www.cppi.ca/cppi.html (613) 232-3709	
Canadian Shipowners' Association	http://www.shipowners.ca/ (613) 232-3539	
Canadian Solar Industries Association	http://www.cansia.ca/ (613) 736-9077	
Canadian Steel Producers Association	http://www.canadiansteel.ca/ (613) 238-6049	
Canadian Vehicle Manufacturers' Association	http://www.cvma.ca/ (416) 364-9333	

Description	Location	Date
Canadian Wind Energy Association	http://www.canwea.ca/indexen.htm 1-800-922-6932	
Centre patronal de l'environnement du Québec (broad business organization that endeavours "to promote the interests of industry and business in environmental matters" – bilingual site)	http://www.cpeq.qc.ca/ (514) 393-1122	
Coal Association of Canada	http://www.coal.ca/ (403) 262-1544	
Energy Council of Canada	http://www.energy.ca/ (613) 952-6469	
GEMCo (consortium of major Canadian greenhouse gas emitters focussed on the development of "offset" projects to reduce emissions or enhance sinks outside their normal operations)	http://www.gemco.org/ (604) 731-4666	
Mining Association of Canada	http://www.mining.ca/english/ (613) 233-9391	
Québec Forest Industries Association	http://www.aifq.qc.ca/english/ (418) 651-9352	
Railway Association of Canada	http://www.railcan.ca/en/welcome/ (514) 879-8555	
Solar Energy Society of Canada	http://www.solarenergysociety.ca/ (613) 234-4151	
Voluntary Challenge and Registry (encourages private and public sector organizations to voluntarily limit their net greenhouse gas emissions)	http://www.vcr-mvr.ca/home_e.cfm (613) 565-5151	

Other Organizations active in the climate change policy debate

Description	Location	Date
Federation of Canadian Municipalities	http://www.fcm.ca/newfcm/Java/frame.htm (613) 241-5221	
Groupe de recherche appliqué en macroécologie (in French only)	http://www.grame.qc.ca (514) 639-4132	
International Council for Local Environmental Initiatives (an association of municipal governments)	http://www.iclei.org/ (416) 392-1462	
International Institute for Sustainable Development	http://iisd.ca/climatechange.htm (204) 958-7700	
National Research Council	http://www.nrc.ca/corporate/english/ (613) 998-7352	
National Round Table on Environment and the Economy (includes representatives of business, labour, academic, environmental organizations and First Nations)	http://www.nrtee-trnee.ca/eng/home_e.htm (613) 992-7189	
Transportation Association of Canada (government/industry)	http://www.tac-atc.ca/ (613) 736-1350	

Politicians

This list is not intended to be comprehensive. News releases and speeches by provincial ministers can be found on provincial government websites (see section 3.3). Positions expressed by political party spokespersons can be found using the indexes to debates in the House of Commons and provincial legislatures (addresses given in the table).

Description	Location	Date
Prime Minister Jean Chrétien's speech to the World Petroleum Congress – includes a brief section on climate change	http://pm.gc.ca/default.asp?Language=E&Page=newsroom&Sub=Speeches&Doc=worldpetroleumcongress.20000611_e.htm	06/2000
Budget 2000 speech by Paul Martin, federal minister of Finance – contains large section on climate change	http://www.fin.gc.ca/budget00/speech/speech1e.htm	02/2000
Most recent federal speech from the Throne	http://www.fin.gc.ca/budget00/speech/speech1e.htm [new date: 01/2001]	10/1999
Speeches by David Anderson, federal Minister of the Environment	http://www.ec.gc.ca/speech_e.html	frequent updates
Recent speeches by Ralph Goodale, federal Minister of Natural Resources	http://nrn1.nrcan.gc.ca/homepage/speeches.shtml	frequent updates
March 2000 Joint Ministers' Meeting communiqué and Records of Decision	http://www.nccp.ca/html/media.htm	03/2000
Québec government's communiqué following March 2000 Joint Ministers' Meeting	http://www.menv.gouv.qc.ca/communiques/2000/c000328b.htm	03/2000
British Columbia government's news release following March 2000 Joint Ministers' Meeting	http://www.env.gov.bc.ca/main/newsrel/fisc9900/march/nr193.htm	03/2000
Ontario government's news release prior to March 2000 Joint Ministers' Meeting	http://www.ene.gov.on.ca/envision/news/0019.htm	03/2000
October 1998 Joint Ministers' Meeting Notice to the Media	http://www.scics.gc.ca/cinfo98/83063350_e.html	10/1998
April 1998 Joint Ministers' Meeting news release (with link to Summary of decisions)	http://www2.ec.gc.ca/press/jmm1_n_e.htm	04/1998
December 1997 First Ministers' Meeting joint communiqué	http://www.scics.gc.ca/cinfo/80003606_e.html	12/1997
Index to debates of the House of Commons since October 1999: this page lists all interventions under the heading "Greenhouse gas emissions (climate change/global warming)"	http://www.parl.gc.ca/common/Chamber_House_iDebates.asp?Language=E&Parl=36&Ses=2	frequent updates

Description	Location	Date
Index to debates of the House of Commons between September 1997 and September 1999: this page lists all interventions under the heading "Greenhouse gas emissions (climate change/global warming)"	http://www.parl.gc.ca/common/Chamber_House_iDebates.asp?Language=E&Parl=36&Ses=1	09/1999
Alberta Legislative Assembly	http://www.assembly.ab.ca/	frequent updates
British Columbia Legislative Assembly	http://www.legis.gov.bc.ca/	frequent updates
Manitoba Legislative Assembly	http://www.gov.mb.ca/leg-asmb/	frequent updates
New Brunswick Legislative Assembly	http://www.gov.nb.ca/legis/index-e.htm	frequent updates
Newfoundland House of Assembly	http://www.gov.nf.ca/hoa/	frequent updates
Northwest Territories Legislative Assembly	http://www.assembly.gov.nt.ca/	frequent updates
Nova Scotia Legislature	http://www.gov.ns.ca/legi/	frequent updates
Ontario Legislative Assembly	http://www.ontla.on.ca/	frequent updates
Prince Edward Island Legislative Assembly	http://www.gov.pe.ca/leg/index.php3	frequent updates
Québec National Assembly	http://www.assnat.qc.ca/eng/indexne3.html	frequent updates
Saskatchewan Legislative Assembly	http://www.legassembly.sk.ca/	frequent updates
Yukon Legislative Assembly	http://www.gov.yk.ca/legassem.html	frequent updates

3.8 The Economics of Climate Change

As major policy measures to reduce greenhouse gas emissions are given more serious consideration, public debate about climate change is increasingly concerned with economics.

Many studies have looked at the economics of climate change, and many more can be expected in the future. As is typical of economic projections, the results vary widely and can be highly sensitive to the initial assumptions. Here is a brief guide to the kinds of numbers that are produced.

Cost of mitigation. This is the cost of implementing packages of measures to reduce greenhouse gas emissions, typically in order to meet a country's Kyoto Protocol target (see section 2.3). It can be expressed as a direct cost to the sectors of the economy that have to reduce emissions, and calculated using microeconomic computer models that account for changes in prices, costs, revenues and capital investments by affected firms. The cost of mitigation is commonly expressed as a "net present value." This is the cost over several years, with the costs of future years successively discounted by a given percentage. The "annualized" cost per year is much smaller than the net present value cost.

Effect on GDP. Mitigation costs can also be expressed as an impact on national GDP (gross domestic product) via macroeconomic models that account for the repercussions throughout the whole economy. It is important to bear in mind that costs presented as "a reduction of x % in GDP" are invariably *relative* to the underlying "business as usual" growth in GDP, and take place over several years: they do not necessarily imply an actual shrinkage of the economy, but rather slower growth.

Tax increases. Mitigation costs are also sometimes expressed in terms of tax increases, as in: "gasoline taxes will have to be increased by x cents a litre to meet the Kyoto target." This can be misleading, since fuel taxes are just one of many policy options that have been proposed to achieve greenhouse gas emission reductions. Many other factors also influence fuel prices.

Impacts on competitiveness. The effect of making substantial reductions in greenhouse gas emissions on Canada's competitiveness is often approached from two opposing points of view. On the one hand, it is commonly argued that Canada would put its competitiveness at risk by reducing emissions if the US or other trading partners did not take any action. Others argue that by adopting and developing the low-emission technologies of the future, Canada could position itself as an international leader and reap economic benefits.

