

# Canada's Potential Role in the Clean Development Mechanism

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## Abbreviations and Acronyms

AIJ	Activities Implemented Jointly (Pilot Phase of trading emission reduction units)
CANet	Climate Action Network – made up of several environmental NGOs
CCCDF	Canadian Climate Change Development Fund
CER	Certified Emissions Reductions (credits of the CDM)
CIDA	Canadian International Development Agency
CDM	Clean Development Mechanism (in the Kyoto Protocol, Article 12)
COP	Conference of the Parties (to the UNFCCC, refers to annual meetings)
COP/MOP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol, after the Kyoto Protocol is ratified by the required number of signatories
ENGO	Environmental Non-governmental Organization
GERT	Greenhouse Gas Emission Reduction Trading (pilot, in Canada)
GHG	Greenhouse gas (emissions)
GWH	Gigawatt hours (of electricity)
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation – in Article 6 of the Kyoto Protocol
KT	Kilotonnes (of GHG emissions)
MW	Megawatts (of electrical capacity)
NGO	Non-governmental Organization
ODA	Official Development Assistance
UG	Umbrella Group (Australia, Canada, Iceland, Japan, New Zealand, Norway, the Russian Federation, Ukraine and the United States)
UNFCCC	United Nations Framework on Climate Change
USJI	US Initiative on Joint Implementation



# 1 Introduction

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The purpose of this report is to inform readers about the role Canada might play in the Kyoto Protocol's Clean Development Mechanism (CDM). The CDM provides a way in which Certified Emission Reduction (CER) credits can be created from greenhouse gas (GHG) emission reduction projects in developing countries. Industrialized countries can then use these credits to help them meet their binding emission reduction commitments under the Kyoto Protocol. The CDM is expected to provide increased flexibility for industrialized countries to meet their commitments and possibly reduce their cost of compliance with the Kyoto Protocol.

The Pembina Institute and the Tata Energy Research Institute (TERI) have explored the application of the Clean Development Mechanism (CDM) in Canada and Asia through a series of publications and workshops. This work is being completed in collaboration with the Bangladesh University of Engineering and Technology; the Global Climate Change Institute at Tsinghua University (China), and the Center for Research on Material and Energy at the Technology University in Bandung, Indonesia.

This document is intended to be used in conjunction with the following companion papers:

- *Negotiating the CDM – A North-South Perspective*. Recommendations on the draft negotiating text for COP-6. June 2000;<sup>1</sup>
- *Implementing the Clean Development Mechanism: Pursuing Sustainable Development and Climate Protection* (September 1999);
- Case Studies on potential CDM project opportunities in the Asian countries of India, Bangladesh, China, and Indonesia (expected in December, 2000); and
- a “How-to Guide” for Canadian investors and developers on the steps required to participate in a CDM emission reduction project (expected in 2001).

In addition, the Pembina Institute and TERI have hosted workshops on the CDM for potential Canadian investors and technology providers and potential Asian partners. These workshops were held in Calgary, Canada in May 1999 and October 2000 and in New Delhi, India in March 1999. Further workshops are planned for 2001.

This paper was prepared to present Asian governments, industry and non-government organizations with the perspectives of the Canadian government and private sector on the CDM, and to assess the potential roles Canadian governments and businesses might play in CDM implementation.

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<sup>1</sup> <http://www.pembina.org/pubs/cop6.htm>

## 2 Background on Canada

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### 2.1 The Canadian Government's Views on the CDM

Industrialized countries, including Canada, tend to strongly support the CDM because of its potential to provide increased flexibility in achieving Kyoto Protocol commitments to manage GHG emissions (Annex-B countries). This has become clear in international climate change negotiations through the submissions of the “Umbrella Group,” which includes Australia, Canada, Iceland, Japan, New Zealand, Norway, the Russian Federation, Ukraine and the United States.

While the Canadian government does not see itself as a CDM project investor, it strongly supports private sector involvement in the CDM. The Canadian government believes it does have a role to play in assisting CDM/JI investments by the Canadian private sector by facilitating the following outcomes via international negotiations on the rules and modalities for the CDM, and other forums:

- mobilizing private sector interests;
- minimizing transaction costs, which requires both regulatory and market transparency, aspects that Canada recognizes as necessary precursors to mobilizing private sector involvement in CDM activities;
- maximizing the flexibility for use of CDM credits to meet Kyoto commitments;
- allowing for the conversion of credits between the different Kyoto Mechanisms;
- allowing for the certification of emissions sequestration from sinks;
- maximizing the environmental and sustainable development benefits of CDM projects; and
- facilitating adaptation in developing countries.

The Canadian government, along with other members of the “Umbrella Group” (UG), envisions a CDM with few restrictions and significant autonomy to the private sector to implement a variety of project activities in developing countries. The UG's original positions on the rules and modalities for the CDM were articulated in submissions made in 1999 to the UNFCCC Subsidiary Bodies (i.e., SBSTA and SBI). These submissions were intended to form the basis for a decision on the rules and procedures for the CDM at the Sixth Conference of the Parties (COP-6) to the UNFCCC.

All of the submissions were synthesized by the Chairman of the “Kyoto Mechanisms Working Group,” Mr. Chow Kok Kee, in the document FCCC/SB/1999/8.<sup>2</sup> Since then, several more submissions have been made and are summarized in new synthesis documents – FCCC/SB/2000/3 and FCCC/SB/2000/4. The views of the UG often differ significantly from those of the European Union, the G-77 and China.

The following points summarize the UG positions on the CDM as expressed in the document from 1999. The UG views on the institutional structure of the CDM are not summarized here.

- On the conversion of credits between Joint Implementation (JI) and CDM, and allowance units under International Emissions Trading (IET), the UG expressed its interest as, “acquired AAUs, ERUs and CERs can be used to fulfill a Party's own obligations or be the object of further trade.” In summary, the UG believes in full fungibility or conversion of trading units for all Kyoto Mechanisms.
- The UG believes there should be no caps on the use of the CDM for meeting domestic emission reduction requirements, thus no supplementarity requirements.

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<sup>2</sup> Document FCCC/SB/1999/8 at <http://www.unfccc.de>, published September 28, 1999



- On the issue of compliance with the Kyoto Protocol and the eligibility to use CERs against Kyoto obligations, the UG has called for the following guidelines: “A Party included in Annex I may not use CERs accruing from CDM project activities if that Party is found not to be in compliance with its obligations under Articles 5 and 7.”<sup>3</sup> The issue of compliance has received a lot of attention by the Subsidiary Bodies in special sessions and negotiating text, separate from negotiations on the CDM.
- On the types of entities that can participate in the CDM, the UG supports private and/or public entity participation, with the approval of the Parties involved in CDM projects, subject to compliance with any rules or guidance for participation in CDM project activities established by the Party in which the entity is resident. Canada has tended to emphasize private sector participation.
- The UG supports a share of the proceeds from CDM project activities being used to: (a) cover administrative expenses of the CDM; and (b) assist developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation. The share of proceeds should be restricted to a limited amount and should not apply to other Kyoto Mechanisms such as JI or IET.
- The UG has asserted that project activities under the CDM shall: (a) cover one or more of the gases listed in Annex A of the Protocol; and (b) provide reductions in emissions and/or an enhancement of removals that are additional to any that would occur in the absence of the project activity. However, the UG position on additionality is limited to “environmental additionality,” which does not include a test on investment or technology additionality.
- The UG supports the following requirements for project registration:
  - The project is approved by all Parties involved and meets their criteria. For example, a Party may develop its own internal mechanisms and criteria for project approval based on its domestic circumstances. These mechanisms and criteria shall be made publicly accessible. A Party may define priority sectors for the formulation of CDM projects.
  - The project should contribute to the sustainable development priorities and needs of the host Party, as determined exclusively by the host Party.
  - The project provides an emissions baseline that meets approved criteria. The emissions baseline shall reflect the *no project* scenario and shall be the basis for calculating the environmental additionality of the project and the emission reductions to be certified. The UG has been cautiously optimistic about a CDM Reference Manual that would provide guidance on baselines, although the UG asserts that the use of the Reference Manual should be voluntary.
  - The project is expected to yield real, measurable and long-term benefits related to the mitigation of climate change and is expected to lower emissions from the level that would have occurred in the absence of the project activity.
  - Includes a monitoring plan, which meets the approved criteria for the collection of data to track the performance of the project and, as appropriate, the baseline.
- The UG supports eligibility for projects that began after 11 December 1997, including those under the AIJ pilot phase, with the agreement of the participating Parties, provided that the CDM project activity meets specified criteria. Following project registration, resultant reductions in emissions by sources and/or enhancements of removals by sinks from 1 January 2000 onwards will be eligible for retrospective certification.
- The UG believes in a flexible approach for project financing, either individually for each project and/or through a portfolio approach such as the World Bank Prototype Carbon Fund.

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<sup>3</sup> Articles 5 and 7 speak to a country having an emissions inventory and projection, and to submitting communications to the Secretariat.

- The UG does not support the development of a “positive list” of CDM project types that would receive priority status.
- The UG has asserted for full inclusion of carbon sinks in the CDM, including reforestation, forest management and agricultural soils, along with afforestation.

## 2.2 Profile of the Canadian CDM/JI Office

The Canadian CDM/JI Office provides support for implementing Activities Implemented Jointly (AIJ), and will provide support for projects that involve Canadian companies and organizations under the Clean Development Mechanism (CDM) and Joint Implementation (JI). The federal government established the CDM/JI office in 1999 to enhance Canada's capacity to take advantage of the opportunities offered by JI and the CDM. One of the other objectives of the organization is to help reduce transaction costs for Canadian entities that are participating in CDM/JI activities.

To further these goals, the Office is involved in many activities including those noted below.

### *Project Approval*

- establishment of guidelines for potential projects, both in terms of advice on contracts and guidelines for development of projects aiming to receive carbon credits.<sup>4</sup>
- project review by an interdepartmental steering committee to determine CDM/JI eligibility. Steering committee members are typically from the Canadian International Development Agency (CIDA), Natural Resources Canada, Environment Canada, Finance, Industry Canada, and Agriculture and Agri-Food Canada. Information on projects that are under review at the CDM/JI Office is not public, however projects are currently at various stages of development with the office (see Section 2.2 and Section 13 in the Appendix for more information).

### *Capacity Building within Canada*

- Outreach to industry on CDM/JI issues by providing information and guidance, excluding any legal support. For example, the CDM/JI Office organized Business Opportunities Forums in Calgary and Vancouver in February 2000. These forums were held to inform Canadian companies about how they can benefit from international climate change opportunities. Other events will be held across Canada.
- Individual support to companies to introduce them to CDM/JI activities.
- Facilitating links between investors and projects. The CDM/JI Office is often approached with proposals for projects, and the Office can help to publicize them with potential investors.
- Provision of a communication service for information on the CDM and JI.
- Undertaking studies on CDM investment opportunities, based on industry interests and guidance from government departments.
- Provision of human resource support for capacity building activities in other organizations related to CDM and JI.

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<sup>4</sup> See new publication entitled *Guidance on the Acquisition of Carbon Credits Under the Kyoto Mechanisms*, Dec. 14, 1999.

*International Activities*

- Encouraging bilateral cooperation agreements with prospective host countries by signing Memoranda of Understanding (MOUs) with relevant authorities in other countries (referenced in Section 2.5).
- Outreach to Foreign Affairs posts overseas to raise awareness of the CDM/JI mechanisms and to promote potential projects. The current plan is to work with Ambassadors or Trade Commissioners in Honduras, Korea and one or more ASEAN countries.
- Support for international trade missions; Brazil, Chile, Argentina and China have expressed interest in the climate change issue on Industry Canada trade missions.

*Support to Other Canadian Government Departments*

- Liaison between, and outreach to, Canadian government departments who are all involved in the climate change issue in some way, including the Climate Change Secretariat, Industry Canada, Environment Canada, Natural Resources Canada, Agriculture and Agri-Food Canada, and the Canadian International Development Agency (CIDA).

*International Climate Change Negotiations*

- The head of the office, Sushma Gera, devotes half of her time to international climate negotiations and policy.

The brochure of the CDM/JI Office is included in Section 11 in the Appendix.

From the perspective of the CDM/JI office, there has been substantial interest from the Canadian private sector in the CDM. There is also substantial interest in the CDM among technology providers, as potential developers and/or exporters of technology to developing countries. The Canadian private sector is keen to have the CDM succeed, which has put pressure on the Canadian government to support it. To date, private sector interest has been concentrated among large emitters.

Developing countries have shown considerable interest in attracting CDM projects. However, it appears that the Canadian private sector has only a limited willingness to invest substantial sums of money in the CDM until the rules around its implementation, and Canada's own response to climate change, become clearer.<sup>5</sup>

**Key Contact Information for the CDM/JI Office:**

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**Key Contacts:**

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Pamela O-Donnell, Deputy Head, Canadian CDM and JI Office

Ted Ferguson, Economic and Policy Analyst

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<sup>5</sup> Personal communication with representatives of the Canadian CDM/JI Office.

## 2.3 Greenhouse Gas Emission Management Spending in the Year 2000 Canadian Federal Budget

The February 2000 federal budget for Canada included new government spending on climate change. Some of this spending may have significance for potential CDM project investors and developers. In total, \$700 million of new funds were earmarked for environmental initiatives, with most going to climate change activities. This is a substantial increase over previous periods. The new initiatives include the following, in order of significance to the CDM.<sup>6</sup>

- \$100 million over four years to the Canadian International Development Agency (CIDA) “for technology transfer and related initiatives to help developing countries reduce their greenhouse gas emissions and promote sustainable development.” The Canadian Climate Change Development Fund (CCCDF) is summarized in Section 2.7.
- \$15 million to the World Bank for its Prototype Carbon Fund. “Through this investment, Canada will contribute to new approaches to reducing greenhouse gas emissions through energy efficiency and renewable energy projects in both developing countries and economies in transition.”
- \$100 million for the Sustainable Development Technology Fund, “...at an initial level of \$100 million. This fund will stimulate the development and demonstration of new environmental technologies, particularly those aimed at reducing greenhouse gas emissions such as fuel cells, wind turbines and advanced materials. Project funding would be available to the private sector, research centres and other institutions.” It is aimed at reducing greenhouse gases.
- \$9 million over the next three years “to the National Round Table on the Environment and the Economy and to Environment Canada to develop environmental and sustainable development indicators in collaboration with Statistics Canada.” These indicators will contribute to environmental policy making in a manner similar to the way in which economic indicators facilitate the Government’s economic and fiscal management. Specifically, environmental indicators will provide a better basis for assessing the interactions between the economy and the environment and will improve Canada’s ability to measure its progress on improving the environment.<sup>7</sup>
- \$210 million in additional new funding for the 1998 Climate Change Action Fund to help Canada achieve its commitment to the Kyoto Protocol to reduce its greenhouse gas emissions by 6% from 1990 levels by the year 2012.
- \$60 million over the next six years for the creation of the Canadian Foundation for Climate and Atmospheric Sciences. It will “be created by the Canadian Meteorological and Oceanographic Society, which represents a broad community of scientists and Canadian scientific institutions.” The foundation “will provide research grants to teams of Canadian scientists to strengthen Canada’s climate research capacity.”
- \$25 million Green Municipal Enabling Fund, “to help municipalities and communities determine the feasibility of and best approaches to renewable energy, building retrofit, water conservation, waste management and urban transit projects.” Much of the funding will go to the Federation of Canadian Municipalities (FCM) and La Coalition pour le renouvellement des infrastructures du Québec.<sup>8</sup>

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<sup>6</sup> From Gallon Environmental Letter, February 9, 2000. Email: cibe@web.net.

<sup>7</sup> See the NRTEE website at <http://www.nrtee-trnee.ca/>

<sup>8</sup> See FCM’s web site at <http://www.fcm.ca>

- \$100 million Green Municipal Investment Fund to “support projects in areas such as energy and water savings, urban transit and waste diversion to strengthen the sustainability of communities.” Loans from the fund will be repaid and then recycled to support new projects. The FCM will manage the funds.
- \$15 million in procurement “of renewable energy over the next ten years for federal facilities in Saskatchewan and Prince Edward Island. In addition, over the next few years, the federal government will strive to increase its purchases of green energy for its facilities located in all regions of Canada.”<sup>9</sup>

## 2.4 Government of Canada Action Plan 2000 on Climate Change

The Canadian Government released an action plan in October 2000 on how it will work towards mitigating greenhouse gas emissions over the next five years. The action plan included some very specific measures and commitments, but many elements of the action plan are not yet clarified. The Government of Canada Action Plan 2000 on Climate Change reflects the Government of Canada's contribution to the First National Climate Change Business Plan, and its intention to invest up to \$500 million on specific new actions to reduce greenhouse gas emissions, over and above spending committed to in the year 2000 budget highlighted above.

Action Plan 2000 targets key sectors and, when fully implemented, will take Canada one-third of the way to achieving the target established in the Kyoto Protocol. It will reduce Canada's greenhouse gas emissions by about 65 megatonnes per year during the commitment period of 2008-2012. Unfortunately, this level is not substantiated in the Action Plan. The remainder of Canada's Kyoto target will be addressed by actions in future plans. In the year 2001, the Government of Canada will further develop these proposals. It will work with provincial and territorial governments and stakeholders to fine tune the measures, and seek partnerships and contributions.