Co-benefits or "ancillary benefits" of mitigation. Many measures to reduce greenhouse gas emissions will also reduce air pollution. This means there are immediate health co-benefits from greenhouse gas emission reductions. These benefits can be expressed in dollars by considering reduced health care costs and/or by applying techniques that convert people's preferences for clean air or better health into dollar terms. Such techniques are a matter of some contention.

Cost of impacts. The projected impacts of climate change (see section 1.2) also carry economic costs, sometimes referred to as "costs of inaction" or "costs of doing nothing" [to reduce greenhouse gas emissions]. These costs are extremely difficult to estimate, especially regarding the possibility of more frequent extreme weather events such as storms and floods. Also, they often do not attempt to convert damage to the environment into dollar terms, which means that it may not be fully taken into account.

Cost of adaptation. A different way of looking at the cost of impacts is to ask how much it would cost to successfully adapt to projected climate change. Environment Canada has estimated that the cost of adapting to *current* climate in Canada (that is, before most of the projected impacts of climate change occur) is several billion dollars annually.

Results obtained by federal and provincial governments

In November 2000, the Analysis and Modelling Group, a group of federal and provincial government officials charged with analyzing options for greenhouse gas emission reductions, released a report entitled *An Assessment of the Economic and Environmental Implications for Canada of the Kyoto Protocol*. The report concludes that attainment of Canada's Kyoto target would result in a 0-3% impact on GDP compared to business as usual. (A 3% impact means that Canada's economy would grow by about 26% in the first decade of the 21st century instead of 30%.) In a partial analysis of health co-benefits, the report values those benefits at $300 to $500 million per year.

What the Intergovernmental Panel on Climate Change has to say

Working groups 2 and 3 of the Intergovernmental Panel on Climate Change (IPCC, see section 1.1), which cover respectively the impacts and mitigation of climate change, both review the literature relating to the economics of climate change in their reports. Their Summaries for Policymakers from the IPCC's Third Assessment Report (2001) contain the following findings:

Cost of the Kyoto Protocol. "In the absence of emissions trading between Annex B [industrialized] countries, the majority of global studies show reductions in projected GDP of about 0.2% to 2% in 2010 for different Annex II [developed country] regions. With full emissions trading between Annex B countries, the estimated reductions in 2010 are between 0.1% and 1.1% of projected GDP. [...] Models [used for these studies] do not include sinks,... the CDM [or]... ancillary benefits..." (For information about emissions trading, sinks and the clean development mechanism (CDM), see section 2.3.)

Costs of mitigation for different sectors. "In general, it is easier to identify activities which stand to suffer economic costs compared to those which may benefit, and the economic costs are more immediate, more concentrated and more certain. Under mitigation policies, coal, possibly oil and gas, and certain energy-intensive sectors, such as steel production, are most likely to suffer an economic disadvantage. Other industries including renewable energy industries and services can be expected to benefit in the long term from price changes and the availability of financial and other resources that would otherwise have been devoted to carbon-intensive sectors."

Cost of impacts. "Benefits and costs of climate change effects have been estimated in monetary units... These estimates generally exclude the effects of changes in climate variability and extremes... These omissions are likely to result in underestimates of economic losses and overestimates of economic gains. [...] Notwithstanding the limitations expressed above, based on a few published estimates, increases in global mean temperature would produce net economic losses in many developing countries for all magnitudes of warming studied (low confidence), and losses would be greater in magnitude the higher the level of warming (medium confidence). In contrast, an increase in global mean temperature of a few °C would produce a

mixture of economic gains and losses in developed countries (low confidence), with economic losses for larger temperature increases (medium confidence). The projected distribution of economic impacts is such that it would increase the disparity in well-being between developed countries and developing countries, with disparity growing for higher projected temperature increases (medium confidence). [...] More people are projected to be harmed than benefited by climate change, even for global mean temperature increases of less than a few °C (low confidence)."

Resources

Description	Location	Date
The Economic Impact on Canada of Greenhouse Gas Reductions: A Comparative Review – review of 14 studies of impacts on the Canadian economy of measures to reduce greenhouse gas emissions	Contact Al Howatson, Conference Board of Canada: (613) 526-3280	11/1997
Volume VIII of Environment Canada's *Canada Country Study* – see chapter 1, "Costing Climate Change"	http://www.ec.gc.ca/climate/ccs/pdfs/volume8.pdf	1998
An Introduction to the Economics of Climate Change Policy by John Weyant, Stanford University	http://www.pewclimate.org/projects/econ_introduction.cfm	07/2000
Report of the Analysis and Modelling Group	http://www.nccp.ca/html/tables/pdf/AMG_finalreport_eng.pdf	11/2000
The IPCC's Summary for Policymakers on the mitigation of climate change	http://www.ipcc.ch/pub/wg3spm.pdf	03/2001
The IPCC's Summary for Policymakers on the impacts of climate change	http://www.ipcc.ch/pub/wg2SPMfinal.pdf	02/2001

4 EXAMPLES OF CANADIAN ACTION TO REDUCE GREENHOUSE GAS EMISSIONS

Sections 4.1 and 4.2 contain success stories published at **climatechangesolutions.com**, the Pembina Institute's "megasite" of interactive tools, resources and success stories on actions to reduce greenhouse gas emissions. New success stories are posted on the site regularly and will also be included in quarterly updates to this Resource Book. For the sake of brevity, the versions presented here have been simplified and references to information sources removed. Complete versions with full references and links to related resources can be found at **http://www.climatechangesolutions.com/english/industry/stories/** and **http://www.climatechangesolutions.com/english/municipal/stories/.**

Further industry and municipal greenhouse gas emission reduction success stories can be found in the submissions made by corporations and municipalities to the Voluntary Challenge and Registry, available at **http://www.vcr-mvr.ca/AlphaList.cfm.**

Additional municipal success stories can be found at the Federation of Canadian Municipalities website at **http://www.fcm.ca/english/national/programs/club/studies.html,** and at the International Council for Local Environmental Initiatives website at **http://www.iclei.org/iclei/casestud.htm.**

4.1 Industry Greenhouse Gas Emission Reduction Success Stories

Low-Impact Renewable Energy in Remote Areas – Purcell Lodge

A micro-hydroelectric facility provides all the electricity and some of the heat for a remote tourist lodge that previously used fossil fuels for those functions.

Purcell Lodge, British Columbia – In many places in Canada, the electrical grid provides power to homes, institutions and businesses. In fact, the system's wires extend to the majority of southern Canadian communities and several northern communities. However, some 200,000 Canadians do not have access to grid electricity. Many of these people are served by electric utilities that have very small distribution grids. Indeed, some of them are not supplied by any electricity companies at all, and need to generate their own power.

These remote power applications include cottages, agricultural properties, aquaculture operations, cathodic protection for oil and gas operations, tourist lodges, telecommunications sites, and others. The vast majority of remote electricity is currently produced using diesel generators. The diesel fuel needs to be transported to the site, often at considerable cost, and the fuel produces greenhouse gas (GHG) emissions when used.

Diesel-generated electricity in remote areas of Canada produces about 200,000 tonnes of GHG emissions every year. A significant proportion of these emissions could be reduced by switching to cost-effective, clean and renewable sources of electricity, such as micro-hydro, small wind and solar photovoltaics.

Purcell Lodge is a year-round eco-tourist resort in the Rocky Mountains, located near Golden, B.C. A small hydraulic electricity generation system, installed at the lodge in 1992 to replace a 12-kilowatt (kW) diesel generator, has reduced GHG emissions and saved the lodge's owners money.

Micro-hydro generators tap the potential energy from a flowing stream or river as it travels downhill. The water passes through a small pipe that is placed near the stream for a length that can vary from between a few hundred metres to a few kilometres. The water in the pipe is directed through the system's turbine, which works like an old-fashioned water wheel. After the water turbine creates electricity, all the water is returned to the stream from which it came.

The 12 kW run-of-river micro-hydroelectric system at Purcell Lodge was installed by a small renewable energy company. The system includes a "pelton wheel," a generator, an 800-metre-long pipe, and an electronic load governor that generates 120 volt, AC power, from a nearby stream. And unlike some other small renewable energy systems, the Purcell Lodge system does not require any storage batteries or an inverter.

The micro-hydro system now provides almost all the electrical needs of the lodge, and has virtually eliminated the use of the diesel generator, while eliminating about 15% of the heating load, which is fueled by propane. The micro-hydro system at Purcell Lodge saves approximately 15,200 litres (L) of diesel fuel and 1,400 L of propane per year, while reducing GHG emissions by about 43 tonnes per year.

Those environmental savings also add up to significant savings on costs. The micro-hydro system saves Purcell Lodge approximately $10,000 a year because of lower diesel fuel and propane consumption, along with lower transportation costs for the fuel, which must be flown in by helicopter. The payback on the investment was about three years, which means that the system essentially provides free electricity after its third year of operation, once its minimal maintenance expenses are covered.

Internal Energy Efficiency – Ontario Power Generation

Province of Ontario – By retrofitting existing nuclear, fossil and hydroelectric facilities, Ontario Power Generation (OPG) has increased the efficiency of its electricity system while also reducing greenhouse gas (GHG) emissions. Improving internal energy efficiency is an important component of OPG's integrated and flexible program to reduce GHG emissions. OPG has voluntarily committed to stabilizing net GHG emissions at 1990 levels in the year 2000. By improving internal energy efficiency, Ontario Power Generation reduced its GHG emissions by 1.7 million tonnes in 1999, equivalent to approximately $70-$80 million.

First introduced in 1994, OPG's Internal Energy Efficiency Program is a corporate-wide initiative to reduce energy consumption. Using a variety of approaches to facilitate program effectiveness, the Program aims to improve energy efficiency through changes in employee behavior, operating procedures, processes and/or equipment. In 1995, the Program was expanded to include energy conversion efficiency improvements that aimed to maximize the amount of electrical energy produced for a given amount of fuel input, whether it be uranium, coal, or water.

Employees are actively involved in the process of identifying and implementing energy efficiency savings. They contribute ideas, learning and apply new skills that produce sustainable results. Each energy efficiency project must be technically sound and not compromise safety or operational constraints. The project must remain in place for a minimum of 10 years.

Retrofits as a result of OPG's Internal Energy Efficiency Program have included a variety of measures as follows:

- Runner and turbine replacements on hydroelectric turbines to maximize the capture of water power;
- Optimization of the steam generating process for thermal and nuclear electrical plants;
- Transformer replacements at several facilities to minimize transformer losses;
- Lighting upgrades in buildings;
- Condenser upgrades and improvements in cleaning practices at thermal and nuclear plants; and
- Computerized process optimization at power plants.

In 1999, the Energy Efficiency Program reduced annual energy requirements at OPG's operations by 1,896 Gigawatt-hours (GWh), or about the same amount of energy consumed in a year by the city of Kitchener, Ontario. By the end of the year 2000, OPG expects the Internal Energy Efficiency Program savings will reach 2,000 GWh per year.

Total energy savings from internal energy efficiency measures are distributed among business units as follows:

- Nuclear – 26%
- Hydroelectric – 25%
- Fossil – 22%
- Other – 27%

With these electricity savings, OPG reduced its GHG emissions by 1.7 million tonnes in 1999, equivalent to approximately $70-$80 million. In the same year, OPG was awarded the "National Energy Efficiency Award – Industrial Comprehensive Tier 1 Category" by the Office of Energy Efficiency at Natural Resources Canada in recognition of its achievements.

Some initiatives by OPG to explore new, more efficient fossil generation technologies up to 1998 include:

- Completed conversion of two oil-fired units at Lennox GS to dual fuelling with natural gas. Burning gas lowers the carbon dioxide (CO_2) emission rate by about 10 percent relative to burning oil.
- Initiated a program to reduce fossil system NOx emissions by 30 percent and the heat rate by two percent with the additional benefit of reducing the CO_2 emission rate by two percent.
- In December 1998, OPG announced its intent, together with three partners – CU Power International Ltd. of Calgary, Toronto Hydro and Hydro Mississauga, to develop a high-efficiency combined cycle gas turbine project at Lakeview GS.

Transmission and distribution savings, yielding about one third of the total annual energy savings, were achieved with conductor improvements such as line upgrades, phase balancing and voltage conversions.

Emission Reduction Trading Facilitates Green Power – Ontario Power Generation

Toronto, Ontario – Ontario Power Generation (OPG) has voluntarily committed to stabilizing net greenhouse gas (GHG) emissions at 1990 levels in the year 2000. Emission reduction trading (ERT) is one component of OPG's integrated and flexible program to reduce GHG emissions, and is a tool that will help meet the GHG target. OPG has contracted with Highland Energy Inc. of Québec to purchase emission reduction credits (ERCs) created from methane combustion at the Meloche landfill gas-to-energy project in Québec between 1998 and 2000. OPG anticipates that purchased GHG ERCs will reduce emissions by about 130 kilotonnes of carbon dioxide equivalent (CO_2e) over three years. As part of its trading initiative, OPG also aims to demonstrate the role of market mechanisms in promoting clean energy technologies and GHG emission reductions.

The 1.6 megawatt Meloche electric power plant, commissioned in 1998, collects and combusts landfill gas (LFG) in engine generators. Combustion of LFG converts methane to carbon dioxide (CO_2), thus reducing the global warming potential of the gas significantly. OPG is purchasing ERCs created in 1998, 1999 and 2000. Credits are not obtained from power production in this case because the main source of power in Quebec is hydro, meaning there would be very little, if any, emission reductions generated.

OPG is willing to purchase ERCs created from projects that reduce GHG emissions and meet the following criteria:

- real,
- surplus,
- verifiable, and
- measurable.

OPG has already purchased ERCs from small hydroelectric, landfill gas electricity generation, biomass and energy efficiency projects. They are also investigating options to purchase ERCs derived from other green energy sources such as wind and solar projects.

Power generation from landfill gas (LFG) is considered an environmentally-friendly technology because it makes use of a waste by-product and reduces methane emissions. Under certain conditions, LFG can be Green Power and thus produce Emission Reduction Credits. LFG generation is recognized under the Environmental Choice Program's EcoLogo Guidelines as a Green Power technology, and can also meet the Pembina Institute's Green Power Guidelines. However, there are some concerns with using LFG as an energy source.

Highland Energy intends to use the revenues from the sale of ERCs to finance the implementation of additional LFG collection equipment at the Meloche landfill. In addition, they intend to capture and burn LFG at other currently uncontrolled landfills in Ontario and Québec. Current plans are to capture and flare LFG through new gas recovery systems, which destroys methane. In the future however, the LFG recovered could potentially be used as a fuel to produce electricity at LFG-to-energy generating facilities.

Based on its report to the Voluntary Challenge and Registry, OPG will have to acquire or develop offsets equivalent to 12 millions of tonnes (Mt) of CO_2 in order to meet the year 2000 net emissions target of 26 Mt CO_2. In 1998, 1.8 Mt CO_2 of internally-generated Emission Reduction Credit (ERC) units were registered through in-house electricity consumption initiatives. OPG voluntarily retires ten percent of all ERCs created to benefit the environment. OPG is active in three North American open market emissions trading programs:

- the Ontario Pilot Emission Reduction Trading (PERT) Project,
- the Canadian Greenhouse Gas Emission Reduction Trading (GERT) Pilot, and
- the U.S. Northeast States for Coordinated Air Use Management GHG Demonstration Project (NESCAUM).

Internationally, OPG is involved in three Activities Implemented Jointly, located in Indonesia, Jordan and Zimbabwe. These projects involve the installation of renewable energy technologies, improvements to plant energy efficiency, and the construction of a hydroelectric station at an existing dam.

"Wind Barons" Foresee Greener Futures – Vision Quest Windelectric

Pincher Creek, Alberta – At the edge of the "badlands" in southern Alberta, it is said that the constantly blowing wind can drive a person insane. The three co-founders of Vision Quest Windelectric Inc. are hoping those same winds will propel Canadians to a cleaner, greener future – where electricity is supplied to businesses and homeowners without contributing to climate change – and turn a profit for their company. In 2000, Vision Quest produced ten million kilowatt hours (kWh) of electricity for their customers, and displaced 10 kilotonnes of greenhouse gas (GHG) emissions. In 2001, they plan to quadruple that amount. Vision Quest is building wind-energy capacity in Alberta by installing wind turbines and delivering green power to users in partnership with corporations like Suncor and ENMAX, as well as directly to some residential customers.

Rivaling the days of the "Texas tea," wind power is now the fastest growing source of energy in the world. It's also providing exceptional opportunities for economic growth in the energy field. In 1995, *The Economist* acknowledged that wind energy was "within nudging distance of price equality with fossil fuels". And the gap has narrowed since then. According to the Canadian Wind Energy Association (CanWEA), costs for wind-generated electricity have dropped over the last decade from 30¢ per kWh to 5.8¢ per kWh. Unfortunately, Canada is falling behind

other industrialized nations in taking advantage of opportunities to develop renewable energy. This is at Canada's economic peril: the global wind energy potential, excluding environmentally sensitive areas, is roughly five times current global electricity use.