In the transportation sector, expected to contribute to 10% of the Action Plan 2000 emissions reductions, measures include fuel efficiency standards, use of ethanol fuel, fuel-cell vehicles, freight transportation efficiency, and urban sustainable transportation strategies.

In the industrial sector, expected to contribute to 15% of the Action Plan 2000 emissions reductions, measures are focused on helping industry to develop the capacity to manage greenhouse gas emissions, including industry benchmarking, energy efficiency audits, use of renewable energy, development of emissions inventory and monitoring procedures, industrial building efficiency program, metals recycling, and others.

The energy sector is expected to contribute to 20% of the Action Plan 2000 emissions reductions. In the oil and gas sector, measures include CO<sub>2</sub> capture and storage and energy efficiency. In the electricity sector, the Action Plan includes a commitment to purchase 20% of government electricity demand from renewable energy, a renewable energy production incentive for other consumers, development of renewable energy in remote areas, consumer information and enhanced electricity trading.

In the buildings sector, expected to contribute to 10% of the Action Plan 2000 emissions reductions, measures include encouraging commercial sector building retrofits, broaden the development of energy efficient homes, establishing more stringent standards for appliances, and upgrading the Model National Energy Code.

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<sup>9</sup> See Environment Canada's Climate Change website at <http://www.ec.gc.ca/climate/index.html> and the website <http://climatechange.gc.ca/english/html/index.html>

The agriculture and forests sector is expected to contribute to 20% of the Action Plan 2000 emissions reductions through nutrient and soil management, promoting best practices in livestock waste management, developing demonstration farms, tree planting and forest management.

The Action Plan 2000 also targeted 25% of emissions reductions through international initiatives, such as the CDM, JI, and technology marketing. Through the CDM/JI Office, the Action Plan aims to facilitate trade opportunities for Canadian companies to initiate and implement CDM/JI projects to maximize low-cost emission-reduction opportunities. The government also aims to market Canadian technology internationally through technology promotion officers, facilitation of Canadian-based technology trade and showcasing technology, and providing detailed international market analyses. This would also facilitate trade opportunities focusing in countries with a positive environment for CDM/JI projects.

The Action Plan 2000 can be downloaded from <http://www.climatechange.gc.ca/>

## 2.5 Canadian Participation in International Emission Reduction Projects

The Activities Implemented Jointly (AIJ) pilot program of the United Nations Framework Convention on Climate Change (UNFCCC) is the precursor to the Kyoto Protocol's Clean Development and Joint Implementation mechanisms. AIJ initiatives have already resulted in a variety of emission reduction projects in developing countries that have been registered with national AIJ programs in the United States, Sweden, Norway, the Netherlands and other countries. As of December 1999, 152 project plans have been reviewed and accepted under the AIJ pilot, primarily in Asia, Latin America, and Eastern Europe, with only five in Africa (including Mauritius).<sup>10</sup>

In Canada, the Canadian Joint Implementation Initiative (CJII) was launched as part of Canada's National Action Program on Climate Change (NAPCC) in July 1996. The CJII aimed to encourage broad participation of Canadian industry in voluntary international actions to reduce greenhouse gas (GHG) emissions. To do this, it provided assistance to establish GHG emission baselines, identifying potential sources of funding for projects, as well as securing host country approval.<sup>11</sup> The AIJ project review process included an interdepartmental review involving government representatives with technical expertise in the areas being considered.

In 1999, the Canadian CDM/JI office took over the responsibilities of facilitating AIJ projects involving Canada and developing countries. Currently, the Canadian criteria for approving AIJ projects require that emission reductions be:

- real,
- long-term,
- measurable, and
- financially additional.

In terms of financial additionality, Canada's policy does not allow Official Development Assistance (ODA) funds to be used for AIJ projects. However, the Canadian government does believe that ODA could be used where capacity building is necessary, for example, in a case where there is no local AIJ/CDM office to approve projects.<sup>12</sup>

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<sup>10</sup> Magazine on Joint Implementation. December 1999.

<sup>11</sup> Environment Canada. 1997. *Canada's Second National Report on Climate Change: Actions to Meet Commitments under the United Nations Framework Convention on Climate Change*. Ottawa, May 1997. 142 pp.

<sup>12</sup> Personal communication with representatives of the Canadian CDM/JI Office.

The government has not yet taken any position on how it will treat CDM Certified Emissions Reductions (CERs) obtained by the private sector, thus the CDM/JI Office does not have a procedure in place to deal with CDM projects. For the time being, all projects are being treated as AIJ projects. The government is unlikely to approve CDM projects until there is further clarity on the Kyoto Protocol following COP-6 or later.

Canadian officials have worked with more than ten Canadian companies on several projects in a variety of host countries. Most of the proposed projects focus on electricity, including energy efficiency, renewable energy, micro-hydro development and co-generation initiatives. Canadian companies have also invested extensively in domestic emission reduction projects. See the first table in Section 13 in the Appendix for a listing of all the major emission reduction (credit) trades that have involved Canadian firms.

The CDM/JI Office is coordinating a process to formally register four AIJ projects outside of Canada, three which may be eligible for the CDM in the future, and one that may be eligible under JI:

- energy efficiency improvements in a power plant in Jordan;
- a solar, wind, and hydro development in Indonesia;
- a micro-hydro project in Zimbabwe; and
- a project between the US and Canada that involves injecting CO<sub>2</sub> from a power plant in the US into an oil well in southern Canada.

The first three projects have already been implemented by the E7, an international group of electricity generators<sup>13</sup> who are committed to reducing GHG emissions and promoting sustainable development. The E7 is now working toward generating CER credits for these activities. Each E7 member company agrees to support national efforts to curb GHG emissions and to participate in the AIJ pilot phase by making at least one investment in an emission reduction project.<sup>14</sup> The Canadian office has formally reviewed the projects in Jordan and Zimbabwe, and they are now being approved and registered with the UNFCCC.

The project in Indonesia, currently being reviewed, involves a number of renewable energy supply systems that will provide electricity to remote rural villages that are not connected to the main electrical grid. Construction was expected to be finished by the end of 1999, and the monitoring phase of the project will continue to the end of 2000. The project will provide homes, schools, and community centers with reliable, though limited, electricity, while reducing emissions of greenhouse gases and other gases caused by traditional forms of fuel such as kerosene. The E7 signed a Letter of Intent and a Memorandum of Understanding with the Indonesian Director General of Electricity and Energy Development in December 1996 to kick the project off.<sup>15</sup>

The project is separated into three main activities:

- Micro-hydro Power Installations – These power systems will be installed at up to four sites in two provinces of Indonesia. The installations will provide from 13 kW to 60 kW of power. Possible sites were located in South Sulawesi Province and East Nusa Tenggara Province.

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<sup>13</sup> The E7 comprises seven of the largest utilities in the world, including: Electricité de France, ENEL in Italy, Hydro Québec and Ontario Power Generation in Canada, RWE in Germany, Kansai and Tokyo Electric in Japan, and Edison International in the U.S.

<sup>14</sup> <http://www.e7.org/>

<sup>15</sup> Anda Kalvins and H.G. Adam. *E7 AIJ Projects in Indonesia, Jordan, and Zimbabwe*. In *Greenhouse Gas Mitigation – Technologies for AIJ*. Proceedings for conference on Technologies for AIJ, May 26-29, 1997, Vancouver. pp. 97 – 102.

- Solar Home Systems – At least 100 Solar Home Systems (SHS) will be installed in several villages. Each SHS will provide 50 watts to individual users. Seventeen existing SHS have been refurbished and training provided, at the Kualeu site in Nusa Tenggara Province.
- Hybrid System – A 50 kW photovoltaic-wind-diesel hybrid system will be installed at a site yet to be determined.

Costs for equipment and construction, as well as training and monitoring, have been borne by participating E7 companies. A previous analysis of this project estimated total greenhouse gas emission reductions to be about 13,130 tonnes over 15 years.<sup>16</sup>

The US Initiative on Joint Implementation (USIJI) is one of the most comprehensive programs for AIJ activities available, and some Canadian companies have participated in USIJI through partnerships with US organizations. For example, TransAlta Corporation is working with a multi-partner consortium to reduce greenhouse gas emissions and increase milk producers' income by enhancing production from dairy cattle in the Indian state of Gujarat. Through the project, a nutrient supplement is fed to dairy cattle to improve the quality and quantity of milk produced. A by-product is a reduction in methane produced by the cattle as a result of improvements in the digestion process. This project is expected to contribute 569,968 tonnes of CO<sub>2</sub> reductions in 2005. TransAlta's participation in the India Dairy Project, which has been primarily financial, has given the company insights into the challenges of international greenhouse gas offsets credits. TransAlta has been seeking recognition for the project with the USIJI and hopes it will receive future recognition as a CDM project. TransAlta recently announced a similar project in Uganda.

## 2.6 Canadian Political Agreements with Potential AIJ/CDM Host Countries

The Canadian government has pursued a number of bilateral and multilateral cooperation agreements on AIJ projects between Canadian companies and foreign entities. It has concluded five statements of intent to cooperate on AIJ including:

- an agreement signed with Mexico and the US to conduct a feasibility study of four potential AIJ projects in Mexico (two in energy and two in the forestry sector);
- an agreement with China providing for cooperation on energy efficiency and renewable energy, mainly small and medium-sized hydroelectric power projects (see the full text in Section 12 in the Appendix);
- an agreement with the Republic of Latvia that includes cooperation on energy efficiency, alternative transportation fuels, renewable energy and AIJ; and
- a Memorandum of Understanding with Poland on Environmental Cooperation with an emphasis on JI projects.

In addition, various other bilateral environmental agreements have been signed between Canada and Asian countries outside of the AIJ. Many of these are being used as a basis for cooperation under the AIJ and the CDM. For example, Canada has signed the following agreements with China:<sup>17</sup>

- Framework Statement for Cooperation on Environment into the 21<sup>st</sup> Century (November 1998)
- MOU on Cooperative Meteorological Matters (1986, renewed in 1997)
- MOU on Cooperation in the Forest sector (1998)

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<sup>16</sup> Ibid.

<sup>17</sup> Report Card, Canada-China Environmental Cooperation. DFAIT.



- MOU on Environmental Collaboration with Hong Kong (1992, renewed in 1998)
- MOU to Cooperate on the Renewable Energy and Energy Efficiency Technologies (1997)
- Sustainable Cities Initiative – Qingdao.

Several climate change-related activities have resulted from the MOU on Renewable Energy and Energy Efficiency, including the following.

- Several demonstration projects were developed, for example, the Canadian International Development Agency (CIDA) and Natural Resources Canada (NRCan) have funded a PV solar project in China.
- NRCan is organizing an alternative energy workshop in Beijing.
- A small hydro joint venture project with the private sector has been approved.

In October 2000, a Gaps Analysis Study was published for Canada-China cooperation on climate change. This study emphasized policy, technology and capacity gaps for emission reduction activities. The opportunities that we identified in this report include the following:

- Policy and Institutional capacity building for CDM and National communications
- Capacity building to provide support for training materials
- Small-scale hydro
- Coal bed methane
- High efficiency boilers
- Energy efficiency in buildings
- Landfill methane recovery
- Knowledge network
- Urban transport/fuel cells

## 2.7 CIDA's Potential Role in the CDM

The relationship between the Canadian International Development Agency (CIDA) and the CDM/JI Office is evolving. CIDA is the Canadian government's official development assistance agency. It manages and implements capacity building projects in developing countries to further the goals of sustainable development. Sustainable development, by definition, implies social, environmental and economic sustainability. Many CIDA projects have the potential to reduce GHG emissions by improving energy efficiency or promoting the use of low-impact renewable energy.

Under the AIJ Pilot Phase and the Kyoto Protocol, the financial additionality criterion states that Official Development Assistance (ODA) should not be used for direct investment in a CDM project, nor can ODA funds be used to generate CER credits. However, some capacity building projects could be undertaken by CIDA to assist CDM work, such as conducting feasibility studies or establishing a CDM Office in countries where there are none to approve potential projects. In addition, some capacity building projects undertaken by CIDA could have CDM components added onto them. A hypothetical case where this could work is a CIDA project to raise awareness of energy use through community education. CIDA could fund the education component and a CDM project could follow up by implementing home energy efficiency retrofits following the awareness raising activities.

CIDA hosted a workshop in April 1999, which demonstrated areas where CIDA should become involved in the CDM. At this workshop, several of the presenters emphasized the links between the CDM and other development issues such as preventing desertification, improving water and food security, engaging women in development, facilitating health care, technology transfer and capacity building, and developing infrastructure services, among others. One presenter suggested that CIDA

activities related to the CDM should prioritize sustainable energy given that such activities are most likely to be compatible with the future rules and procedures for the CDM, irrespective of the status of international negotiations on the Kyoto Protocol.<sup>18</sup> All of the speakers highlighted the importance of ensuring that the CDM does not take away from the ODA funds.

Several recommendations were developed from the session with respect to CIDA's role in the CDM.

- Many participants supported CIDA getting involved in the CDM early, despite the inherent risks, particularly since the rules may not be finalized for many years (i.e., after ratification of the Kyoto Protocol). This is justified by the potential significance of the CDM, both in terms of the magnitude of new sources of funding for development projects and the experience that could be gained from such project activities.
- Information and communication channels should be established within CIDA and with other agencies such as the CDM/JI Office.
- Activities related to the CDM should be linked to CIDA's existing objectives, with poverty reduction and environmental protection being principal areas of focus.
- Climate change considerations should be integrated into existing CIDA projects where possible, engaging champions from developing countries to move the agenda forward, and building on experiences and lessons learned from those projects.
- Capacity building activities should include establishing reliable baselines, helping developing countries negotiate a good deal with investors, and providing support to implementation partners.
- It was suggested that the CDM/JI Office should take the lead on policy development and technical expertise around CDM methodologies, while CIDA could play a major role in identifying players and potential partners for CDM-related activities. For example, CIDA has a network of Project Officers who could be involved in supporting the CDM.
- A CDM program should start with a few countries and with specific CDM activities as models. A few projects under such models should be tested and evaluated before developing a comprehensive program.

CIDA recently established a committee to investigate the implications of CIDA's work over the past five to seven years in relation to GHG emission reductions. According to preliminary estimates, about 30 CIDA projects have potentially had implications for reducing GHG emissions. A report from this committee is expected in the fall of 2000.

According to a recent study commissioned by CIDA, a new policy framework is required to integrate CIDA's development goals with GHG emission reductions in developing countries. Climate change project development, approval, management and evaluation would be guided by this new policy framework on climate change to ensure that these projects are consistent with CIDA's development priorities, in keeping with CIDA's expertise and respecting host countries' interests. The following table illustrates possible linkages between CIDA activities and potential CDM projects.

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<sup>18</sup> Chris Henderson, The Delphi Group.

**Table 1 Integrating CIDA Development Priorities and Climate Change Initiatives**

CIDA Development Priorities	Examples of Complimentary Climate Change Initiatives
Basic Human Needs	<ul style="list-style-type: none"> <li>• Decentralized renewable power generation</li> <li>• Protection of local resources (e.g., forest ecosystems for food and fuel, or sources of water) through adaptation measures</li> </ul>
Gender Equality	<ul style="list-style-type: none"> <li>• Role of women in local energy decisions, and adaptation measures</li> <li>• Job creation for both genders</li> </ul>
Infrastructure Services	<ul style="list-style-type: none"> <li>• More sustainable energy infrastructure</li> <li>• Life-cycle cost/benefit assessments</li> </ul>
Human Rights, Democracy and Good Governance	<ul style="list-style-type: none"> <li>• Reduced population displacement through prevention/adaptation</li> <li>• Energy market liberalization to reduce sustainable energy barriers</li> </ul>
Private Sector Development	<ul style="list-style-type: none"> <li>• Improved efficiencies through capacity building/technology transfer</li> <li>• Financing sustainable energy projects</li> </ul>
Environment	<ul style="list-style-type: none"> <li>• Rehabilitation of watersheds through tree planting/forest management</li> <li>• Reduced air pollutants through effective landfill gas management</li> </ul>

Source: The Delphi Group. 1999. *Climate Change Development Opportunities: Assessing Potential CIDA Projects for Asia*. Prepared for Canadian International Development Agency, Asia Branch: Ottawa, December 1999.

The CDM/JI Office is working toward setting up a system for collaboration with CIDA to identify potential project activities in developing countries. CIDA has a very large network of offices throughout the developing world and CIDA officers are likely to come across potential CDM projects. CIDA also provides regional funds for small capacity building activities that could be used to train and educate developing world personnel in climate change issues and mitigation strategies.