According to the Worldwatch Institute, global wind power capacity increased by 35% (or 2,100 megaWatts) to 9,600 megawatts (MW) during 1998. This capacity is sufficient to generate 21 billion kiloWatt-hours of electricity – enough for about 3.5 million suburban homes. In 1999, worldwide wind equipment sales were $3 billion.

A recent study by the Pembina Institute, *Life-Cycle Value Assessment of a Wind Turbine*, concludes that GHG emissions from a wind system are approximately 98.5% less than from a comparable natural gas system and 98.9% less than the coal-burning plants that feed the Alberta power grid. To put this in context, "a single 600 kW wind turbine producing 1.3 million kWh of electricity annually, offsetting the current [Alberta] grid system, would result in a reduction of approximately 1.4 kilotonnes of CO_2 equivalents per year".

Vision Quest uses the triple bottom line to guide its decision making – balancing environmental, social and economic considerations. Says Jason Edworthy, Executive Director of Vision Quest, "We want people to know that when they buy our product, they are making a difference."

The company's mission is "to develop markets for energy and its associated products in Canada and world-wide; explore, procure and test suitable wind energy development locations; and to build, own and operate utility-scale wind-electric generating plants." And their plans are right on track.

In April 2000, Vision Quest landed a new contract with ENMAX, their largest client, to supply 30,000 MW hours per year of wind-generated electricity – enough to power the equivalent of 5,600 homes. Their 1997 contract with ENMAX, was also an important landmark event, since it led to the first registered emission reduction under the Greenhouse Gas Emissions Reduction Trading Pilot (GERT).

Vision Quest's 1998 contract with Suncor was another important milestone, since it was one of the first signals of the oil patch's willingness to purchase emissions reductions. More recently, TransAlta provided Vision Quest with a healthy $5 million investment. However, the company's three founders will remain majority shareholders, a decision with which TransAlta wholeheartedly agrees. After all, Edworthy, Mike Bourns and Fred Gallagher have been dedicated to renewable energy and environment-related issues throughout each of their careers – and have demonstrated the commitment to put everything on the line and to make the company work.

And there's a lot to put on the line. Vision Quest erected its first four wind turbines in 1997 and 1998. Each of the 16 turbines being built in 2000 costs about a million dollars. Two were built in June 2000 and 14 more will be built in October and November 2000. Vestas, the manufacturer of the turbines, is based in Denmark, and worldwide demand for their machines is so great that it is getting increasingly difficult for them to deliver as quickly as they would like. Each turbine is 50 metres (m) high (about 16 storeys) with a 47 m rotor blade. On top of the turbine sits a cabin about the size of a Winnebago which houses generating equipment that can produce 660 kilowatts (kW) at peak output – enough to power 300 homes.

The real climate change advantage of wind energy is that no fossil fuels are burned to produce the electricity. The value-added is that it is very close to being an economically viable replacement for the most environmentally damaging forms of electricity production. While wind cannot supply all of Canada's electricity needs, it could potentially supply up to 20% of all the power used from coast to coast. In combination with other alternatives and renewables such as solar, wind energy has a powerful potential for both economic gain and climate change reduction.

Bypass Valves Modified To Save Gas – SaskEnergy Inc.

Province of Saskatchewan – SaskEnergy Inc. operates a natural gas distribution utility, including metering facilities, regulator stations, and 63,000 km of distribution pipelines, all located in Saskatchewan. At town border stations, the pressure is reduced from the normal level in the main pipeline to suit local natural gas distribution systems running through more populated areas. Piping bypass systems at these border stations facilitate maintenance procedures. But the valves in the bypass piping have a tendency to leak natural gas. As part of a concerted effort to reduce corporate emissions, and on the advice of its maintenance staff, SaskEnergy undertook a retrofit program to eliminate these bypass valve leaks. By modifying 1,022 bypass valves between 1996 and 1998, the company reduced its annual greenhouse gas (GHG) emissions by 12.5 kilotonnes (kt) of carbon dioxide equivalent (CO_2e). If the effect of this initiative could be replicated in all the natural gas distribution networks in Canada, the single action of modifying bypass valves could reduce our country's GHG emissions by more than 40 kt of CO_2e.

SaskEnergy also noted that its modifications had the effect of conserving natural gas, which helped to offset the cost of the upgrades. About 904,550 cubic metres of natural gas a year are conserved, contributing roughly $54,000 in additional sales revenues annually.

Since 1991, SaskEnergy has implemented a program to carry out audits of all its facilities on a rotating basis. Environment staff, safety personnel, the general manager and field operators check the company's facilities on various aspects related to safety and environment. The audits evolved and over time, and bag tests were conducted during the audits to determine the leak rates of a representative sample of bleed and bypass valves.

Leaky maintenance bypass valves at town border stations often resulted in phone calls from concerned residents that there might be a natural gas leak from a pipeline in the area. Reducing fugitive GHG emissions at these sites thus provided the added benefit of reducing the number of customer complaints. In turn, fewer call-outs to investigate complaints lowered operator costs, reduced vehicle wear and tear, and also cut fuel costs.

The valve improvements were undertaken as a special maintenance project. Field operators decided how best to implement the modifications, which included closing bleed valves, and installing locking devices to ensure that the low-pressure side of the bypass system was protected from over-pressurization. Routine maintenance on the bypass valves (greasing) was not affected by these changes. Since the program was completed in 1998, new stations have been required to use the new modified design for bypass valve installation and operation.

Costs of the bypass valve modification project are estimated at $250 per upgrade, for an aggregate of $255,500. These costs were rolled into the corporation's climate change and

regular maintenance budgets. Although the opportunity to improve the operation of the bypass valves had been known to exist for many years, it took a concerted effort to reduce corporate GHG emissions to bring about the change. This illustrates the value of corporate emission reduction programs.

Replacing Continuous Bleed Pneumatic Devices Reduces Operating Costs – TransGas Ltd.

Province of Saskatchewan – TransGas Limited, a subsidiary of SaskEnergy, operates the transmission portion of the parent company's natural gas pipelines. TransGas uses a wide range of regulators, pneumatic devices, control valves, and metering devices to deliver natural gas safely to customers. Pneumatic devices pump fluid, monitor fluid levels, and open and close valves. Most of these pneumatic devices use the pressure of the natural gas in the pipeline as their motive power, and some of them continuously leak gas in order to operate properly. TransGas has replaced many of these "continuous bleed" devices with better equipment - devices that either do not leak gas at all, or only leak smaller amounts. The annual reductions in greenhouse gas (GHG) emissions from upgrading 132 devices in 1998 amounted to about 4.6 kilotonnes of carbon dioxide equivalent (CO_2e).

In Saskatchewan, TransGas' facilities include gathering lines, compressor stations, metering facilities, regulator stations, underground storage facilities and more than 13,500 km of transmission pipelines. After reviewing the operation, the company's environmental task force suggested replacing the continuous bleed devices throughout the distribution, storage and transmission systems. TransGas management supported the proposal, since it complied with their corporate commitment to reduce GHG emissions. The equipment changeover proved to be an excellent initiative, since it reduced operating costs and increased functional reliability.

In 1998, the company's electrical engineering department changed 132 pneumatic devices that continuously bled natural gas, including Fisher level controllers and a variety of temperature controllers. Almost all the devices were converted to compressed air, which significantly reduced the release of GHG emissions. The remainder of the equipment was replaced with low-bleed devices.

The retrofit process involved various conversions. In some cases, the entire system had to be removed and replaced with a new controller. In others, air-driven pneumatic systems were used to replace systems that formerly operated on natural gas. The company expects that its retrofit program will largely be completed in 2000. And in the future, when pneumatic equipment needs to be replaced, and in all new construction, the company's policy is to use "low-bleed" or "no-bleed" technology.

SaskEnergy and TransGas estimate that the changes made to 132 devices, phased in during 1998, reduced its GHG emissions by 1,630 tonnes in that year. Including the full effect of reduced natural gas leakage from the pneumatic device improvements performed in 1998, subsequent annual GHG emissions were reduced by about 4,595 tonnes.

If the effect of this initiative could be replicated by all the natural gas companies in Canada, based on the volume of natural gas transported in 1998, it is estimated that Canada's annual GHG emissions could be reduced by 80.6 kilotonnes (kt). In 1998, the total capital cost of the changes made by TransGas amounted to $46,000. The changes had the additional benefit of

reducing maintenance costs, and the labour costs of changing the equipment were absorbed in the company's regular maintenance budget.