## 2.8 The Canadian Climate Change Development Fund (CCCDF)<sup>19</sup>

In its 2000 Budget, the Government of Canada provided “\$100 million for Official Development Assistance through the Canadian International Development Agency for technology transfer and related activities in order to help developing countries reduce their greenhouse gas emissions and promote sustainable development.” The Canadian Climate Change Development Fund is a four-year program. Its goal is to contribute to Canada’s international objectives in climate change by promoting activities in developing countries that address the causes and effects of climate change while contributing to sustainable development and reducing poverty. The Government of Canada’s international climate change objectives are to:

- maximize Canada’s ability to meet its UNFCCC commitments and Kyoto climate change targets at the lowest cost;
- contribute to the achievement of global climate change objectives and ensure a level playing field with Canada’s competitors by maximizing participation of major developed and developing economies in the Kyoto Protocol; and
- maximize opportunities for Canadian business in international projects and initiatives on climate change.

As ODA, these funds must have as their primary objective the economic development and welfare of the partner country. Canada’s international development objectives for the CCCDF are to:

- contribute to the reduction in growth of greenhouse gas emissions in developing countries;
- contribute to carbon sequestration in sinks in developing countries;

<sup>19</sup> A full business plan can be downloaded from <http://www.acdi-cida.gc.ca/>

- help or assist developing countries to reduce their vulnerability and adapt to the adverse effects of climate change;
- contribute to strengthening the capacity of developing countries to participate in global efforts to combat climate change;
- create opportunities for the private sector by promoting linkages between Canadian and developing country firms;
- transfer technology and build capacity in areas related to the UNFCCC and Kyoto Protocol, and where necessary strengthen an enabling environment for future technology transfer and the CDM;
- ensure that geographic equity and balance is achieved; and
- fund a range of projects; no individual project should receive more than \$5 million of the CCCDF.

Individual CIDA branches will identify and develop projects to ensure that activities are consistent with existing programming strategies and respond to identified and agreed-upon needs and priorities of partner countries. In the case of responsive programs, programs and projects will be identified, developed and submitted by partner organizations and institutions in accordance with established priorities, mechanisms and procedures. Unsolicited proposals from organizations, institutions, firms or other government departments can be submitted to the relevant geographic programs for consideration. Project and program proposals will be submitted to a competitive process for selection. The call for project or program proposals will take place twice a year or more often if required. A proposal for a program, project, project component, or a small projects fund can be put forward for consideration once it has been approved at the program level within its sponsoring CIDA branch.

CIDA has identified several countries and regions as target countries for activities funded under the CCCDF(see Table 2). Approximately 75% of programming should be undertaken in these countries; however, these do not represent the only countries in which activities will be considered.

**Table 2 Target Countries for the CCCDF**

Emission Reduction Program	Carbon Sequestration Program	Adaptation Program	Core Capacity Building for Climate Change Program
China India Brazil Egypt Southern Africa Nigeria Kazakhstan	Indonesia Honduras Central Africa	Small Island Developing States Sub-Saharan Africa Bangladesh Central America	Least-developed countries Francophonie developing countries The Southern Cone (including Argentina, Chile, Uruguay and Paraguay)

### 3 Drivers for the Canadian Demand for Greenhouse Gas Emission Reduction Offsets

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This section analyzes several factors that could influence the demand for GHG emission reduction offsets within the Canadian private sector, including CDM Certified Emission Reductions (CER) and other forms of GHG emission reduction credits. The Canadian government has indicated it will encourage private sector involvement in the CDM rather than invest in CER credits itself. For the purposes of this paper, it is assumed that all purchases of CER credits from Canada and/or investments in CDM project activities will be undertaken by the Canadian private sector.

#### 3.1 Ratification of the Kyoto Protocol and Allocation of Responsibilities among Emitters

Ultimately, the demand for credits depends on the international ratification and entry into force of the Kyoto Protocol or other legally-binding mechanisms to manage global GHG emissions. This will require that 55 countries, covering 55% of global emissions must ratify the Protocol through domestic legislation. To date, the only major industrialized countries that have ratified the Kyoto Protocol are France and New Zealand. As of September 12, 2000, 29 others, mostly developing countries, have ratified.<sup>20</sup> However, at the Summit of the G8 industrialized countries in Otsu, Japan in April, members of the group indicated their intention to ratify the Kyoto Protocol by 2002, with the exception of Canada and the US, who opposed a fixed deadline.

Under the Kyoto Protocol, if it were ratified, Canada would be obliged to reduce its emissions to 6% below 1990 levels on average between the years of 2008 and 2012. To implement a program to manage emissions in Canada, the government will probably need to “allocate responsibility” among emitters to contribute toward national emissions reductions.

An “allocation” could take the form of legally binding caps on emissions, or of planning targets that would help governments plan, define, develop, and monitor a climate change action plan.<sup>21</sup> Allocations could be based on an assignment of emission reduction targets to regions and/or sectors of the economy. For example, it could be decided that certain regions or sectors would contribute to a greater proportion of national emission reductions than others. Either of these allocation mechanisms would indicate how responsibility for greenhouse gas emission reductions would generally be shared within Canada.

Following the determination of targets for each sector and/or region, the government would then apply one, or several, policy mechanisms to implement the allocation; these could include:

- imposing a legal obligation that requires emitters to hold greenhouse gas emissions to a specific level (e.g., emissions cap) that may be coupled with an emissions trading system;
- imposing a legal obligation that requires emitters to pay a charge for each unit of greenhouse gas emitted (e.g., carbon tax); and/or
- imposing a legal obligation that requires emitters to implement specific actions or to meet specific performance standards (e.g., efficiency standards).

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<sup>20</sup> <http://www.unfccc.int/resource/kpstats.pdf>

<sup>21</sup> Eric Haites and Robert Hornung. *An Overview of Approaches to Allocating Responsibility for Reducing Canada's Greenhouse Gas Emissions*. April 1998.

Allocation is a complex and highly political issue and the debate on it is only beginning in Canada. While it does seem highly probable that emissions trading will form an important part of Canada's Kyoto Protocol implementation strategy, the sources covered by the system and the basis for allocation under the system are far from determined. Indeed, a full-fledged allocation and emissions trading system are unlikely to be in place in Canada for several years.

It is clear that regulatory caps on the emissions of the industrial sector, like those described above, will be the primary driver for industrial emitters to invest in the CDM in the future.

### 3.2 Credit for Early Action

In the interim, the Canadian government may establish a regulatory mechanism that provides a strong positive incentive for Canadian industry to seek out emission reduction credits. Such a "credit for early action" system would allow industry to obtain GHG emission reduction credits now and apply them against any regulated limits on emissions they may face as part of a future allocation. In reality, such a system takes a portion of Canada's total allocated emissions level under the Kyoto Protocol and distributes it early to emitters that take actions now to reduce emissions.

In the spring of 1998, Canada's Federal and Provincial Energy and Environment Ministers made a commitment to "...establish by early 1999 a system for crediting verifiable early actions to reduce greenhouse gas emissions against any future emissions obligations." One of the "issues tables" established under the National Climate Change Consultation Process was asked to consider this issue, but failed to design a system for deliberation by Ministers. Building on the work of the issue table, a Collaborative of industry and environmental organizations did produce a proposal in July 1999 for consideration by governments. The "Canadian Early Emission Reduction Program (CEERP)" remains the most comprehensive design proposal for a credit for early action system in Canada.

The CEERP Collaborative had the following objectives:

- to reach consensus on the broad design of a Canadian Early Emission Reduction Program;
- to consult with and enroll other key players;
- to recommend decisions to government that would facilitate the implementation of an early emission reduction system;
- to develop a proposed timeline of implementation and identify further work to be done; and
- to jointly advance the design and implementation of the system through submission to formal government process and dialogue with Ministers responsible for policy issues associated with the Credit for Early Action system.

The Collaborative published a document entitled, *The Canadian Early Emission Reduction Program: Early Action to Reduce Greenhouse Gas Emissions and Manage Canadian Climate Change Compliance Liabilities*.<sup>22</sup>

While Ministers have missed their spring 1999 deadline, work continues in this area and federal and provincial governments are now developing their own proposals for a credit for early action system. Federal and provincial governments announced a "baseline protection" initiative in January 2000 and further considered the issue of credit for early action at a meeting of Ministers in October 2000.

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<sup>22</sup> Available on request from the Pembina Institute: Drayton Valley, Alberta. July 1999 draft; contact piad@pembina.org

The existence of a Credit for Early Action system may produce some demand for CDM CERs in the near future, but that demand is likely to be limited. This is because governments will probably limit the number of early action credits they make available because every early action credit awarded gives the government fewer emission rights to allocate when the Kyoto Protocol enters into force. Also, it is unclear whether such a CEA system will in fact recognize CERs for credit; rather, the system may be limited to investments in domestic emission reductions.

### 3.3 Regulatory Risk Management

Until the Kyoto Protocol is ratified and in the absence of a “Credit for Early Action” system, the demand for CDM CER credits will be low, but greater than zero. The evidence for this is the fact that some industrial emitters are already beginning to tentatively invest in emission reduction credits, even without these factors.

The current demand for emissions offsets, including credits for CDM projects, is linked to regulatory risk management and the recognition among many industrial emitters that although there are no regulatory requirements today, they are likely to be imposed in the future. Investing in emission reduction credits now provides a company with a commodity that may help it to meet future regulatory obligations (although there is no guarantee of this). More importantly, engaging in such activities now will give a company valuable knowledge and experience that should prove useful when regulatory drivers are in place and the search for emission reduction credits begins in earnest.

A number of Canadian companies have adopted voluntary commitments to limit greenhouse gas emissions and have invested in offsets in developing countries through the AIJ Pilot Phase to help meet those commitments. These companies include Suncor Energy, TransAlta Utilities, PanCanadian Petroleum, Ontario Power Generation (formerly Ontario Hydro), and Hydro Québec. Numerous other companies have invested in offset projects in Canada and the US to meet their own voluntary emission reduction commitments. See the first table in Section 13 in the Appendix for details.

Such investments in risk management are influenced by:

- the company's perception of the anticipated government allocation and emissions cap for the company and the likelihood of such a cap being implemented;
- the projected emissions levels of a company relative to historical levels (the extent of emissions growth above 1990 levels);
- the capacity of the company to reduce emissions in its own operations in a cost-effective manner; and
- the likelihood of receiving future credit from the government or the UNFCCC for investments, among other factors.

This combination of factors has historically translated to a willingness to pay between \$1 and \$5 per tonne of CO<sub>2</sub>-equivalent GHG emission reductions among Canadian companies. However, as these factors are strengthened, the willingness to pay could increase.

### 3.4 Other Drivers

Reducing GHG emissions often has economic, social and other environmental benefits, such as improved public perception, employment creation, new business opportunities, technology development, and improvement of local environmental quality. For a more detailed description, see Section 6.2.

Some companies view these benefits as additional drivers for investing in GHG offsets. In recent years, Canadian companies have paid as much as \$50/tonne for premium emission reduction projects that have a variety of non-carbon benefits.

### 3.5 Conclusions on Drivers for Canadian Corporate Investment in the CDM

Legally-binding caps on emissions from the industrial sector in Canada, along with the ability to purchase GHG emission reduction credits, will be the primary driver for industrial emitters to invest in the CDM in the future.

Until such limits are in place, investments in CDM projects will likely be limited to those emitters who perceive a significant business risk from future regulations due to large increases in emissions since 1990. Many of these emitters may have identified other benefits of such investments, in addition to GHG management (e.g., new business opportunities). Already, several large energy companies are investing in projects in developing countries that might be eligible for CERs in the future.

The CDM is ideally suited to such investments for regulatory risk management purposes because it commenced on January 1, 2000. If the Kyoto Protocol is ratified, then investments in the CDM will receive credit in the future. Even if the Kyoto Protocol is not ratified, it is likely that any future emission control agreements would recognize emissions reductions in developing countries.

Despite the fact that Canadian investment in CDM-type projects may be limited in the short term, ratification of the Kyoto Protocol and the allocation of emission control responsibilities among emitters in Canada would result in potential demand for CER credits. Chapter 4 analyzes this in more detail.

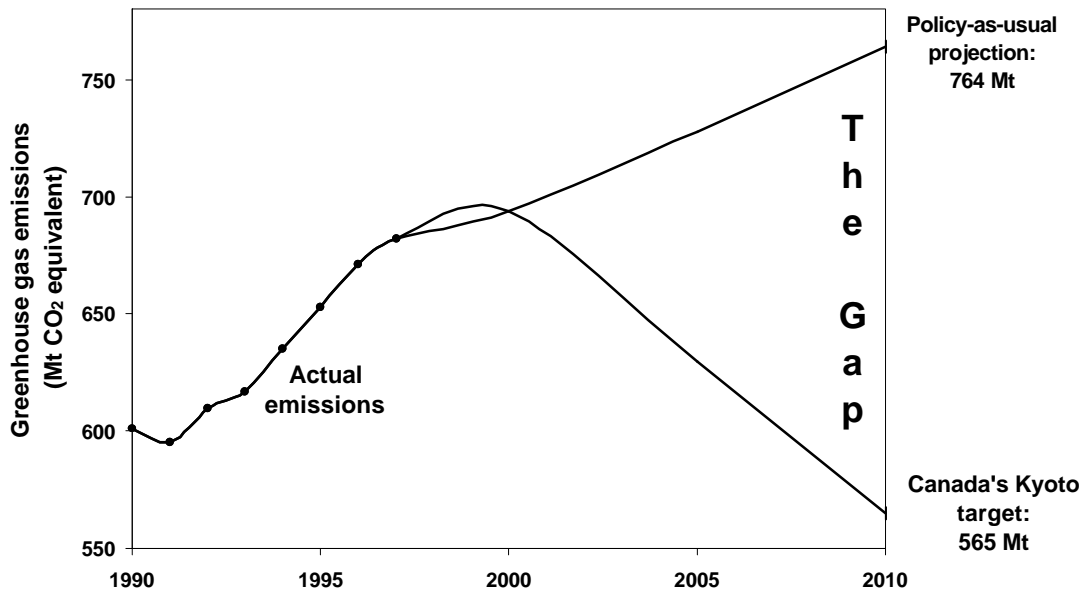


## 4 Canada's Greenhouse Gas Emissions Inventory and Projections<sup>23</sup>

### 4.1 Canada's Greenhouse Gas Emissions and Gap

Canada's commitment under the Kyoto Protocol is to reduce greenhouse gas emissions to 6% below 1990 levels on average during the period 2008-2012. However, emissions in 1997 were already 13.5% above 1990 levels, and official projections show that meeting the Kyoto commitment will require a 26% reduction in emissions from projected levels in 2010. As a result, the "Kyoto" gap between projected national emissions and Canada's international commitment is now 199 megatonnes, as illustrated in Figure 1. Recent information demonstrated that Canada's 1998 emissions are 13% above 1990 levels.

**Figure 1** Canada's Kyoto Gap

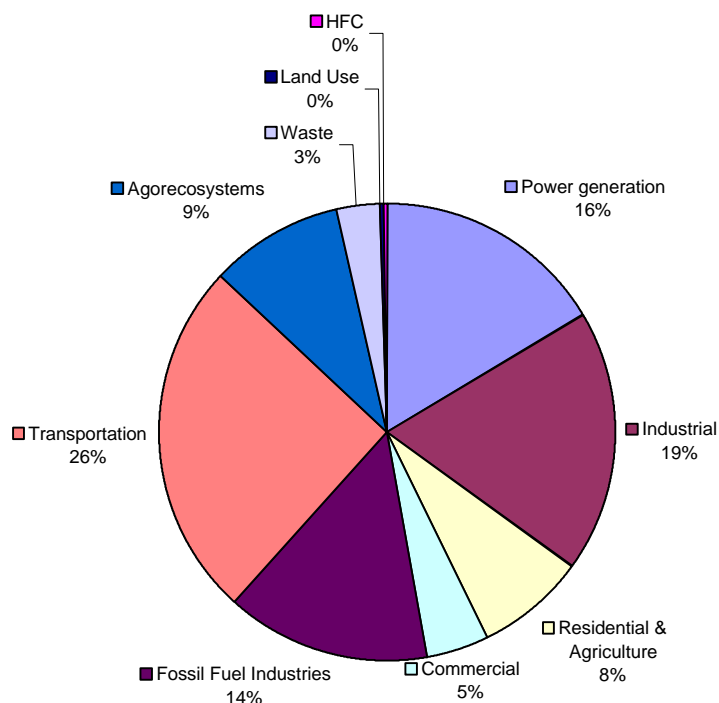


The distribution of Canadian GHG emissions in 1997 is illustrated in Figure 2. Industry accounts for almost 50% of Canada's GHG emissions (682 Mt in 1997). The key contributors are electricity generation (111 Mt), fossil fuel industries (i.e., oil and gas) (98 Mt), and all other industry (127 Mt).

<sup>23</sup> Main Reference: Analysis and Modelling Group of Canada's National Climate Change Process. Natural Resources Canada. *Canada's Emissions Outlook: An Update*. 1999.