The extra energy used by the air compressors to power the equipment was not considered significant, and thus was not included in the calculations above. In most cases, the air systems were already on site to provide compressed air for much larger operational requirements. The incremental load of the new pneumatic device installation was not significant enough to calculate the change in the air compressor's overall output.

4.2 Municipal Greenhouse Gas Emission Reduction Success Stories

Employee Trip Reduction – Vancouver Region

Vancouver, British Columbia – The Greater Vancouver Regional District (GVRD) has established a highly successful Employee Trip Reduction Program to reduce emissions of greenhouse gases (GHG) and other air pollutants from private automobiles. Under the program, GVRD employees are encouraged to avoid commuting alone in their cars. The program has been extremely successful. After one year, only 46% of GVRD's 500-plus employees were commuting in single-occupant vehicles, compared to 57% before the program began. By switching to alternative commuting methods, the program's participants had collectively reduced their estimated GHG emissions by 63 tonnes in 1997 and a further 51 tonnes in 1998.

GVRD's Employee Trip Reduction Program was initiated by the region's Employee Environmental Awareness Committee, in an effort to increase the use of more climate-friendly commuting methods, such as carpools, public transit and cycling. The program was adopted as a formal corporate initiative, and launched on May 1, 1996.

The cornerstone of the program is a gradual phase-out of the region's former 60% subsidy for employees' parking costs. During negotiation of a new contract with the employees' union, the parties agreed that the parking subsidy would be replaced by a range of other benefits that encourage alternative commuting methods. Surplus gains made by GVRD from the phase-out of the parking subsidy are paid into an additional employee benefit account.

Each of the seven benefits that make up the program is designed to reduce a specific barrier to alternative commuting methods and/or increase their financial attractiveness:

1. Parking subsidy for carpools. Only carpool groups can now claim reimbursement of their parking costs. The reimbursement is 50% for two-person carpools and 100% for groups of three or more employees. Carpool vehicles also have access to a reserved parking area.

2. Provision of corporate carpool vehicles. GVRD has made available seven corporate vehicles—half of the corporate fleet—to carpool groups that do not have access to their own vehicle, at a charge of 26 cents per kilometre to cover running costs. All seven vehicles are now fully used by carpools.

3. Vanpool empty seat insurance. The GVRD offers insurance to cover the cost of one empty seat for up to two months per year in vanpools that operate through the Jack Bell Foundation vanpool service. This reduces the likelihood that vanpools will have to disband if one or more members drop out.

4. Cycling safety workshops and workplace facility upgrades. Free bicycle safety and maintenance workshops are regularly organized for employees interested in cycling to work. When the program was launched, cycling coaches were recruited to prepare individualized routes and accompany participants on a trial run. Workplaces have also been upgraded with better shower facilities and more bicycle racks, and some underground parking spots have been replaced by a cage that holds up to 50 bicycles.

5. Guaranteed ride home service. In order to ensure that participants never find themselves stranded at the office during an emergency, unscheduled overtime or missed rides, each employee is entitled to a ride home in a corporate car or taxi free of charge, up to four times per year.

6. Flextime. Wherever feasible, participants can change the times they start and finish work by up to 30 minutes, to increase their options for carpooling, public transit or cycling.

7. Subsidized public transit. Employees can purchase monthly transit passes at a 15% discount through payroll deduction. BC Transit provides the discount to GVRD employees who agree to sign a contract to purchase the passes for at least twelve consecutive months. BC Transit representatives hold occasional workshops for GVRD employees to identify optimal commuting routes and travel times. GVRD also distributes transit tickets for local business travel.

Employees enroll in the Trip Reduction Program by filling out a form that indicates their willingness to use alternative commuting methods at least one day per week, with the expectation that many will later find they want to increase their involvement. Of the 213 employees participating in the program during 1999,

- 96 used public transit,
- 92 used carpools,
- 13 cycled, and
- 10 walked to work.

An Employee Transportation Coordinator administers the program. One of the Coordinator's main tasks is to match people travelling from the same neighbourhood so that they can commute in a single vehicle. This is a half-time position that already existed in GVRD's Air Quality department. GVRD is now looking to reduce this staffing requirement by, for example, automating ride-matching over a corporate intranet.

Before the program began, the employee parking subsidy cost GVRD $120,000 per year. By contrast, the current program costs only $12,000 per year (not counting the Coordinator's salary), most of which is used for the new carpool parking subsidy. Several employees from two-car households have found that they have been able to sell one of their cars, which has yielded major additional savings.

The most significant barriers to implementing the program were:

- securing comprehensive support from management,
- obtaining funding for program start-up,
- educating employees about the value of the program, and
- structuring the transit pass payroll deduction system.

Similar large urban municipalities could easily replicate the GVRD's Employee Trip Reduction Program. Smaller employers would need to find ways of minimizing the staffing requirement, perhaps by using intranet-based software and/or volunteers. Since parking subsidies can be regarded as an important benefit for existing and future employees, employers who implement a trip reduction program need to stress the value of the alternative benefits that favour low-impact commuting. GVRD is one of the sponsors of British Columbia's GO GREEN Choices program, which provides free help to employers interested in setting up their own trip reduction program.

Landfill Gas Utilization – City of Edmonton and EPCOR Utilities Inc.

Edmonton, Alberta – The City of Edmonton is one of a growing number of municipalities that captures landfill gas (LFG) and uses it for energy. By arrangement with the City, EPCOR Technologies Inc. is capturing and purifying LFG from Edmonton's Clover Bar Landfill, and providing it as a secondary fuel to the natural gas-fired Clover Bar Generating Station. The City receives an economic benefit from a resource that would otherwise be wasted, and is reducing greenhouse gas (GHG) emissions at the same time.

LFG waste-to-energy projects like this can reduce GHG emissions in two ways. They convert methane into carbon dioxide during the combustion process, and they avoid "upstream" emissions associated with the use of non-renewable fossil fuels by substituting LFG as the energy source. In 1999, the Clover Bar LFG waste-to-energy project reduced GHG emissions by 174,949 tonnes, including avoided upstream emissions for natural gas and reduced methane emissions from the landfill site. The emissions reduction is roughly equal to the amount of CO_2-equivalent greenhouse gases that would be emitted by more than 42,300 cars in a year.

In implementing the project, Edmonton found that, in addition to the climate change benefits of recovering and using LFG, other negative environmental and social impacts of the landfill site were also reduced. For example, uncollected LFG can create suffocating or toxic conditions, pose an explosion hazard, cause stress to local vegetation, and create offensive odours. Avoiding these negative impacts—and the potential for new financial revenues—are motivating more and more local governments to investigate ways to capture LFG and use it an energy source.

All landfill sites produce methane (CH_4)—a resource much like natural gas. Traditionally, methane has been allowed to escape into the atmosphere, where it is a major contributor to climate change. In fact, methane is 21 times more damaging to the earth's climate than carbon dioxide (CO_2), on a weight-for-weight basis, which is measured in global warming potential. LFG is produced by the anaerobic decomposition of organic wastes, and is composed primarily of methane and CO_2. Every tonne of organic waste that is put into a landfill site will eventually produce between 40 and 100 kilograms (kg) of methane, which makes LFG a reliable, yet relatively untapped source of energy at many landfill sites in Canada. Of the 33 landfills in Canada that have active LFG recovery systems, 70% of the captured gas is used to generate energy at 13 facilities. Of those facilities, a total of six installations generates 82.5 Megawatts (MW) of electricity. The other seven facilities use the LFG directly as fuel for industrial processes.

In Edmonton, LFG collected from the Clover Bar Landfill is the preferred fuel for generating electrical power at the Clover Bar Generating Station, which is located only three kilometres from the Clover Bar landfill. The LFG sold to EPCOR Generating Inc. is discounted below the equivalent energy rate for natural gas, meaning that the generating company is sure to use all the LFG available. The power station occasionally uses LFG for up to 25% of its fuel needs, but with the plant at full load, the LFG generally accounts for about 2% of the fuel it consumes. As of April 2000, more than 162 million cubic metres (m^3) of LFG have been collected, purified and used to generate electricity since the project began. Between 1992 and April 2000, approximately 287 GigaWatt-hours of electricity were produced from LFG. During 1999, about 39 GigaWatt-hours of electricity were produced from LFG—enough power to meet the annual needs of about 3,200 homes.

Project development began in 1989, with an assessment of the landfill site's LFG production potential by Environmental Technologies Inc. (ETI). Once the company established that LFG collection and use were economically viable, ETI helped to establish agreements between the City of Edmonton and what was then Edmonton Power. The LFG-to-energy project began operating in 1992.

The technologies used to collect LFG at the Clover Bar Landfill Site ensure a high quality fuel that is free from impurities, but still contains its original CO_2. This is important to maintain a safe, reliable, stable operation of the boilers using the LFG. The gas is extracted from the landfill site through a number of wells that were drilled between 20 and 30 metres into the waste. The wells are installed in phases, according to the filling of the landfill. To collect LFG and direct it to the treatment plant, about 140 wells have been drilled, of which about half are operational at any one time. The operation of the well-field is frequently adjusted to optimize the quantity and quality of the LFG collected. A three-kilometre, dedicated pipeline transports the treated LFG to the generating station, where it supplements natural gas used in two of the four boiler/turbine units.

The Clover Bar facility is just one example of the many different uses for LFG. The greatest potential for reducing LFG-related GHG emissions in Canada is at small and medium landfill sites. Environment Canada has produced a series of six technical bulletins to demonstrate waste-to-energy projects of different sizes and types across Canada. The department has also made significant progress in estimating LFG production potential and economic costs involved in collecting and using LFG at several of Canada's landfill sites. The US Environmental Protection Agency has also demonstrated that LFG can be used to produce electricity from high-efficiency, low-emission fuel cells, in a 100-home project in Connecticut.

Comprehensive Greenhouse Gas Emission Reductions – Regina, Saskatchewan

Regina, Saskatchewan – The City of Regina is a Canadian leader in reducing greenhouse gas (GHG) emissions in a cost-effective manner, having won honourable mention at the Voluntary Challenge and Registry (VCR) Awards. In December 1990, Regina's City Council first endorsed the goal of reducing overall GHG emissions by 20% from 1988 levels, including emissions attributable to municipal operations and all activities within the geographical jurisdiction of the City. Then, in 1995, Regina formalized this goal by joining the Federation of Canadian Municipalities' Partners for Climate Protection program (formerly the 20% Club) and made a commitment to achieve its GHG emission reduction goal by 2005. Thus far, the City has already successfully reduced emissions from its internal operations to 9% below 1988 levels, which translates into a reduction of about 10,000 tonnes of GHG emissions annually. This case study summarizes several of the initiatives that the city has undertaken since making a commitment to protect the climate.

Regina took two major steps to reduce GHG emissions in its municipal operations:

- it established a formal Energy Management Program for all city operations with appropriate administrative staff, and
- it set up an "internal bank," called the Special Initiatives Fund, from which municipal departments could borrow against the city's reserves to undertake energy efficiency retrofits.

Both steps have helped Regina demonstrate that energy management is an important part of sound overall financial management.

Ongoing technical training of staff, skills upgrading and accountability also contribute to Regina's success in reducing GHG emissions from its municipal operations. Since the City's Energy and Materials Management Department is responsible for energy budgets, it uses energy reports from the energy accounting system to analyze energy use, including the tracking of energy initiatives. Energy consumption and billing reports are also sent to Water Supply on a monthly basis to facilitate tracking and monitoring of energy initiatives. Some operators went through Facility Operator Energy Management Training, a formal process for staff to become accredited in energy management. Another recent initiative incorporates environmental costs and benefits into municipal purchasing and operational decisions, for example, Regina's purchase of natural gas vehicles.

Regina's Energy Management Program addresses all areas of the City's corporate GHG emissions—including efficient lighting, variable-speed drives at pumping stations, power factor corrections, reduced building temperatures, fleet conversion to natural gas, and installation of high efficiency furnaces. Following are some major results of Regina's energy initiatives:

- Improving building energy efficiency (including sports facilities) and electrical system enhancements have reduced GHG emissions by 1,656 tonnes per year.
- Street lighting conversion to efficient, cost-effective high pressure sodium lights has yielded a GHG emission reduction of 5,182 tonnes per year.
- Changes to water supply systems in the form of pipeline twinning, variable-speed pumps, operational efficiencies and a water utility efficiency improvement program have cut 3,898 tonnes of GHG emissions per year.
- Sewer and wastewater system improvements have provided annual emission reductions of 2,917 tonnes of GHGs.
- The deployment of 79 natural gas vehicles in Regina's civic fleet, including fleet vehicles for transit and public works, is reducing GHG emissions across the city. Natural gas vehicles emit 26% fewer GHG emissions at the tailpipe than the same vehicles that run on regular gasoline. Previously, the conversion of 60 civic vehicles to natural gas and the installation of related fueling facilities, were projected to reduce GHG emissions by 250 tonnes per year and save about $80,000 annually.
- The City participates in the annual Commuter Challenge events, and municipal employees are encouraged to car-pool to reduce vehicle trips.

Regina is now considering energy efficiency retrofits to seven major civic properties. A planned $1.2 million renovation to the building systems in its City Hall is expected to save $180,000 and reduce GHG emissions by 1,253 tonnes per year. Retrofits for all the properties under consideration are expected to cost about $2.5 million, and provide a savings of $400,000 in energy costs per year (representing about a 30% savings for these properties), while reducing GHG emissions by a further 4% from the 1988 baseline. The City is looking at bids from Energy Service Companies (ESCOs) to carry out these energy retrofits, including some of the following: energy efficient lights and motors, installation of variable-speed drives, installation of window films, installation of direct digital controls, sealing the building envelopes, night free cooling, electrical demand management, replacement of chiller and/or boilers, and addition of an ice storer.

By looking outside its own operations, the City of Regina is also acting as a community leader by encouraging GHG emission reduction among the residential, commercial and industrial sectors. The first program to actively involve the community as a whole has been an initiative to reduce water consumption. The program has served the dual purposes of avoiding costly expansions to water treatment infrastructure, and effectively abating GHG emissions from residential water use. Regina's community-wide water conservation program has successfully reduced GHG emissions from electricity used in water treatment by more than 1,700 tonnes per year, providing an economic saving of about $600,000. Local residents are also benefiting through lower utility bills. In June 1999, the city launched its Cool Down the City program, a community-wide initiative to raise awareness and involve citizens, industries, institutions and businesses in Regina's climate change strategy.

Renewing Commercial Buildings – Toronto Better Buildings Partnership

Toronto, Ontario – Canada's largest city is proving that municipal governments can undertake major building retrofits to improve energy efficiency and achieve impressive cost savings, while simultaneously realizing large reductions in greenhouse gas (GHG) emissions. Toronto's pioneering Better Buildings Partnership (BBP) program uses an innovative approach to financing to encourage the renewal of the city's buildings, as part of its effort to meet the goal of a 20% reduction in the municipality's community-wide GHG emissions. During the program's first four years, retrofit efforts have reduced annual GHG emissions by 110 kilotonnes (kt), while cutting annual building operating costs by $11.8 million and creating 3,000 person-years of employment. The BBP is now being expanded into a full-scale initiative with the goal of a three-megatonne (Mt) annual reduction in GHG emissions, and the creation of 90,000 person-years of employment, by 2005.

In January 1990, the former City of Toronto—a larger, amalgamated city was created in 1998—established itself as a world leader in GHG emissions reductions with an official commitment to reduce CO_2 emissions by 20% from 1990 levels by the year 2005. More recently, the larger, amalgamated City of Toronto has reaffirmed the municipal goal, with the base year adjusted to 1990, in accord with the Kyoto Protocol. And Toronto has demonstrated a lot more than just good intentions: during the 1990-95 period, emissions in the city declined by 6.5%, even though over the same period, the city's population grew by 3.4%—and Canada's total emissions grew by 9%.

To have a chance of meeting its 20% GHG emission reduction goal, Toronto needed to address its major emissions sources more aggressively. Recognizing that energy used in commercial, institutional and apartment buildings accounted for a substantial slice of Toronto's GHG emissions (38% in 1995, split about equally between on-site natural gas combustion and electricity use), the City launched the BBP as a pilot project in June 1996. Toronto's Energy Efficiency Office initiated and runs the program in partnership with the Toronto Atmospheric Fund (TAF), Enbridge Consumers Gas, Toronto Hydro and three energy service companies (ESCOs) that design and direct the retrofits. By early 2000, 217 buildings had been retrofitted to reduce energy and water consumption and improve indoor air quality.

Retrofits generally repay their capital investment in reduced energy bills over a period of three to ten years. Barriers to such investment include a lack of awareness of the potential savings and

obtaining financing for the investment. Addressing these barriers successfully and innovatively has been the key to BBP's success.