**Figure 2**      **Distribution of Canadian GHG Emissions (1997)**

**Greenhouse Gas Emissions by Sector (Mt of CO<sub>2</sub> Equivalent)**

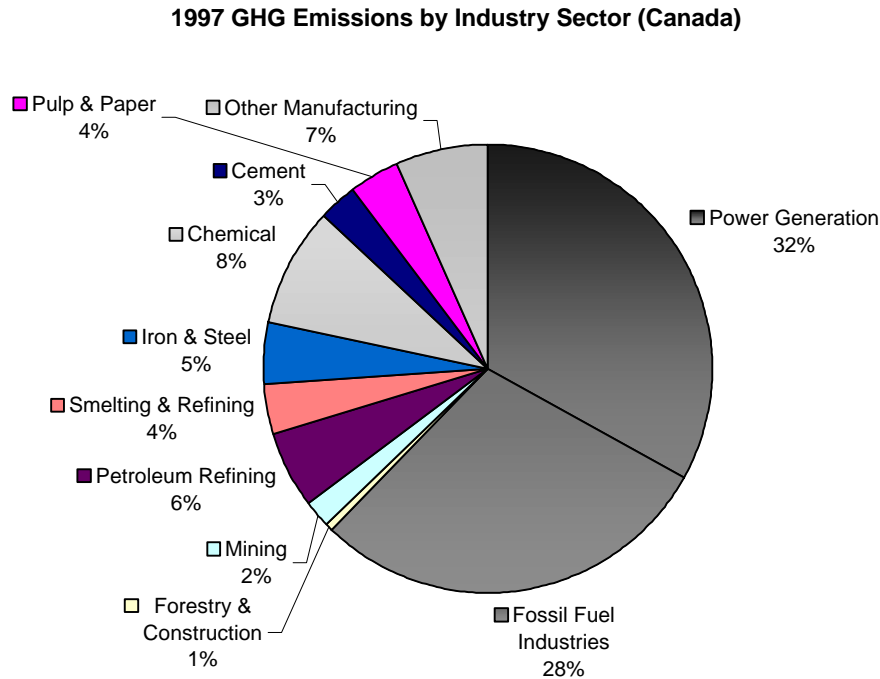


For the purposes of this paper, it is assumed, with respect to industrial emitters, that the Canadian government will allocate emission reduction responsibilities, in part, by requiring all large industrial emitters to reduce their greenhouse gas emissions to 6% below 1990 levels by the years 2008-2012. We also assume that a domestic emissions trading system will be established to provide these large industrial emitters with additional flexibility in meeting their regulated emission caps. Finally, we assume that all large industrial emitters will also have access to the Kyoto Protocol's emission trading mechanisms, including the CDM.

With respect to emitters in the residential, commercial and transportation sectors, we assumed these emitters will be controlled through various regulatory and fiscal mechanisms like a carbon tax or efficiency standards. Accordingly, we are assuming that these emitters will not participate in domestic or international emissions trading systems and will therefore not be seeking emission reduction credits.

The distribution of total industrial emissions is illustrated in Figure 3.

**Figure 3 Distribution of Industrial Sector GHG Emissions (1997)**



As the figure above makes clear, the industrial sector is very complex and diverse. It includes a range of activities, from transforming raw materials into more refined products such as refining and smelting operations, to manufacturing finished products such as pharmaceuticals and electronics. Oil and gas exploration, processing and transportation; electricity production; chemicals; petroleum refining; iron and steel; smelting and refining; pulp and paper; and cement are all energy intensive industries and account for the vast majority of the emissions.

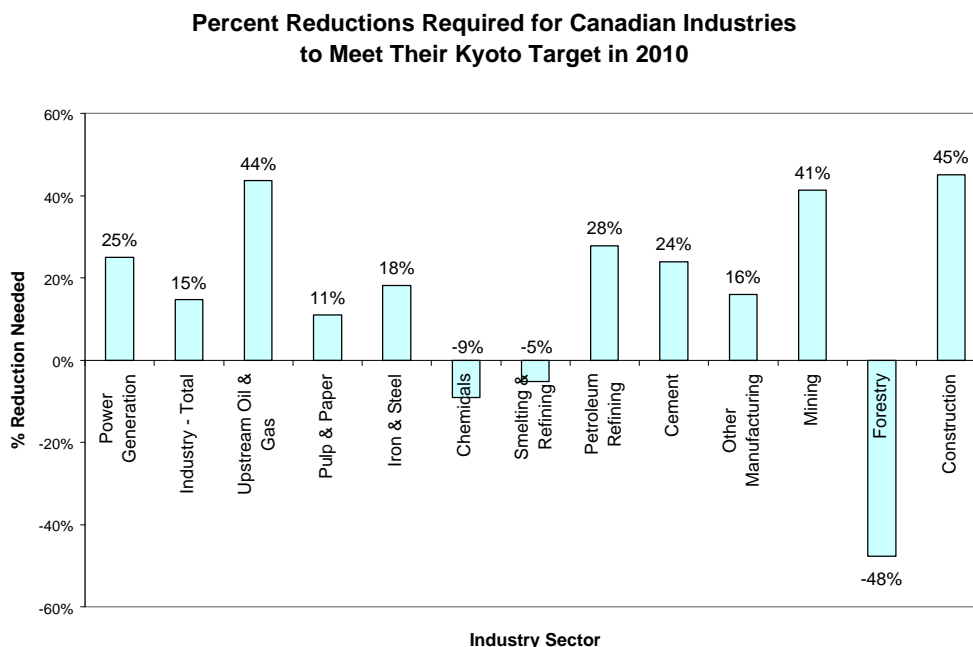
In most of these industry sectors, emissions are growing rapidly. Between 1990 and 2010, emissions are projected to grow as follows:

- “fossil fuel industries” (66%),
- metal mining (64%),
- petroleum refining (31%),
- electricity production (25%),
- cement (24%),
- iron and steel (15%), and
- other manufacturing (12%).

Emission decreases are expected in some sectors over the same period: forestry (30%), smelting and refining (11%), and chemicals (14%).

Figure 4 illustrates the gap for the entire industry sector between a Kyoto Protocol commitment (6% below 1990 levels) and projected emissions in 2010. At least half of the industries will need to reduce their projected emissions for 2010 by more than 20%.

**Figure 4 Illustration of the Kyoto Gap for Industrial Sector Emitters**



## 4.2 Electric Power Industry

Figure 5, below, illustrates the specific gap for the electric power generating industry. Emissions in 1997 were 111 Mt. Greenhouse gas emissions from power generation are projected to grow by about 25% between 1990 and 2010. Recent factors that are contributing to this increase include:

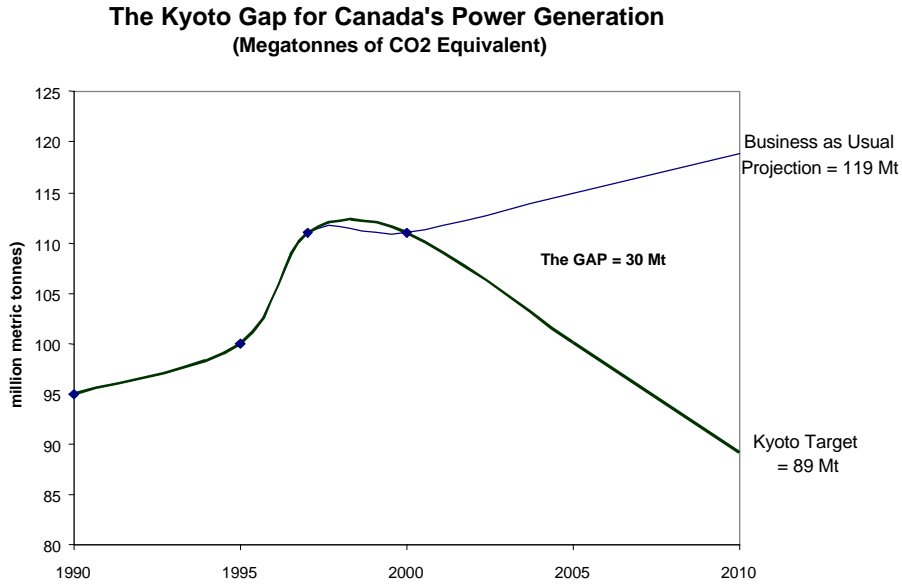
- increased economic activity. The overall economy has been growing, on average, 2.9% per year between 1995 and 2000, and is expected to grow at about 2.3% per year between 2000 and 2010.
- nuclear power facilities. Seven units at major nuclear generating facilities in Ontario have been shut down for an indefinite period, meaning that about 4,700 MW of power have been procured mostly through coal-fired facilities instead.

However, natural gas is starting to replace coal and oil plants and projected growth of natural gas generation is as high as 650%. At the same time, emissions from oil-fired generation are expected to drop by 55% between 1990 and 2010, and coal-fired generation is expected to grow by only 5%. Even more dramatic changes in emissions reductions are expected for the period 2010 to 2020 due to the conversion to natural gas.

Electricity exports to the United States were 43,061 Gigawatt-hours (GWh) in 1997, equivalent to about 7.8% of Canada's total electricity generation. Imports were 7,460 GWh, making the 1997 net exports to the US 35,591 GWh.<sup>24</sup>

<sup>24</sup> Canadian Electricity Association and NRCan. *Electric Power in Canada 1997*.

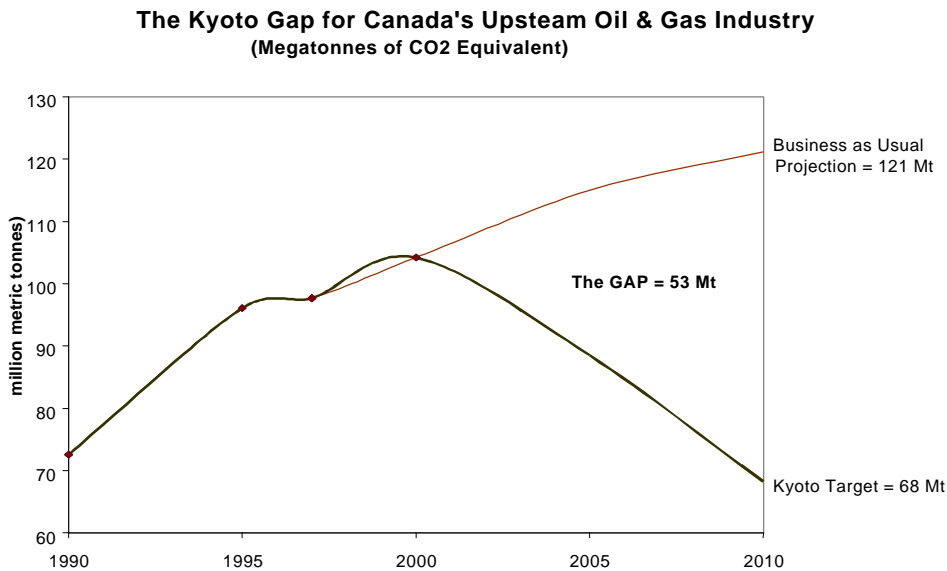
**Figure 5 Power Generation Industry Gap**



### 4.3 Upstream Oil and Gas Industries

Figure 6 illustrates the specific gap for upstream oil and gas industries. In 1997, the industry accounted for 98 Mt of GHG emissions. The emissions are expected to grow by 67% between 1990 and 2010. Emissions are derived primarily from fuels used for the exploration, development, production and transportation of crude oil, natural gas, and coal, and from “fugitive emissions,” mainly CO<sub>2</sub> and CH<sub>4</sub> from the production and transport of raw materials.

**Figure 6 Oil and Gas Industry Gap**



Recent increases in emissions from fossil fuel production are chiefly related to oil sands development in western Canada, accounting for 15.5 Mt of increases in GHG emissions between 1990 and 2010. There has also been a significant increase in natural gas production since 1990, concentrated in western Canada, but growing into offshore natural gas in eastern Canada as well. Table 3 illustrates the emissions from different activities in the oil and gas sector.

**Table 3 Emissions from Oil and Gas Activities<sup>25</sup>**

Activity	1990 Emissions (Mt)	1997 Emissions (Mt)	2010 Forecast (Mt)	Increase from 1990-2010 (Mt)	Increase from 1990-2010 (%)
Frontier Production	0	0	0.7	0.7	N/A
Bitumen Production	3.7	6.1	12.4	8.7	235%
Oil Sands Production	9.6	11.8	25.1	15.5	161%
Natural Gas Production	13.5	19.2	23	9.5	70%
Natural Gas Processing	8.5	12.2	14.3	5.8	68%
Flaring	5.9	7.4	6.7	1.8	14%
Light Crude Oil Production	8.2	9.2	8	-0.2	- 2%
Heavy Crude Oil Production	8	13.6	10.5	2.5	31%
Gas Distribution	3.1	3.5	3.5	0.4	13%
Upgrader Emissions	0.3	0.5	0.4	0.1	33%
Pipelines	11.1	18.5	21.7	10.6	95%

Canada is a major exporter of fossil fuels, particularly to the United States and East Asia. Emissions from exports of all energy resources were responsible for about 5.9% of Canada's total emissions (of 567 Mt<sup>26</sup>) in 1990 and are projected to increase to 10.3% in the year 2010.<sup>27</sup> Net of energy imports, the figures are reduced to 3.3% in 1990 and 7.9% in 2010. The following emissions have been attributed to exports.

**Table 4 GHG Emissions from the Net Export of Fossil Fuels**

Fuel	1990 Net Exports (Exports – Imports) (Mt)	2010 Net Exports (Mt)	% Increase from 1990 to 2010
Natural Gas	11.8	32	171%
Crude Oils	8.8	15.2	73%
Coal	0.7	1.3	86%
Natural Gas Liquids	0	0	0%
Refined Petroleum Products	1.1	0.9	-18%

Although the oil and gas industry has taken action to constrain CO<sub>2</sub> emissions and methane leakage, emissions overall continue to increase because efficiency gains are offset by increased production. However, fugitive emissions from oil and gas production and transportation are stabilizing due to voluntary actions in the industry to reduce venting and pipeline leakages.

<sup>25</sup> The totals do not add up to the values shown in Figure 6 because of an emission credit in the inventory for diesel fuel use in the mining sector of 5.3 Mt in 2010 and 0.5 Mt in 1990.

<sup>26</sup> This figure is lower than the 601 Mt inventory in the more recent study used for previous charts.

<sup>27</sup> Environment Canada. *Fossil Fuel Energy Trade and GHG Emissions – A Quantitative Assessment of Emissions Related to Imports and Exports*. Prepared by T.J. McCann and Associates, Clearstone Engineering, MWA Consultants, Sigurdson and Associates with Appendix by Lynn Ross.

## 4.4 Other Industries

Figure 7 illustrates the gap for the petroleum refining industry. In 1997, the industry accounted for 18.6 Mt of GHG emissions. The emissions are expected to grow by 30% between 1990 and 2010. New regulations to reduce sulphur content in motor gasoline will be phased in from 2002 to 2005. Given existing technology, it is estimated that each unit of output will require 10% more “own use” petroleum product. Less energy-intensive technology is being developed, but will not be ready by 2002. This increase in emissions is offset by closure of three small refineries, one each the Atlantic region, Ontario and BC.

**Figure 7 Petroleum Refining Industry Gap**

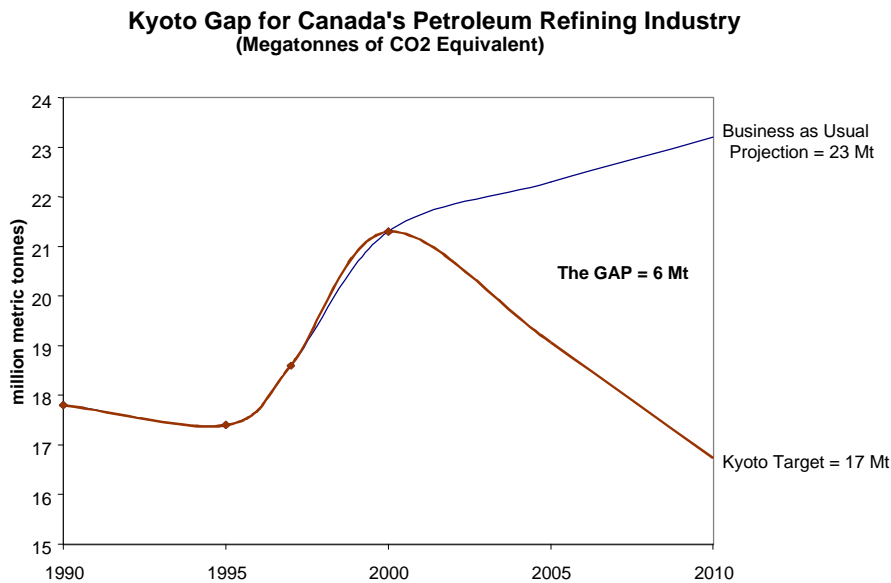


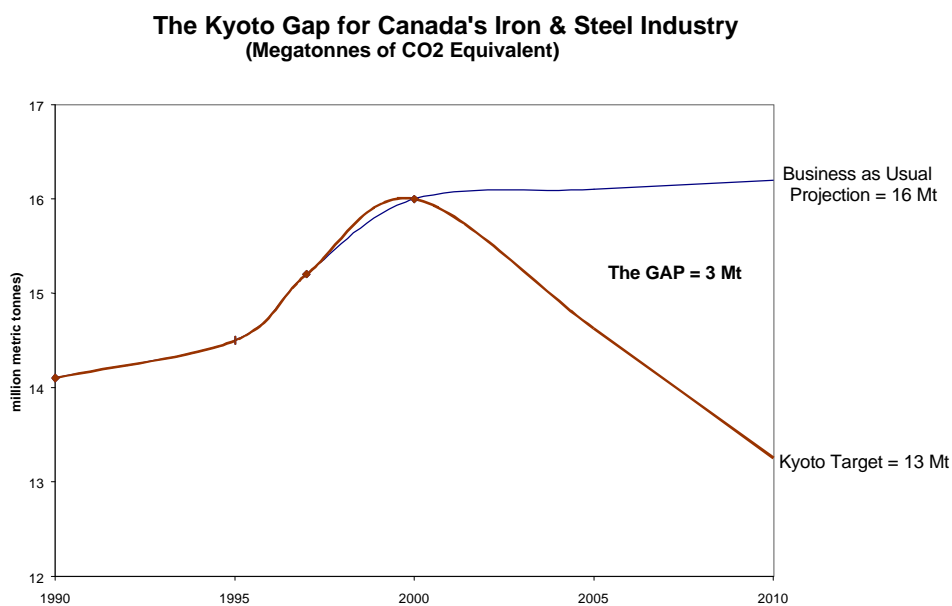
Figure 8 illustrates the gap for the iron and steel industry. In 1997, the industry accounted for 15.2 Mt of GHG emissions. The emissions are expected to grow by 15% between 1990 and 2010. Emission projections are based on output growing by 1.3% per year, and an improvement in energy intensity of 0.8%. They also include the effect of more rapid penetration of electric arc furnaces.

Figure 9 illustrates the gap for the cement industry. In 1997, the industry accounted for 9.3 Mt of GHG emissions. The emissions are expected to grow by 24% between 1990 and 2010. The chemical process to produce cement accounts for about two-thirds of GHG emissions, resulting mainly from the combination of heat and limestone (CaCO<sub>3</sub>) producing carbon dioxide (CO<sub>2</sub>) and quicklime (CaO). Some emissions reductions are being facilitated by using coal combustion flyash in the cement mix, reducing the need for CaO. The cement industry is also beginning to use waste fuels, replacing natural gas. By 2010, waste fuels are expected to constitute 15% of the fuel mix, meaning an increase in GHG emissions of 0.1 Mt because they are more carbon intensive than natural gas.

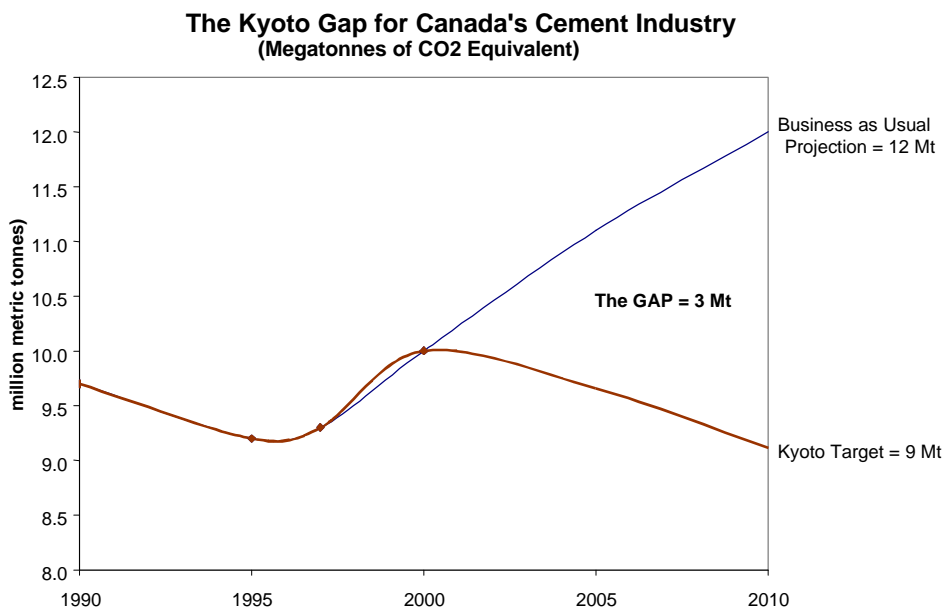
Figure 10 illustrates the gap for the “other manufacturing” sector. This sector includes auto manufacturing, high-tech industries, clothing, food products, and other industries. In 1997, the industry accounted for 22.1 Mt of GHG emissions. The emissions are expected to grow by 12% between 1990 and 2010.

Figure 11 illustrates the gap for the mining and smelting industries. In 1997, these industries accounted for 18.7 Mt of GHG emissions, and emissions are expected to grow by 7% between 1990 and 2010. For the mining sector alone, emissions will increase by 60%. In contrast, emissions from smelting and refining of minerals are expected to drop by 11%. Sulphur hexafluoride, used for magnesium smelting, has a global warming potential of 23,900 CO<sub>2</sub> equivalent; decreases in its use will reduce GHG emissions from 2.9 Mt in 1990 to 0.5 Mt in 2010.

**Figure 8 Iron and Steel Industry Gap**



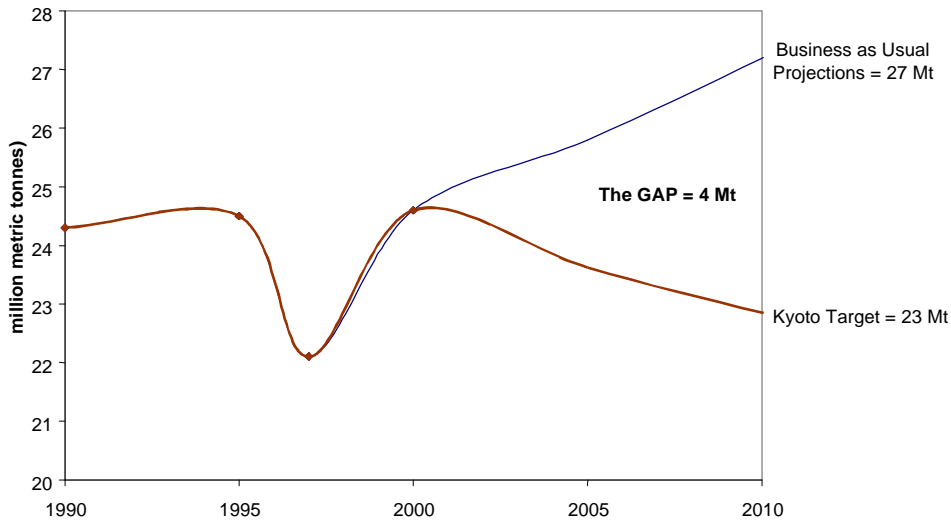
**Figure 9 Cement Industry Gap**





**Figure 10 Manufacturing Industry Gap**

**The Kyoto Gap for Canada's "Other Manufacturing"  
(Megatonnes of CO2 Equivalent)**



**Figure 11 Mining and Smelting Industry Gap**

**The Kyoto Gap for Canada's Mining and Smelting Industry  
(Megatonnes of CO2 Equivalent)**

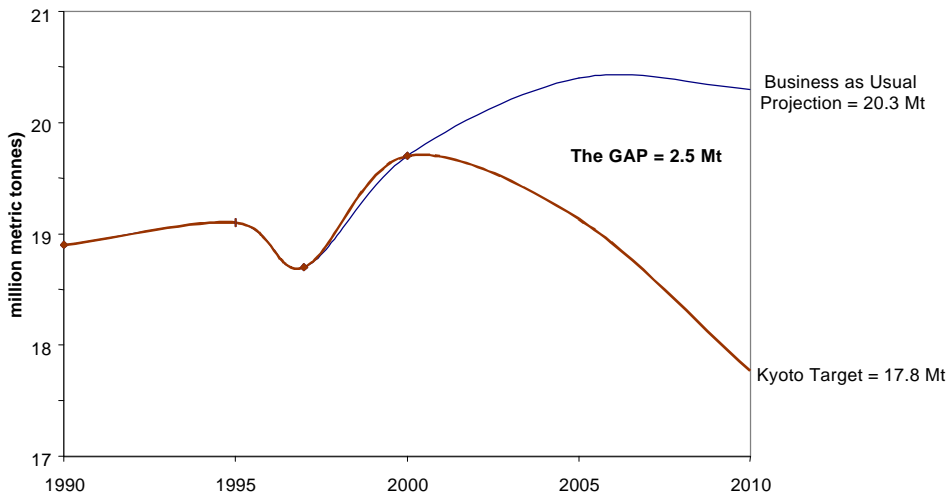
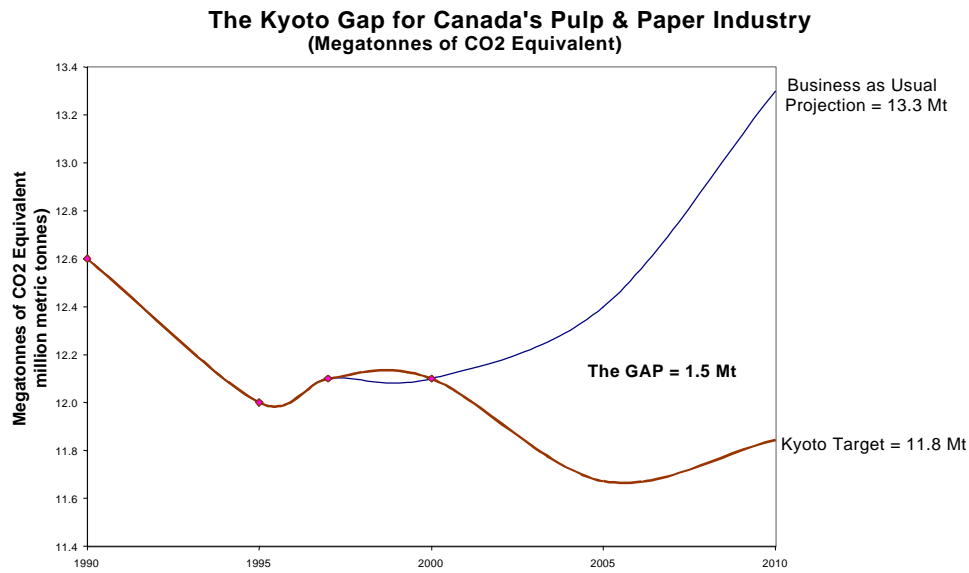


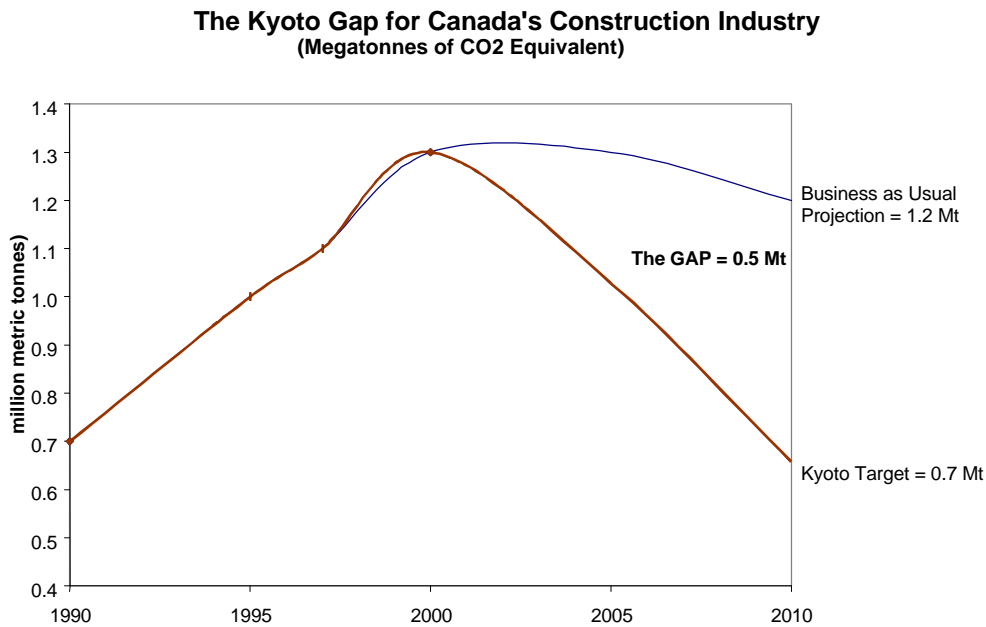
Figure 12 illustrates the gap for the pulp and paper industry. In 1997, the industry accounted for 12.1 Mt of GHG emissions. Emissions are expected to grow by 6% between 1990 and 2010. The pulp and paper industry is now facing a shortage of economically available wood waste for fuel. GHG emissions increase as wood waste is replaced by natural gas, with the exception of Quebec where electricity is used. In contrast, the forestry industry (i.e., logging) emissions will fall from 1.1 Mt in 1990 to 0.7 Mt in 2010, a 36% reduction. These emissions are not included in Figure 12.

**Figure 12 Pulp and Paper Sector Gap**



Construction industry emissions were 1.1 Mt in 1997 and emissions are expected to increase by 71% between 1990 and 2010.

**Figure 13 Construction Industry Gap**



## 5 Potential Demand for CDM Offsets (CERs)

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### 5.1 Competing Mechanisms for Industry to Respond to Climate Change

Corporate emitters of GHGs will have several options for meeting Kyoto Protocol targets. Broadly speaking, these options fall under the following categories:

1. internal emissions reductions;
2. purchase of GHG offsets within Canada, through a variety of mechanisms;
3. investments in Clean Development Mechanism credits (CERs) under the Kyoto Protocol;
4. investments in Joint Implementation credits under the Kyoto Protocol; and/or
5. investments in International Emissions Trading allowances under the Kyoto Protocol.

Ultimately, all of these options will compete with each other for emission reduction dollars. Section 5.2 provides an analysis of the factors that will affect the demand for offsets from different mechanisms.

#### 5.1.1 Internal Emission Reductions

All industrial emitters have opportunities to reduce GHG emissions by making changes in their management practices and/or investing in new technologies. The actions taken are specific to the industry, and some industries can reduce emissions more cost-effectively than others. For example, electric utilities have many opportunities to reduce the GHG emissions associated with their corporate functions and with the production, transmission, distribution, and sale of electricity to consumers. They can also help to influence their customers' use of energy through a variety of incentives.

Internal energy efficiency measures include the following:

- Improving the efficiency of thermal power plants by reducing the amount of fuel (i.e., coal, natural gas) required to produce a unit of electricity.
- Increasing the conversion efficiency of non-thermal plants such as hydroelectric facilities by changing equipment, enhancing energy resources, and/or reducing energy losses.
- Reducing energy losses in transmission and distribution (T&D) lines, either by addressing physical limitations (e.g., conductor size or voltage) or by reducing power theft.
- Increasing the use of distributed electricity supply plants, such as renewable energy, that are located close to customer loads, thus reducing T&D requirements and associated energy losses.
- Reducing the amount of heat, hot water, light, and other energy used in company buildings.
- Reducing emissions in vehicle fleets by using high-efficiency vehicles or reducing the kilometres traveled by the fleet.

Increasing the market supply of zero-emission, renewable energy resources such as wind, hydro, solar hot water, solar space heating, solar photovoltaic, wood-waste, other biomass, and geothermal technologies and resources can also reduce corporate GHG emissions. This occurs when the new renewable energy sources displace existing fossil fuel supplies or delay the construction of new supplies.

Measures that encourage customers to reduce their energy consumption can be claimed as emissions reductions. If a customer saves a unit of energy that would be generated by a fossil fuel source, then an emission reduction is achieved as long as the power company does not sell it to another customer. The value of emission reduction credits can help to offset the financial losses associated with reducing the utilities' energy sales to those customers.

The cost of GHG emission abatement varies significantly among different sectors of the economy. In the industrial sector, several emission reduction activities are expected to have a negative cost, given that the financial savings from reduced energy use or improved productivity are expected to exceed the direct financial cost of the technology or management practice used to create the reduction. Some of the potential costs of emission reduction activities are summarized in Section 13 in the Appendix.

### 5.1.2 Purchase of Greenhouse Gas Offsets in Canada

The demand for GHG offsets in Canada will depend largely on the “allocation” of Kyoto Protocol targets to various industrial emitters in the long term and the creation of a “Credit For Early Action” system in the short term. A number of Canadian companies have already invested in emission reduction offsets in anticipation of a future limitation on GHG emissions. Some of these investments are listed in Section 13 in the Appendix.

Two pilot programs to register emission reduction projects for the purpose of trading offsets are operating in Canada. These registration mechanisms may facilitate credit certification in the future if and when the government proceeds with developing a domestic credit trading procedure. The two programs are the Greenhouse Gas Emission Reduction (GERT) Pilot and the Pilot Emission Reduction Trading (PERT) system. Many bilateral trades have also been made.

#### *GERT Pilot*

Emission reductions can be registered voluntarily in Canada through the GERT Pilot.<sup>28</sup> GERT is designed to register greenhouse gas offset trades connected with projects that begin between January 1, 1997 and December 31, 2001. Emission reductions up to 2008 will be eligible for recognition through GERT. Any emissions reductions that involve at least one Canadian partner are eligible. International projects can also be registered under GERT.