Financing building retrofits is a challenge mainly for the public, non-profit and small building sectors. Instead of providing grants, the BBP has addressed the problem by securing $7.1 million in provincial and federal funds under the Canada-Ontario Infrastructure Works Program. Those funds are paid out as interest-free loans to BBP participants, and a further $3.5 million in private-sector loan support was arranged by the three ESCOs. For small- and medium-sized buildings where commercial bank financing is also often not available, the BBP's Loan Recourse Fund offers securitized loans made by Enbridge-Consumers Gas. The Toronto Atmospheric Fund initially provided $2 million to capitalize the Fund. The return on the City's investment has been an impressive 25%.

Toronto City Hall, one of the city's best known landmarks, provides a good illustration of the BBP's potential. City Hall was first opened in 1965, when energy was still relatively inexpensive. An extensive energy audit of the building carried out in the 1980s led to an upgrade of the heating, cooling and lighting systems, which convinced City officials of the economic and environmental benefits of energy retrofits. Under the BBP, new technology has helped spur further improvements, through lighting upgrades, occupancy sensors and building automation system upgrades. Other improvements to City Hall under the BBP have included a high-efficiency chiller replacement, condensate heat recovery system and window replacements. The complete BBP project, which included six other municipal facilities, has led to an annual reduction of 7 kt in CO_2 emissions. The project cost $4 million, but with annual savings of $570,000, the work is expected to pay for itself in just seven years.

On May 4, 1999, the BBP announced a major expansion featuring the new goals of:

- reducing annual CO_2 emissions by three Mt in total, and
- creating 90,000 person-years of employment by 2005.

These achievements are to come from retrofitting 40% of the total institutional, commercial and industrial floor space in the city; an undertaking that will require some $3 billion worth of investment. While that is a great deal of money, the potential energy and environmental savings are also huge. Carrying out energy efficiency upgrades on Toronto's municipal buildings alone could cut more than $7.5 million annually from the City's $30-million energy bill, according to the Toronto Atmospheric Fund. These cuts in building operating costs can be credibly marketed as reductions in the costs of doing business in the city, and the Toronto Construction Association estimates that 20 person-years of direct employment are created for each $1 million invested in retrofits.

The BBP's clear potential for replication has already inspired other major cities to plan similar programs. The Municipalities Issue Table under the National Climate Change Process has proposed a National Building Energy Securitization Fund that would provide a country-wide mechanism similar to the BBP. The 2000 Federal Budget also created two new funds that municipalities could use to plan and implement building retrofit programs.

Achieving 50% Waste Diversion – The Region of Halifax

Halifax, Nova Scotia – Halifax Regional Municipality (HRM) has become a leader among Canada's large urban areas by adopting an advanced municipal solid waste (MSW) management system that has significantly reduced the amount of waste going to landfill. As a result, greenhouse gas (GHG) emissions from the municipality's landfill site have been reduced by approximately 0.5 megatonnes of carbon dioxide-equivalent (Mt CO_2E) GHG emissions per year, or about 1.4 tonnes per resident, compared to 1995. These reductions are among many environmental benefits of a system that has helped achieve a 61.5% reduction in the amount of waste per person sent to landfill between 1989 and fiscal year 1999/2000.

Traditional landfilling of putrescible (rotting) biological material, such as food scraps and garden waste, leads to the production of landfill gas, as bacteria break down the waste under anaerobic (oxygen-starved) conditions. Landfill gas is a major source of methane, which is a powerful GHG. Such waste also sets off complex chemical reactions in landfills that tend to make the landfill leachate (effluent) more toxic than it otherwise would be. However, if the putrescible fraction of MSW is decomposed in the presence of air, no methane is produced, the toxicity of the landfill leachate is reduced, and the site produces compost that can be sold as a sustainable alternative to mineral fertilizer.

HRM has recognized these facts by adopting a new four-way residential waste collection system that began full operation in January 1999. The region's residents are asked to separate their waste into recyclables, compostables and hazardous materials, as well as residual refuse. Recyclables that are not covered by Nova Scotia's deposit-return system go into blue bags, and compostable materials go into green aerated carts, both of which are provided by the municipality. Residents are required to take hazardous wastes to special collection points.

The recyclable materials are processed at a materials recovery facility (MRF), while the compostables are processed at two composting facilities. Residual refuse is handled at a front-end processing/waste stabilization facility. To serve the new MSW management system, the MRF was expanded and the three other facilities were built from scratch. At the front-end processing/waste stabilization facility, the waste is passed along conveyor lines, where any remaining recyclable materials are removed by hand. The remaining material is then ground into small pieces and transferred to an 18-day composting plant, to ensure that any residual putrescible material is rendered inert. Finally, the waste is landfilled in a new "residuals disposal facility" that is "expected to be virtually methane-free," has no odour problem, does not attract vermin or birds, and does not require an on-site leachate collection system.

The capital costs of the new MSW system totaled $70.1 million, and were financed through a mixture of public and private capital, along with design/build/operate contracts between the private sector and the municipality. Operating costs of the new system are $32.5 million per year, compared to $23.4 million in operating costs for the old system in 1996. But the municipality points out that the new system represents a significant improvement over past practices, and that both public and governmental bodies are satisfied with the new system, and consider the additional costs it incurred to be justified. A significant portion of the operating costs (approximately 33%) is also recovered through tipping fees. The front-end processing/waste stabilization facility employs 85 people, while the two composting plants employ 22.

Waste management is generally a politically sensitive issue, and is often the subject of considerable public concern. The creation of Halifax's new system, however, shows that public concern can be harnessed to produce a highly successful outcome. After the option of incineration was rejected because of cost and environmental concerns, public support for a new landfill was obtained through the creation of a Community Stakeholder Committee (CSC) that involved 500 residents. It was the CSC that insisted the new system be based on source separation and avoid the landfilling of putrescible materials. The CSC members also played a watchdog role in ensuring that the new system was implemented, in spite of the reservations of some municipal politicians. Another crucial element of the system's viability was Nova Scotia's range of province-wide bans on landfilling recyclable and compostable materials.

During the new system's first nine months of operation, from January to September 1999, the amount of waste that required landfilling was 40% less than the previous year. However, the amount of commercial, industrial and institutional waste (ICI) (including waste from apartment buildings) fell only by 8%, which means that some waste must be temporarily exported to the neighbouring Queens region for landfilling. The ICI sector is responsible for its own waste collection, but HRM encourages ICI waste generators to separate compostables at source in two ways: by setting differential tipping fees ($68/tonne for compostables and $110/tonne for residual refuse) and by reserving the right to refuse unsorted loads that are delivered to the front-end processing/waste stabilization facility. HRM seems confident that these and other measures will be able to correct the situation. Despite the problems with the ICI sector, the amount of waste landfilled per person in the municipality in fiscal year 1999/2000 was 61.5% lower than in 1989.

Co-generation and District Energy Systems – Sudbury

Sudbury, Ontario – In October 2000, the City of Sudbury opened a district energy system that will make money for the City, while at the same time substantially reducing emissions of greenhouse gases (GHG). For building owners, the new district energy system will provide both financial savings and more convenient energy services. The new system was built through a 50/50 public-private partnership between the City of Sudbury and Toromont Energy. It uses high-efficiency, natural gas-fired cogeneration to supply heating and cooling to several buildings in the city's downtown core. The district energy system replaces older, less efficient equipment formerly used in the separate buildings, while feeding electricity into the provincial grid. Electricity provided by the district energy system displaces the generation of coal-fired power, which produces much higher GHG emissions. Taking into account these two factors, Natural Resources Canada has estimated that Sudbury's initial district energy project will reduce GHG emissions by 21 kilotonnes (kt) per year. A future expansion of the system could generate reductions of up to 51 kt per year.

Most major downtown buildings in Canada use their own boilers and chillers to supply heating and air conditioning. But these individual plants have several disadvantages:

- they are often inefficient, resulting in high GHG emissions and other forms of pollution;
- their inefficiencies also make them expensive to operate;
- they are not always well maintained, which further reduces their efficiency;
- they generate vibrations and noise; and
- they take up valuable floor space.

With a district energy system, heating and cooling are provided through hot or cold water – produced by a single, centralized, highly efficient, computer-controlled power plant that can serve a large number of buildings at the same time. If a centralized plant uses cogeneration, as in Sudbury, efficiency is maximized because the facility is not just providing heating and/or cooling to the connected buildings, but also generating electricity. This efficiency translates into cost savings for all those who use and benefit from the system.