Companies submit a description of an emission reduction project to the GERT Technical Committee for endorsement, with the documented “Reference Case” (business as usual) emissions for that activity. Projects must meet various eligibility criteria, which are designed to uphold the overall objectives of the pilot. Each year, a Registered Emission Reduction (RER) is granted by GERT for actual emissions reductions below the Reference Case. These RERs may be eligible for credit in the future at the discretion of the Canadian government. They may serve as an acceptable means for an investor company to partly or fully comply with future regulatory requirements imposed as a result of the Kyoto Protocol. The ultimate value of RERs in any future regulatory regime is likely to depend largely on the extent to which the project has clearly and unambiguously addressed the eligibility criteria.

To date, six projects have passed or are being reviewed through the GERT process, including:

- a small hydro plant in Newfoundland that is offsetting oil-fired electricity (OPGI);
- a wind power facility in southwest Alberta that is displacing coal and gas fired electricity (ENMAX);
- a boiler fired by wood waste at a pulp mill in British Columbia (Pacifica);
- a solar energy system that heats a swimming pool (Taylor Munro);
- a tree planting and forest management project in Saskatchewan (SERM); and
- a landfill gas project in greater Vancouver that is used by a lumber mill (Norseman).

The registry for GERT projected will be housed by the Voluntary Challenge and Registry (VCR) when the pilot has ended its mandate.<sup>29</sup>

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<sup>28</sup> See <http://www.gert.org> for a description.

<sup>29</sup> <http://www.vcr-mvr.ca>

### *PERT*

The Pilot Emission Reduction Trading Program (PERT) in southern Ontario is a similar mechanism to the GERT Pilot.<sup>30</sup> It originated as a trading program for local air pollutants (e.g., NO<sub>x</sub>, VOCs, PM<sub>10</sub>) and has only recently expanded to include greenhouse gases. Actual emissions reductions are registered with the Clean Air Action Corporation, the registry for PERT. PERT will play a role (as yet undefined) in the implementation of Ontario's new cap and trade emissions trading system for NO<sub>x</sub> and SO<sub>2</sub>. All of the Ontario Power Generation projects are done through PERT.

### *Bilateral Emission Reduction Trades*

A number of GHG emission reduction offsets investments have proceeded as bilateral trades between corporate entities without any registration, instead using contract law to specify emission reduction quantities, appropriate monitoring procedures and other necessary attributes of offsets.

In many cases, the trade involves a third party verification agency to ensure that emission reductions actually occur. In the trade between Suncor Energy and Niagara Mohawk in the US, the parties hired the verification services of the Environmental Resources Trust to provide unbiased verification of emissions reductions that are claimed. The Greenhouse Gas Management Consortium (GEMCo) has acted on behalf of corporate buyers in a number of trades such as the one with International Fuel Cell. GEMCo has its own verification staff. TransAlta has also undertaken several investments using its own staff to verify emission reductions.

### *Credit for Early Action*

As mentioned in Section 3.2, a future opportunity for Canadian emitters to invest in GHG emission reduction offsets may be credit for early action. This mechanism would allow parties who reduce emissions to sell credits on an open market. It is possible that international projects under the CDM or JI could receive credit under such a system.

## 5.1.3 The Kyoto Protocol's Clean Development Mechanism

The CDM will provide credit for emissions reduction projects in developing countries. Starting in the year 2000, investments in projects in developing countries could be eligible for credits under the CDM. The CDM will be proclaimed in the event the Kyoto Protocol is ratified.

The CDM includes a number of criteria that projects must meet to be eligible for generating credits. These criteria are currently being finalized. Certified Emission Reduction (CER) credits will be awarded by an "Operational Entity," following the demonstration of real emission reductions from a project. CER credits can be banked for later use when regulatory requirements are imposed under the Kyoto Protocol in industrialized countries like Canada, likely during the period 2008 to 2012, the "first commitment period."

For more information on the mechanics of the CDM, see the description in the companion paper, *Implementing the Clean Development Mechanism: Pursuing Sustainable Development and Climate Protection*.<sup>31</sup>

Investment in the CDM could take the form of purchases of Certified Emission Reductions (CERs) and/or equity investment in projects in developing countries in return for receiving CERs. Alternatively, Canadian companies may develop their own projects through technology transfer and seek approval from authorities in the host developing country.

<sup>30</sup> See <http://www.pert.org> for a description.

<sup>31</sup> To download this report, go to: <http://www.pembina.org/pubs/cop6.htm>

#### 5.1.4 Joint Implementation

The Kyoto Protocol established Joint Implementation (JI) as one of the Kyoto Mechanisms for emissions trading. JI will recognize projects starting in 2008 that reduce emissions in industrialized countries that have accepted Kyoto Protocol targets. JI permits the trading of emission reduction credits between industrialized countries such as Canada and the US.

Some countries have called for an early introduction of JI to facilitate “early action” project activities in which emissions reductions can be banked for use during the period 2008 to 2012. Further clarification on JI is occurring under current international negotiations surrounding the Kyoto Protocol.

#### 5.1.5 Purchase of Allowances under International Emissions Trading

The International Emission Trading mechanism introduced in Article 17 of the Kyoto Protocol will allow countries to trade part of their emissions budget specified in Annex B. Those countries that have a surplus budget due to emissions reductions since 1990 will be able to trade part of their budget to countries that have seen increases in emissions. It is unclear whether individual emitters of greenhouse gases will participate in an international emissions trading market, or will be limited to participation in JI and the CDM only.

#### 5.1.6 World Bank Prototype Carbon Fund

The Prototype Carbon Fund (PCF) was endorsed by the World Bank's Executive Directors on July 20, 1999.<sup>32</sup> The PCF is a public-private partnership that aims to pilot GHG emission reduction activities within the framework of the Kyoto Protocol. It will invest contributions made by companies and governments into projects designed to abate carbon emissions and produce emission reductions that are consistent with the regulatory framework under the UNFCCC and the Kyoto Protocol for the CDM and JI, with emphasis on economies in transition (EIT), such as Eastern Europe.

The PCF was designed to reach a minimum capitalization of US\$60 million in the year 2000 after which time it will be launched. Seventeen corporations from Japan, Norway, France, the UK, and Finland have contributed funds to finance emissions reductions. In addition, six industrialized country governments, including Canada, have contributed to the PCF. The Canadian Government allocated CAN\$15 million to the PCF in its 2000 federal budget. Through this investment, Canada will contribute to new approaches to reducing greenhouse gas emissions through energy efficiency and renewable energy projects in developing countries and economies in transition. As of September 29, 2000, the PCF had raised \$145 million in capital to fund projects.<sup>33</sup> The current target is to fund \$80 million in projects under the CDM, and \$70 million for JI projects.

Eighteen developing countries and EITs have agreed to formally participate while several more indicated a serious interest. Most participants are in Latin America while some are in Africa and Eastern Europe. These countries will host emission reduction projects, eligible for credits in the future under either the CDM or JI, if the Kyoto Protocol is ratified. To date, one project has been funded, a landfill gas project in Latvia. Other pending projects include a renewable energy aggregator in Costa Rica, a small-hydro facility in Uganda, a bagasse cogeneration project in Guyana, and energy efficiency projects in the Czech Republic.

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<sup>32</sup> <http://www.prototypecarbonfund.org>

<sup>33</sup> Presentation by Odil Tunali Payton at the Alberta-Latin American CDM Workshop, Calgary, Sept. 28-29.

The fund has various project eligibility criteria and principles for investment, with particular emphasis on the following:

- A broad balance will be achieved in the number of projects undertaken in EITs and in developing countries and, considering potential projects identified prior to the establishment of the Fund, emphasis will be directed initially to the development of projects in developing countries.
- A major emphasis will be on developing projects in the area of renewable energy technology such as, but not limited to, geothermal, wind, solar and small-scale hydro energy projects.
- For projects funded by the PCF, only the “additional” component of the project is funded, not the “baseline component,” which should be funded from other sources.
- Project development costs, excluding PCF transaction costs, must not exceed US\$2.70/tonne of CO<sub>2</sub> (\$10/tonne C).
- Credits (CERs and ERUs) will be priced at approximately US\$4-5/tonne of CO<sub>2</sub>.

The Canadian government's participation in the PCF is its first involvement in the CDM, outside of AIJ projects. However, no Canadian companies have invested in the PCF to date despite some limited interest from two firms. Some firms have indicated a concern around the gap between the price of emissions reductions and the cost of CERs under the PCF. Despite this, there may be an opportunity for Asian project developers to leverage funds from the PCF (which is partly funded by the Canadian government) provided that their country governments become partners in the PCF. As of September 29, 2000, no Asian countries have become partners.

## 5.2 Corporate Criteria for Greenhouse Gas Offset Investments

With all of the investment options listed in the previous section, how will companies choose where to invest? Many important factors will influence the decision, a number of which are outlined in this section. In the end, the private sector will base its greenhouse gas emission reduction investment choices on various factors, including but not limited to those listed below.

- Total project costs – These are the total capital and operating costs of the emission reduction project. Projects that have lower project costs for a given level of environmental performance and financial risk will be preferred.
- Transaction costs for registration and credit creation – These are the costs required for making the project proceed, including getting project approval, addressing local development regulations, purchasing insurance, and certifying offsets for credit creation and trading. Projects with lower transaction costs for a given level of environmental performance and financial risk will be preferred.
- Cost of the GHG offset (e.g., CER credit) – This cost reflects the price that needs to be received for the GHG emissions reductions to make the project proceed. It is often expressed in terms of the cost of purchasing an offset, in dollars per tonne of GHG emission reductions. It reflects the previous two criteria and, in many situations, could replace both of them. Projects that demonstrate lower offset prices for a given level of environmental performance and financial risk will be preferred.
- Timing on the eligibility for credit – Projects that are eligible for internationally recognized credit in the short term (i.e., CDM) will be preferred. The CDM has an advantage over JI and IET, as projects initiated after 2000 are expected to receive credit, compared with 2008 for JI and IET projects. However, some Canadian investors have indicated a concern about the lack of Canadian government recognition for investments to date.

- Public relations benefits – Projects that receive higher levels of public support due to social, environmental and economic characteristics will be preferred.
- Level of financial risk – Projects that minimize financial risk will be preferred. Examples of financial risk include not achieving emission reduction objectives, changes in interest rates, cost overruns and other factors.

Individual firms may have investment criteria in addition to those listed above. For example, companies may prefer to invest in technologies or management practices with which they are familiar (e.g., electricity company investing in renewable energy), in geographic regions where they already have business experience (e.g., in countries where they have subsidiaries), or with partners with whom they already have established business relationships.

Table 5 provides a preliminary qualitative assessment of how these criteria have been met within each of the investment mechanisms. This assessment is the view of the Pembina Institute. Of course, the project type will also influence the achievement of investment objectives. International Emissions Trading is not included in the matrix as the applicability of corporate participation in this mechanism is uncertain. The World Bank Prototype Carbon Fund is covered under CDM and JI.

**Table 5 Matrix of Investment Objectives and Emission Reduction Mechanisms**

	<b>Internal Emissions Reductions</b>	<b>Canadian Offset Investments (e.g., GERT pilot)</b>	<b>Clean Development Mechanism (CDM)</b>	<b>Joint Implementation (JI)</b>
<b>Total Project Costs</b>	Low-High Industry dependent	Low-Medium	Low-Medium	Low-Medium
<b>Transaction Costs</b>	Low	Low-Medium	Medium-High	Medium
<b>Cost of Offset</b>	Low-High	Low-Medium	Low-Medium	Low-Medium
<b>Public Relations Benefits</b>	High	Medium-High	Low-Medium	Low-Medium
<b>Level of Financial Risk</b>	Low	Low-Medium	Medium-High	Low-Medium
<b>Timing of Credit</b>	High	Low-Medium	High	Low

Internal emissions reductions can help a company reach its target emissions without having to purchase GHG offsets. Internal reductions typically have low or no transaction costs because there is no need to register a credit. However, they could have high project costs relative to some offsets because of limited options to reduce emissions within a company, which could translate into a high cost per tonne of GHG emissions reductions. Such reductions have high public relations benefits due to the visibility of the investment to customers and the public, and are very likely to be credited because they will reduce the actual emissions of the firm. The level of financial risk is likely to be low given that investments will be in the area of expertise of the company.

Investments in Canadian offsets offer low to medium costs and risk, depending on the type of investment. Many low to medium cost offsets in Canada in energy efficiency and the transportation sector remain untapped. The amount of investment in Canadian offsets will depend largely on the introduction of a Credit for Early Action (CEA) system by government. If no system is introduced, the credit potential is the same as JI because that will become the predominant mechanism for trading offsets within industrialized countries, but only after 2008. If a CEA system is introduced, then credit can be claimed for projects in advance of 2008. The level of financial risk is low due to the extensive investment protection laws in Canada.



Investments in the Clean Development Mechanism after January 1, 2000 offer credit under the Kyoto Protocol and can offer low-cost offsets due to the variety of opportunities. However, the transaction costs are potentially high due to the challenges of international trade and the rules around the mechanism. Also, the level of financial risk is high for those firms investing in new regions.

The Joint Implementation mechanism will offer low-cost offset opportunities with low transaction costs and a medium level of financial risk, but these presently are not eligible to receive credit until 2008.

### 5.3 Potential Demand for CER Credits

It is uncertain what the actual demand for CER credits will be in the future. Researchers have speculated on the size of the global market for CER credits generated under the CDM. The investment range is from \$1 billion (US)<sup>34</sup> to more than \$20 billion in the year 2010. The range of expected total credit (including the CDM) purchases is from 27 million tonnes of carbon equivalents (100 Mt of CO<sub>2</sub> equivalents) to over 500 Mt, depending on the availability and cost of alternative investment options. Until the rules for the CDM are verified, possibly at the COP-6 meeting, there is a large range of uncertainty as to the size of the CDM market.

Previous sections outlined the factors that could influence Canadian demand for CER credits from the CDM, relative to investments in other emission reduction opportunities. The industrial sector is most likely to invest in the CDM. The table below restates the gap for each industrial sector.

**Table 6 Summary of Industrial Sector Gaps**

<b>Industry</b>	<b>Size of Gap (Mt)</b>
Upstream Oil and Gas	53
Power Generation	30
Refineries	6
Manufacturing	4
Iron and Steel	3
Cement	3
Mining and Smelting	2.5
Pulp and Paper	1.5
Construction	0.5
<b>TOTAL INDUSTRIAL GAP</b>	<b>103.5 Mt</b>

Under a scenario analysis completed by Haites,<sup>35</sup> the CDM received between 3% and 58% of total investment dollars in offsets, assuming 16.5% went to “hot air,” 10% to 80% went to domestic actions, and between 1% and 16% to Joint Implementation.

The high end of the range for the CDM was for a “no limits” scenario with no supplementarity requirements. The low end of the range was for very strict supplementarity requirements that allow for 50% of emissions reductions below 1990 levels to be met from international investments while the rest must be undertaken by emissions reductions within the country.

<sup>34</sup> Eric Haites. *Estimate of the Potential Market for Cooperative Mechanisms in 2010*. Toronto, September, 1998. His range is from \$1-\$21 billion, with the estimated range of CDM credits from 27-571 million tonnes of carbon equivalents.

<sup>35</sup> Ibid.

Applying a similar range to the data presented above, the potential megatonne investment in the CDM from Canadian industrial firms is between 3 Mt and 60 Mt of CO<sub>2</sub> equivalents.

The actual investment in the CDM will depend on the extent of internal emissions reductions, whether Canada introduces a Credit for Early Action system and whether JI is started prior to 2008. Even if the competing mechanisms are favorable, the level of the “Gap” among industrial sector emitters is high enough that many will not be able to meet a Kyoto allocation through internal emissions reductions alone. They will look to the CDM, due to the potentially vast supply of offsets.

Other than undertaking internal emission reductions and reducing corporate emissions, the CDM is the only mechanism that offers credit to Canadian companies under the Kyoto Protocol. It is likely that Canadian firms will purchase to at least the middle of the range of potential demand stated above—that is, on the order of 30 Mt of annual GHG emission offsets.

## 6 Approach of Canadian Corporate Investors in the CDM

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This chapter looks at the approach that many Canadian investors could follow with respect to investments in the CDM. Several Canadian companies have already invested in GHG offsets, including investments in developing countries. These are summarized in Section 13 in the Appendix. In addition, several Canadian firms have indicated a commitment to invest in GHG offsets in the future, as summarized in Section 15 in the Appendix.

### 6.1 Corporate GHG Offset Strategy

The investment criteria listed in the previous chapter often will be clearly identified in the corporate GHG management strategies that many Canadian firms have developed or are developing. GHG strategies typically tie in with overall corporate strategies, and many also include a specific strategy for dealing with GHG offset investments. The most important elements of such strategies typically include the following:

- **Offset Investment Objectives** – a description of key investment objectives that specify the types of investments that are desired, such as equity investments in projects that reduce emissions outside company operations, or purchases of credits from other companies or organizations. These often include a clear statement about the level of risk tolerance with respect to offset investments.
- **Allocation of Investment** – a description of:
  - the types of projects that are desired (e.g., energy efficiency, renewable energy, tree-planting);
  - the specific geographic location (e.g., Canada, developing countries);
  - the sectors (e.g., mining, electricity, transportation); and/or
  - the partners (e.g., private sector, government, non-governmental organizations).
- **Investment Magnitude** – a description of the targeted quantity of greenhouse gas offset investments, linked to the corporate GHG emission inventory and projection for 2010 relative to 1990 levels, and a GHG target for limiting emissions by a certain year.
- **Budget** – a specific allocation of funds for offset investments. This is often tied to the total investment magnitude that is desired, along with a consideration of the market price of greenhouse gas offsets and futures indices.
- **Project Investment Criteria** – clear corporate project investment criteria that are designed to guarantee environmental benefits and minimize financial risk. The next section outlines some suggested criteria for investment.
- **Monitoring and Quantification Methodology** – a specific approach that is used to quantify emissions reductions purchased through offsets, including standards for monitoring project emissions, even when they are outside of company operations.
- **Communications Strategy** – a communications component for building and maintaining support for offset investments among shareholders, employees, customers, and the general public.
- **Evaluation Framework** – an investment evaluation framework that facilitates fine-tuning of the strategy to maximize benefits and minimize risks based on the assessment of previous investments.

For examples of GHG management and/or offset strategies in action, see the Voluntary Action Plans of several large emitters such as Suncor Energy, Enbridge, TransAlta Utilities, Transcanada Pipelines, and Westcoast Energy, among others, on the Voluntary Challenge and Registry web site.<sup>36</sup>

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<sup>36</sup> <http://www.vcr-mvr.ca>

## 6.2 Project Eligibility Criteria

This section summarizes some of the project characteristics that are likely to be required by Canadian firms for investments in the CDM. These criteria have been compiled by the Pembina Institute based on experience doing GHG offset evaluations with several oil and gas and electric power companies in Canada. These criteria should not be regarded as representative of the entire Canadian industrial sector, as they reflect the Pembina Institute views on investment criteria. Future versions of this paper will reflect feedback received from Canadian industry on these matters.<sup>37</sup>

The project eligibility criteria are expected to include:

- conformity with the Kyoto Protocol criteria;
- conformity with Canadian CDM/JI Office criteria;
- price considerations, including transaction costs;
- alignment with corporate investment interests;
- conformity with additional criteria to protect environmental quality; and
- political and public interest criteria.

### 6.2.1 Kyoto Protocol Mandatory Criteria

The Kyoto Protocol includes several project eligibility criteria for CDM projects that reflect environmental and developmental objectives. However, these criteria are still very general and have been the source of a significant debate under the Subsidiary Body meetings since COP-3. They are expected to be clarified by the UNFCCC at COP-6 in November 2000. The major project eligibility criteria for the CDM as expressed in the Kyoto Protocol include the following:

- Projects are undertaken voluntarily by public or private entities.
- Projects must contribute toward the sustainable development objectives of the host country.
- Projects must demonstrate real, measurable, and long-term benefits related to the mitigation of climate change.
- Reductions in emissions are additional to any that would occur in the absence of the certified project activity.
- Projects are supplemental to domestic actions in industrialized countries.
- Governments from the industrialized and developing countries associated with the project must approve the project. Ideally, each country would have an established project review process. The review process will typically be a reflection of Kyoto Protocol criteria.

These criteria are outlined in more detail in the companion paper, *Implementing the Clean Development Mechanism: Pursuing Sustainable Development and Climate Protection*.<sup>38</sup> Also, the Pembina Institute and TERI have expressed their views on “additional” and “supplemental” in the published report *Implementing the Clean Development Mechanism: Pursuing Sustainable Development and Climate Protection*.<sup>39</sup>

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<sup>37</sup> Please contact Robert Hornung of the Pembina Institute to provide any feedback (roberth@pembina.org).

<sup>38</sup> To receive a copy of this unpublished paper, contact the Climate Change Program at the Pembina Institute (joannea@pembina.org).

<sup>39</sup> To download this report, go to: <http://www.pembina.org/pubs/cop6.htm>

## 6.2.2 Canadian CDM/JI Office Criteria

As described in detail in Sections 2.2 and 2.3, the Canadian CDM/JI Office is currently working on the assessment of projects under the Activities Implemented Jointly (AIJ) Pilot Phase and has developed a series of project eligibility criteria. The Office is expected to adopt the mandatory project eligibility criteria for the CDM, specified by the UNFCCC. However, it is possible that they will adopt additional criteria to reflect Canadian social, economic, and/or environmental interests. These will be clarified as the CDM/JI Office begins to review CDM projects.

## 6.2.3 Price of Offsets

The price of a CER credit must be competitive with market prices for competing GHG offsets. As illustrated in Section 13 in the Appendix, prices paid for offsets have ranged from CAN\$1 to \$50 per tonne of CO<sub>2</sub> equivalent reductions, but the vast majority have been in the \$1 to \$5 range. Also, the World Bank Prototype Carbon Fund is expected to sell credits for about CAN\$6-\$7.50 per tonne.<sup>40</sup>

The current price of offsets is low due to the lack of a significant demand for them in the absence of a ratified GHG treaty (i.e., Kyoto Protocol). The demand and price are driven largely by regulatory risk management considerations, as outlined in Section 3.3, and are affected by the perceived risk of taking no action on GHG emissions today.

Upon ratification of the Kyoto Protocol or another international treaty, the demand for offsets is expected to increase as emitters are required to manage GHG emissions. The increase in demand will help create a global marketplace for offsets, although it is still uncertain whether all types of offsets (e.g., CERs, ERUs from JI, allowances from IET) will be convertible (i.e., fungible) on par, or whether some types of offsets will have more value than others.

The increased demand for offsets from a ratified Kyoto Protocol will presumably bring several new players into the market to create emissions reductions from projects, both in Canada and in other countries.

The price of offsets will reflect the supply of, and demand for offsets, and the amount of flexibility granted within the global marketplace for trading offsets. It is possible that the price of offsets will fluctuate significantly depending on:

- the availability and cost of emission reduction activities;
- the nature and magnitude of industrial growth in industrialized countries that are required to reduce emissions;
- the cost of renewable energy and energy efficient technologies; and
- the political acceptance of permitting certain types of low-cost offsets such as excess allowance transfers from Eastern European countries (i.e., "hot air"), large-volume carbon sequestration projects (e.g., forest management and soil sequestration), and conventional industrial projects under the CDM (e.g., new large-scale power plants).

Even if there are price fluctuations, several "financial hedging" mechanisms will be established to manage risks for large investors in the market. These will include options,<sup>41</sup> futures,<sup>42</sup> and contracts-for-differences.<sup>43</sup> All in all, the price of offsets may not change significantly in the future.

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<sup>40</sup> See Section 5.1.6 for more details.

<sup>41</sup> The right to a future quantity of a good for a certain reservation price.

One of the primary considerations around price is transaction costs. This is the cost of negotiating a purchase of offsets, including the cost of measuring emissions reductions, legal costs associated with developing a purchase contract, and the costs of certifying emissions reductions. Transaction costs will gradually decline as investors and developers gain experience in trading offsets.

#### 6.2.4 Alignment with Corporate Investment Interests

As summarized above, companies purchasing GHG offsets will typically have several investment criteria they apply when considering competing project options. Examples may include:

- offset cost considerations;
- preference for offsets generated in countries of business operation;
- preference for investing in sectors of core competency or the corporate line of business to promote and/or implement their own technology or management practices in the project development; and/or
- offset risk tolerance considerations.

#### 6.2.5 Conformity with Additional Criteria to Protect Environmental Quality

Investors in GHG offsets may require that the project does not result in any significant degree of environmental burden shifting from greenhouse gas emissions to other forms of environmental impacts such as local or regional air quality, toxic wastes, land use degradation, and others. Also, it is likely that any project that produced significant environmental burden shifting would fail the CDM's mandatory sustainable development criterion. In fact, investors will prefer GHG offset projects that provide multiple environmental benefits, in order to enhance the public perception of international investments in emissions reductions.

#### 6.2.6 Political and Public Interest Criteria

Investors in GHG offsets may require that projects have the support of the local communities in which they occur. The Kyoto Protocol clearly indicates that CDM projects must support sustainable development. It will be hard to make that case where significant local opposition to a project exists. In fact, companies will prefer to invest in projects that create significant social benefits in the host country such as job creation, economic development and improved quality of life.

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<sup>42</sup> The purchase of a good for receipt at a future date.

<sup>43</sup> A contract that guarantees a set price for the delivery of a good over a period of time, despite fluctuations in the market price of that good.

### 6.3 Profile of a CDM Project Investor

This section provides a hypothetical illustration of a potential investor in GHG emission reduction offsets, such as the CER credits generated from CDM projects. The example below outlines how a company could rationalize investments in the CDM, even given the availability of internal emissions reduction options and domestic offsets.

Suppose a particular mining company, Boreal Oil and Gas (Canada), had emissions of one million tonnes of greenhouse gas equivalents per year in 1999. The projected emissions for 2010 are 1,200,000 tonnes because of the immense growth of the company in response to an increase in demand for natural gas from southern Canadian and US markets.

Assume that Boreal Oil and Gas (Canada) has committed, in a publicly distributed action plan, to reduce emissions to 6% below its 1990 levels of 900,000 tonnes by the year 2010. This target matches the commitment made by the Canadian Government under the Kyoto Protocol. Boreal is confident that the Kyoto Protocol will eventually be ratified. To meet this target, the company needs to identify and implement measures to reduce emissions to 846,000 tonnes by 2010. The following table outlines the emissions reductions required.

**Table 7 Boreal Oil and Gas (Canada) Emissions Characteristics**

1990 Emissions	900,000 tonnes
1999 Emissions	1,000,000 tonnes
Forecasted Emissions in 2010	1,200,000 tonnes
Publicly communicated emissions control target	846,000 tonnes (6% below 1990 levels)
<b>Emission reduction required</b>	<b>354,000 tonnes (30% of 2010 levels)</b>

The *challenge* for emissions reductions may appear daunting at first. The target calls for a 30% reduction of emissions below business-as-usual levels. However, combining cost-effective internal emission reduction measures with investment in a portfolio of greenhouse gas offsets will enable the company to meet its target.

First, Boreal Oil and Gas (Canada) may already have a target to its industry association (e.g., Canadian Association of Petroleum Producers) that aims for an operational improvement in energy efficiency of one percent per year. Assuming that 90% of the emissions from the company are from energy use (including fleets and buildings), the emission reduction that could be expected from meeting the efficiency target is 11% of energy use, or a 10% reduction in greenhouse gas emissions. This approach will reduce emissions by 120,000 tonnes per year.

Next, the company may significantly change the way electricity is produced at its production facilities; for example, it could convert from fossil fuel power to hydroelectricity with an initial capital cost, but with a reasonable payback on investment from reduced purchases of electricity that are generated from fossil fuels. A 50 megawatt hydroelectricity plant could produce approximately 219 gigawatt-hours of electricity per year, saving approximately 175,000 tonnes of greenhouse gas emissions annually, assuming displaced coal and natural gas fired electricity.<sup>44</sup>

<sup>44</sup> The assumed emissions factor of the electricity system is 800 tonnes/GWh.

**Table 8 Boreal Oil and Gas (Canada) Emissions Reductions and Offsets**

Forecasted Business-as-usual Emissions in 2010	1,200,000 tonnes
Internal Energy Efficiency Measures	- 120,000 annual tonnes by 2010
Renewable Energy Project	- 175,000 annual tonnes
Expected Emissions in 2010	905,000 tonnes
Targeted Emissions in 2010	846,000 tonnes
<b>New Emission Challenge</b> (expected – target)	<b>59,000 tonnes</b>

At this point, the oil and gas operation may have exhausted the cost-effective greenhouse gas emission reduction opportunities within its own operations. It faces the choice of undertaking investments in its own operations that are not cost-effective under corporate criteria or investing in greenhouse gas offsets. Either way, an additional investment is required.

Options for investments in greenhouse gas offsets are diverse, particularly in light of the fact that the Kyoto Protocol recognizes certified offsets (credits) as a legitimate mechanism for meeting national emission control commitments.

Boreal Oil and Gas (Canada) could develop a comprehensive “offsets strategy” that specifies a budget for greenhouse gas offset investments, the magnitude of offsets demanded, risk management considerations, and the types of benefits outside of greenhouse gas management that are desired from the investments. The strategy could specify the types of projects considered, partners, prices for offsets, the level of risk tolerance, and the particular emissions trading or credit creation mechanisms that will be used.

To manage financial risks and other considerations for investments in offsets, investors will often develop a portfolio of offsets, containing diverse emission reduction project types, locations, and partners. Spreading investment dollars across a diversity of projects enhances the ability to maximize credit creation on the overall offset portfolio.

Boreal Oil and Gas (Canada) needs to compare the cost of further emission reductions in its own operations with the market price of offsets to decide which is more cost-effective. The company may set the price of additional internal emissions reductions at \$5/tonne of GHG reduced. If offsets make more sense and the company is willing to pay an average price of about \$5/tonne for offsets, the total investment in offsets will be about \$300,000 per year.

Generally, the offset investor faces a trade-off between price and risk. Thus, the offset portfolio could include a variety of investments, some of which are low cost and high risk, and others that are higher cost with low risk. For example, there may be uncertainty about whether the high-risk offsets will receive credit under the Kyoto Protocol. A detailed investment risk analysis might indicate specific allocations for different risk tolerance. For example, an offset portfolio could be devised with the characteristics shown below.



**Table 9 Boreal Oil and Gas (Canada) Offset Investment Portfolio**

	Cost of Offset (\$/tonne)	Magnitude (tonnes)	Level of Investment Risk	Proportion of Portfolio
Total Investment	\$10.00	10,000	Low	17%
	\$5.00	20,000	Medium	33%
	\$ 3.30	30,000	High	50%
Average (\$/tonne)	\$ 300,000.00	60,000		
	\$ 5.00			

In this case, 50% of the offsets would come from low-cost (i.e., about \$3/tonne) sources, but would have potential risk characteristics. Thirty-three percent of the investments could be slightly higher cost (\$5/tonne) with much smaller risk characteristics. As a risk management hedge, 17% of the offset investments should include those that will, without doubt, be eligible for credit under the Kyoto Protocol and national emission control legislation in the future. Overall, the offset portfolio translates to an average price of about \$5.00, which is within the budget specified earlier.

Following this assessment, Boreal could consider where to allocate investments among competing mechanisms (e.g., the CDM, domestic trading), competing emissions reduction technologies and management practices (e.g., renewable energy, tree planting), and competing regions for investment (e.g., Canada, Africa, Asia).

## 7 Canadian Technology and Expertise in GHG Emission Reductions

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### 7.1 Introduction

Canadians actively trade goods and services with other countries and the Canadian economy is highly dependent on exports. In 1999, Canadian companies exported about CAN \$400 billion worth of goods and services, compared with imports valued at approximately \$370 billion. Exports are equivalent to about 40% of Canada's annual GDP. The leading export industries in Canada include electrical and electronics, transportation equipment, primary metals and machinery.<sup>45</sup>

Due to Canada's extensive trade orientation, it is probable that Canadian companies will seek opportunities to export technology and expertise in areas related to GHG emission reduction. The CDM will provide a unique opportunity for certain companies to export into developing countries.

In addition, the UNFCCC includes a process for facilitating technology transfer to developing countries. Technology transfer was originally introduced as Article 4.5 of the UNFCCC. A decision on a "framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the Convention" is expected at COP-6. An IPCC special report on "Methodological and Technological Issues in Technology Transfer" is pending release, emphasizing the central role of the private sector and its identification of needed actions. Technology transfer may occur through the CDM, although it is unclear at this time whether it will be delivered through the private sector, through government via non-commercial means, or other approaches.

Technology transfer could occur as part of Canadian companies' purchase of CER credits under the CDM. Companies may play a role as investors in CER credits, as outlined in Section 5, and as partners in the project development as well, by providing the technology to reduce emissions. In many cases, Canadian technology providers will partner with companies or organizations in developing countries who have experience in the area.

The rest of this section focuses on areas of Canadian expertise for technology transfer to developing countries through the CDM. The focus is on the oil and gas, pipeline and electricity sectors, given that those three sectors account for the largest increases in GHG emissions in Canada, and given the evolving experience of those sectors in managing GHG emissions. The Pembina Institute's website, *Climate Change Solutions*,<sup>46</sup> includes specific activities that Canadian companies have undertaken to reduce GHG emissions. A number of these are listed in Section 16 in the Appendix.

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<sup>45</sup> The Trade and Investment Monitor. Fall/Winter 1999/2000. Industry Canada.  
<http://strategis.ic.gc.ca/SSI/ra/timfw99e.pdf>

<sup>46</sup> <http://www.climatechangesolutions.com/>

## 7.2 Upstream Oil and Gas Sector Emission Reduction Expertise

Canada is one of the world's major producers of natural gas and oil. Section 4.3 provides some details on this sector's emissions. In recent years, the sector has made improvements in the GHG intensity of oil and natural gas production (i.e., tonnes of emissions per unit of production) in several ways.