The initial stimulus for district energy in Sudbury came back in 1997, when the developers of the new "Centre for Life" complex contracted the municipally-owned Sudbury Hydro to investigate options for supplying energy to the new complex. The following year, the City and Sudbury Hydro Electric Commission decided to reap the advantages of district energy, and joined forces with Toromont Energy to form the Sudbury District Energy Corporation. The corporation built its first district energy plant on railway lands adjacent to the city's downtown area. The plant contains two natural gas-powered engines. Together, they produce almost 5 megawatts (MW) of electricity – enough for about 2000 homes. The heat from the engines – that would otherwise be wasted – is captured and used to heat water that is piped to connected buildings.

The district heating system began operating in December 1999. By November 2000, a total of seven large downtown buildings had been connected to the system, and the corporation's partners expect that many more building owners will eventually come on board. The district heating system can also provide optional cooling, in the form of piped, chilled water.

As of January 2001, the City of Greater Sudbury and Toromont Energy are equal owners of the Sudbury District Energy Corporation. The two partners each hold a 10% equity stake in the corporation, while most of the remaining funding was loaned by Toromont. The new district energy system was built at a cost of $15 million. And while the system is not yet profitable, the partners expect a good rate of return in the long term. Confidence in the financial success of the project is such that the corporation is now building a second, similar cogeneration plant that will supply the energy needs of the new Sudbury Regional Hospital, with the capacity to expand in the future to serve other nearby buildings.

The Government of Canada contributed $500,000 to Sudbury's district energy system through its Technology Early Action Measures (TEAM) program. Natural Resources Canada, through its CANMET Energy Technology Centre, also loaned the corporation half of the $250,000 cost of the initial feasibility study – thereby helping to overcome a significant barrier to developing the project.

Another common barrier to cogeneration projects is getting access to the electricity grid. Sudbury's district energy system was able supply electricity to the provincial grid as a result of legislative changes that came into force with the passage of Ontario's *Energy Competition Act, 1998*. In this case, the electricity produced by the district heating plant is used in city-owned buildings. But when Ontario eventually opens up its electricity market to competition, the option of selling surplus electricity to the provincial system is expected to become a more widely available option.

Currently, Sudbury's key challenge is to persuade more building owners to sign the 15- or 20-year contracts that are needed to amortize the capital costs of the piping, heat exchangers and other infrastructure used for district heating. Even though the typical building owner can expect

to save 10% per year on the amortized life-cycle cost of operating and owning boilers and chillers, potential clients are sometimes reluctant to sign such long-term contracts.

District energy systems have a huge potential in Canada. Based on "minimum technical potential," potential GHG emission reductions from district energy are estimated at 21 megatonnes per year. District energy has already been successfully installed in more than 160 communities of all sizes throughout the country. Yet Canada lags far behind countries like Denmark, Finland, Lithuania and Ukraine where district heating accounts for more than 50% of national heating market.

In the 2000 Federal Budget, the Government of Canada created Green Municipal Enabling and Investment Funds that can be used by municipalities to help plan and implement district energy systems.

4.3 Things Individuals Can Do to Reduce Greenhouse Gas Emissions

Individuals and families directly generate about one-fifth of Canada's greenhouse gas emissions (see section 1.3). If the emissions from generating the electricity they use is included, this rises to about one-quarter. The three main sources are:

- private automobiles,
- use of fuel (natural gas, oil or wood) in the home for space and water heating, and
- electricity use in the home for appliances, lighting, etc.[†]

Most things that can be done to reduce emissions focus on increasing energy efficiency. Saving energy also means saving money. Even apparently large investments in energy efficiency usually pay for themselves in the long term.

Ways to reduce emissions from automobiles include:

- Reduce use of your car for commuting by switching to van- and car-pooling or car-sharing.
- Reduce your speed, avoid idling and avoid using air conditioning. Altered driving behaviour can reduce fuel consumption by up to 20%.
- Reduce distance travelled by combining several separate trips into one.
- Buy ethanol-blended gasoline. It can reduce greenhouse gas emissions by 4% to 10%.
- Maintain your vehicle properly. It can result in up to a 10% reduction in fuel consumption.
- Use public transit. Buses produce only about one-third the greenhouse gas emissions of cars per passenger-kilometre.
- When buying a vehicle, favour smaller cars with lower fuel consumption, or a new hybrid electric car. New vehicles sold in Canada now display an EnerGuide label carrying information on fuel efficiency.
- Cycle or walk to work, even just one or two days a week.
- Live close to your workplace and amenities, reducing your transportation needs at source.

Ways to reduce emissions from fuel and electricity use in the home include:

- Reduce loss of heat from your home by upgrading windows and doors, and improving insulation. Energy evaluators are available to advise you on energy efficiency renovations through the EnerGuide for Houses program (see Resources below).
- Wash clothes in cold water. Detergent designed for use in cold water is widely available.
- Install low-flow shower heads. They can reduce hot water consumption by 20% to 40%.
- Make sure your hot water tank and pipes are insulated.
- Dry clothes outdoors or on a drying rack whenever possible, instead of in a dryer.
- Install programmable thermostats to reduce heating during the night and when you are at work.

[†] In Québec, Manitoba and British Columbia, electricity is responsible, on average, for very low emissions of greenhouse gases. However, there are other good environmental reasons to reduce use of electricity.

- Choose compact fluorescent light bulbs. They use 60% to 80% less energy and last 10 to 20 times longer than standard incandescent bulbs.
- Consider replacing old appliances with more efficient modern ones. Refrigerators and freezers are especially important because they run all the time.
- When buying appliances, choose energy efficient models. Major electrical appliances sold in Canada are required to display an EnerGuide label carrying information on energy efficiency.
- If your electricity supplier offers a choice of energy sources, choose renewable energy. Some electricity suppliers in Ontario, Alberta and British Columbia are now offering "green" power options.
- Install a new high-efficiency furnace and/or have your hot water pipes run through the furnace (producing hot water energy savings of up to 50%). Energy evaluators are available to advise you through the EnerGuide for Houses program (see Resources below).
- If you are building a new home, plan to make maximum use of the sun's heat and light. Have the building plans checked through the EnerGuide for Houses program or consult the Canadian Renewable Energy Guide (see Resources below).
- If buying a new home, choose one that is certified to the R-2000 energy efficiency standard.

Individuals and families can also indirectly reduce greenhouse gas emissions by following the 3RC principle: Reduce, Reuse, Recycle and Compost. Reducing our consumption of material goods and reusing existing ones prevents many environmental impacts "upstream" from the point of sale, including greenhouse gas emissions. Recycling also avoids emissions associated with producing virgin raw materials. Composting food scraps and garden waste prevents the production of methane from rotting garbage in landfills (methane from landfills represents 3% of Canada's greenhouse gas emissions).

Source: **http://www.climatechangesolutions.com**

Resources

Description	Location	Date
Website by the Pembina Institute on what individuals and families can do reduce greenhouse gas emissions, including full references to information sources	http://www.climatechangesolutions.com/english/individuals/	03/2000
Links to comprehensive information on energy efficiency for consumers, at home and on the road (Natural Resources Canada)	http://oee.nrcan.gc.ca/english/consumer.cfm	
Fuel consumption ratings for all vehicles sold since 1995	http://autosmart.nrcan.gc.ca/pubs/fcg3_e.cfm	frequent updates
Information on alternative automotive fuels such as propane and natural gas	http://alt-fuels.nrcan.gc.ca/home_E.htm	
Active Transportation – a program that "encourages Canadians to choose active modes of transportation," such as walking and cycling	http://www.goforgreen.ca/active_transportation/	
Detailed information on changes that can be made in the home to improve energy efficiency (Natural Resources Canada)	http://oee.nrcan.gc.ca/buildings/renosense/project_planner.htm	
The Residential Energy Efficiency Database	http://www.its-canada.com/reed/	
Guide to energy efficient appliances (Natural Resources Canada)	http://energuide.nrcan.gc.ca/default.cfm?PageID=1&Lang=e&Fiptop=hg&Header=hg	
Guide to energy efficient heating, ventilation and air conditioning systems (Natural Resources Canada)	http://hvac.nrcan.gc.ca/consmain.htm	
Information on how to obtain personal advice on energy-efficient renovations, furnaces and new building plans through the EnerGuide for Houses program	http://energuide.nrcan.gc.ca/houses-maisons/english/e3.cfm	
The Canadian Renewable Energy Guide (Second Edition)	http://www.gsph.com/9newre11A.html	06/1999
Information on R-2000 homes	http://chba.ca/r2000/	
Guide to composting by the Composting Council of Canada	http://www.compost.org/AboutComposting.htm	
Taking Charge: Personal Initiatives – detailed report on what individuals and communities can do to combat climate change	http://www.davidsuzuki.org/Publications/Climate_Change_Reports/	1997