First and foremost, companies are improving the energy efficiency of their production processes; key opportunities include:

- making greater use of energy-efficient equipment (e.g., motors, burners, pumps);
- optimizing facilities and procedures; and
- adopting new technologies and processes that decrease the energy needed for production.

Organizations that promote energy efficiency are listed in Section 7.5.

A number of companies are also taking steps to make greater use of alternative energy sources such as co-generation and renewable energy technologies that are less greenhouse gas-intensive.

There are also many cost-effective ways to reduce fugitive methane emissions in oil and gas production. Specifically, companies have reduced the intentional release of methane, by:

- recovering vented methane and using it as an energy source;
- recovering vented methane and processing it for sale;
- increasing combustion efficiency at all stages of production (e.g., flaring); and
- changing operating practices for servicing and maintaining oil and gas wells.

Finally, some companies are injecting waste gas or carbon dioxide back into the ground in abandoned oil and gas wells. This "geological storage" has the potential to prevent carbon dioxide from reaching the atmosphere for an extended period. Injection is one method for disposing of waste gas and can also facilitate the recovery of new petroleum resources by increasing pressure in a well.

Examples of measures that have been undertaken are included in the Appendix in Section 16.1.

## 7.3 Pipeline Companies' Emission Reduction Expertise

As a major petroleum producer, Canada has an extensive network of pipelines to transport oil and natural gas to petroleum refineries and to industrial and individual consumers. This network—some 700,000 kilometres in length—includes pipelines that gather and transmit natural gas from production fields to distributors, distribute natural gas to customers, and transport oil and other liquid hydrocarbons throughout the country. Many of these companies are separate from the upstream oil and gas producers mentioned previously.

Each type of pipeline has a unique mix of GHG emission sources. Pipelines require a significant amount of energy to transport oil and natural gas over long distances. As a result, one of the major opportunities for reducing GHG emissions in energy pipelines is to improve energy efficiency. Some companies have installed high-efficiency equipment (e.g., natural gas compressors, co-generation technologies and variable speed drives) and use special coatings that reduce friction inside the pipelines. A number of companies have also begun to reduce their energy-related GHG emissions by switching fuel to less carbon-intensive energy sources.

Methane, which comprises over 95% of processed natural gas, is a significant greenhouse gas. Thus, another major opportunity to reduce the overall GHG emissions from energy pipelines is to limit the release of natural gas into the atmosphere. Companies have reduced leakage of natural gas from pipelines, by:

- replacing leaky equipment (e.g., valves, seals and monitoring equipment);
- implementing leak detection and repair programs;
- using information programs to prevent third party activities that could result in the unintentional rupture of a line; and
- reducing venting of natural gas from pipelines during construction and maintenance.

In cases where methane leakage cannot be reduced or captured, companies attempt to at least flare the emissions, thereby converting the methane emissions to carbon dioxide, a less potent greenhouse gas.

Finally, many natural gas distribution companies help their customers reduce GHG emissions through demand side management (DSM) programs. These programs use a combination of tools, such as information, audits and financial incentives, to encourage customers to use natural gas more efficiently. While DSM programs may reduce the demand for natural gas (and thus the need to transport it through pipelines), companies are also discovering that providing energy services can give them a new revenue stream to compensate for lower sales. At the same time, they're finding that DSM programs can postpone or reduce the need for investments in costly new distribution facilities.

Examples of measures that have been undertaken are included in the Appendix in Section 16.2.

## 7.4 Electricity Sector Emission Reduction Expertise

The Canadian electricity sector was introduced in Section 4.2. Canadian electricity companies have successfully reduced emissions in the following areas:

- Electrical system efficiency
- Demand side management programs from their customers to save energy
- Use of renewable energy

The following sections outline the types of measures that have been undertaken by Canadian electricity companies. Specific examples are included in the Appendix in Section 16.3.

### 7.4.1 Electrical System Efficiency

Some electricity companies have worked toward optimizing the efficiency of their electricity systems through the following measures:

- Improving the heat rate of thermal power plants by reducing the amount of fuel needed to produce each unit of electricity.
- Increasing the power output and capacity factor of power plants that produce few or no emissions, such as low-impact renewable energy plants, hydroelectric facilities or nuclear power stations.
- Reducing line losses in transmission and distribution (T&D) lines.
- Increasing the use of distributed electricity facilities that are located either at or close to industrial facilities they supply. For example, smaller-scale, local cogeneration technologies can provide heat and power while reducing T&D requirements and associated energy losses.

## 7.4.2 Consumer Energy Efficiency

Canadian electricity companies have offered consumer energy efficiency (i.e., demand side management) programs to homeowners, businesses, institutions and industry. These programs aim to achieve three broad objectives:

- Energy conservation: programs can reduce the overall consumption of electricity by reducing the need for heating, lighting, cooling, cooking energy and other functions. For example, insulating a building can reduce the need for heating in winter and cooling in summer.
- Energy efficiency: programs can encourage customers to use energy more efficiently, and thus get more out of each unit of electricity produced. For example, energy-efficient light bulbs provide the same amount of light but use much less energy than conventional units.
- Load management: programs allow electricity companies to better manage the timing of their customers' energy use, thus reducing the large discrepancy between peak and off-peak demand. For example, utilities can interrupt industrial power supplies temporarily during periods of high demand, and/or store power during periods of low demand for later use when demand is high.

Importantly, consumer energy efficiency programs can remove barriers and help encourage consumers to adopt cost-effective actions to reduce their electricity consumption. An energy company can assist through a variety of programs, including the following:

- Information programs on technologies and management practices. Such programs can include a special information telephone line, printed materials such as bill stuffers or mailouts, communications campaigns and Internet sites.
- Free energy audits of buildings to identify program opportunity areas.
- Low interest-rate financing programs to help pay for improvements and new homes.
- Rebates or subsidies to support improvements.
- Information on customer bills that illustrates energy consumption over time, and the average energy consumption among all customers, along with the GHG emissions that can be related back to each customer. This information can provide an incentive for consumers to reduce their overall consumption.
- Certification programs that allow customers to make the most energy-efficient choices.
- Pricing schemes to promote load management. In such schemes, the price of electricity varies in different periods to reflect the different costs of providing the energy to consumers. Demand-driven pricing gives customers an incentive to reduce their energy consumption during peak periods.

Energy service companies (ESCOs) are also working to improve the use of energy in Canada. ESCOs often work in concert with electricity supply companies, but sometimes market their services separately. Their efforts are very similar to those above.

Both ESCOs and electricity companies provide energy efficient technologies to companies. The range of technologies is too large to note in this paper, but further information can be gathered from various organizations that promote energy efficiency in Canada, some of which are listed in Section 7.5.

### 7.4.3 Renewable Energy

Canadian electricity companies have started to reduce their GHG emissions by incorporating low-impact, renewable energy in their systems and encouraging its use by their customers. Renewable energy provides heat and electricity from natural resources that are not depleted over time. Canada has extensive renewable energy resources, which include wind, solar radiation, water power, earth energy, and biomass. These resources can be used without an impact on climate. Some examples of low-impact renewable energy technologies for electricity generation include:

- wind power;
- photovoltaic solar energy;
- run-of-river hydroelectricity;
- co-generation of heat and power from geothermal steam;
- sustainable use of wood or other biomass, for example fire-killed timber, waste wood from forestry operations, or agricultural wastes; and
- water velocity turbines, used in rivers or to capture the tidal power of the oceans.

Canadian electricity companies have developed a limited amount of expertise in renewable energy by installing renewable energy technologies for use in their own operations—such as buildings, transformer stations or remote applications. They have also started to establish limited programs to promote renewable energy including:

- Purchasing some power from renewable energy sources, while sharing the costs among all customers and/or the company's shareholder(s).
- Establishing a green power marketing program that offers customers an opportunity to purchase low-impact, renewable energy. Such programs can take the place of the company's regular power and individual customers can be charged for any differential in price. Governments at all levels and, indeed, organizations in any sector can support green power marketing by purchasing green power and establishing green power procurement policies .
- Establishing a net metering program to allow customers to generate their own power from low impact, renewable energy sources. Customers typically receive credit for any excess power they produce that is fed into the grid.
- Helping energy users purchase cost-effective, renewable energy technologies that provide heating and cooling can also reduce electricity use.

Far more significant is the Canadian private sector's expertise in electricity supply technologies for hydroelectricity, wind power, solar thermal and biomass. Also, a number of companies have been active in photovoltaic solar technologies. Many of these companies have worked with large electricity suppliers (i.e., utilities), and also with private power consumers living in remote areas both inside and outside of Canada. A detailed example of a remote power development is included in the Appendix (Section 16.3.4).

The range of technologies is too large to note in this paper, but further information can be gathered from various organizations that promote renewable energy in Canada, some of which are listed in Section 7.5.

## 7.5 Energy Efficiency and Renewable Energy Organizations in Canada

Energy efficiency organizations to contact for further information include:

- Office of Energy Efficiency of the Canadian government (<http://www.oeenrncan.gc.ca>).
- Federation of Canadian Municipalities (<http://www.fcm.ca>)  
Cities for Climate Protection (<http://www.fcm.ca/english/national/programs/club/club.html>).
- Canadian Industry Program for Energy Conservation ([http://batiments.rncan.gc.ca/ieei/home\\_e.htm](http://batiments.rncan.gc.ca/ieei/home_e.htm)).
- Residential Energy Efficiency Database (<http://www.its-canada.com/reed/index.htm>)
- Canadian Industry Energy End-Use Data and Analysis Centre (<http://www.cieedac.sfu.ca>)
- National Energy Use Data Centres (<http://eeb-dee.nrcan.gc.ca/general/neud/fs04.html>)
- Energy Efficiency and Renewable Energy Network, U.S. (<http://www.eren.doe.gov>)
- Green Communities Association (<http://www.gca.ca>)
- International Council for Local Environmental Initiatives (<http://www.iclei.org/co2/index.htm>)
- Energy Council of Canada (<http://www.energy.ca>)
- American Council for an Energy Efficiency Economy (<http://www.aceee.org/>)

Further information on renewable energy can be found through the following sources:

- The Canadian Renewable Energy Guide – 2<sup>nd</sup> Edition<sup>47</sup> (<http://www.solarenergysociety.ca/largeguide.htm>).
- Canadian Wind Energy Association (<http://www.canwea.ca>)
- Canadian Solar Industries Association (<http://www.cansia.ca>)
- Solar Energy Society of Canada Inc. (<http://www.solarenergysociety.ca>)
- Canadian Government Renewable and Electrical Energy Division (<http://www.nrcan.gc.ca/es/erb/reed/>)
- Earth Energy Society of Canada (<http://www.earthenergy.ca>)
- Canadian Association for Renewable Energies (<http://www.renewables.ca>)
- Independent Power Producers Society of Ontario (<http://www.ippso.org/>)
- Independent Power Producers Society of Alberta (<http://www.ipssa.com/>)

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<sup>47</sup> Published in 1999 by the Solar Energy Society of Canada Inc. The book can be ordered from General Store Publishing House. Box 28, 1694 Burnstown Road. Burnstown, ON, K0J 1G0. Canada. Fax: +1-613-432-7184. Tel: +1-800-465-6072. E-mail: [orders@gsph.com](mailto:orders@gsph.com).

## 8 Other Canadian Involvement in CDM Projects

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Other Canadian companies and organizations can support CDM projects. These include:

- Offset brokers
- Verification services
- Financing agencies
- Offset analysts

Offset brokers can support CDM project developers and investors in successfully implementing their projects by:

- providing knowledge and expertise about the emerging markets;
- providing services for selection emission reduction projects;
- helping to assess risk factors for certain investments;
- quantifying emissions reductions;
- establishing ownership and title of offsets; and
- arranging warranties on emissions reductions.

Companies and organizations that provide verification services and registries of GHG emissions reductions take responsibility for the environmental benefits of projects. For example, a project developer and/or investor can hire a verifier to determine whether a project is achieving its intended emissions reductions, then emissions reductions can be recorded in a registry. Following the successful implementation of the CDM, a central registry system will likely be established, both internationally and within countries. In Canada, the national registry is called the Voluntary Challenge and Registry (VDR) Inc.<sup>48</sup>

Financing agencies fund projects in exchange for a return on their investment proportional to the prime lending rate. Financers will typically put money into projects that have a guaranteed revenue flow to ensure they are paid back. Banks are the most common financing agency, of which there are many in Canada. The Canadian government also provides financing for exports of Canadian technologies and services. Canadian corporations may finance projects in return for the rights to GHG offsets and a stream of revenue.

Analysts can be hired to quantify emissions reductions from a particular CDM project and/or to assess the potential for a project to receive credit under the CDM in advance of the rules being established.

A list of Canadian firms providing these and other functions is included in the Appendix (Section 17).

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<sup>48</sup> <http://www.vcr-mvr.ca/>



## 9 Concluding Summary

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Canada has supported the Clean Development Mechanism (CDM) since its inception because of the potential role of the CDM in providing low-cost greenhouse gas offsets under a ratified Kyoto Protocol. Overall Canadian GHG emissions are expected to increase from about 600 million tonnes in 1990 to 764 Mt in 2010. To meet the Kyoto commitment of reducing emissions to 6% below 1990 levels, Canada will need to reduce emissions by 199 Mt by 2010.

The Canadian government has established a CDM/JI Office to facilitate investments in the CDM, the Activities Implemented Jointly (AIJ) Pilot Phase, and Joint Implementation. Also, the Canadian International Development Agency is administering the Canadian Climate Change Development Fund of \$100 million Canadian over four years to invest in emissions reductions, sequestration, adaptation and capacity building.

Canadian industrial sector emitters are expected to experience significant increases in GHG emissions between 1990 and 2010. Emissions reductions of up to 45% are required for Canadian industry to meet a Kyoto commitment of 6% reductions below 1990 levels. The industrial sectors with the largest "Kyoto Gap"—that is, a gap between expected 2010 levels and Kyoto levels—are the electric power and oil and gas industries. The electric power industry gap is expected to be about 30 Mt, while the oil and gas gap is expected to be 53 Mt. In total, the Canadian industrial gap is expected to be 103.5 Mt. That means Canadian industrial emitters will need to reduce emissions by just over 100Mt to get emissions to 6% below 1990 levels by 2010.

Canadian industrial emitters are expected to take interest in CDM investments, provided that several investment drivers are in place, most importantly the ratification of the Kyoto Protocol. However, some companies are investing in GHG offsets in advance of ratification for regulatory risk management and other purposes, including investments in developing countries through the AIJ Pilot Phase.

The magnitude of investments in the CDM will depend on such factors as the cost of offsets, the timing of credits being recognized, the level of financial risk and potential public relations benefits. The CDM will compete with other emission offset mechanisms, including domestic emission reduction offsets, Joint Implementation and others.

One analyst predicts that between 3% and 58% of Canadian investments in offsets will be in the CDM, depending on the extent of flexibility to meet Kyoto Protocol commitments through the CDM (i.e., supplementarity requirements). Thus, Canadian industrial sector investments in the CDM are expected to total between 3 Mt and 60 Mt of emissions reductions in the year 2010.

CDM projects will be required to meet Kyoto Protocol criteria, price preferences, alignment with Canadian corporate investment interests, and possibly other environmental, political and social considerations.

Canadian organizations and companies may also participate in the CDM as technology providers and/or project development partners in concert with developers in the host countries. Canada has developed expertise in emissions reductions in many sectors of the economy. Several areas of technology and emission management expertise are summarized in this paper for the upstream oil and gas, pipeline and electricity industries. Some of this expertise could be applicable in developing countries.

Finally, Canadian offset brokers, verification agencies, registries, financiers, and analysts can support CDM projects.

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11 Appendix 1 – Brochure from the Canadian CDM/JI Office



The federal government has established the Clean Development Mechanism and Joint Implementation Office to enhance Canada's capacity to take advantage of the opportunities offered by the CDM and JI.

### Kyoto Commitments

Under the Kyoto Protocol, industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% by the period 2008-2012. Canada's target under the Kyoto Protocol is a 6% net reduction in greenhouse gas emissions below 1990 levels in the same period. The net reductions occur through initiatives aimed at reducing anthropogenic (human-related) emissions by sources or enhancing anthropogenic removals by sinks.

*The following greenhouse gases are included under the Kyoto Protocol:*

- Carbon dioxide (CO<sub>2</sub>)
- Methane (CH<sub>4</sub>)
- Nitrous oxide (N<sub>2</sub>O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF<sub>6</sub>)



For further information, please contact:

#### CANADA'S CDM AND JI OFFICE

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Canada is taking part in the global effort to address climate change. In December 1997, 160 countries negotiated the Kyoto Protocol, a landmark agreement to address the challenge of climate change. Under this agreement, industrialized countries have committed to reduce their greenhouse gas (GHG) emissions. These reductions can be achieved through both domestic and international actions.

The global benefit of reducing GHG emissions is the same no matter where in the world the reduction is made, but emission reduction costs vary by location. Under the Kyoto Protocol, three mechanisms were established to help countries meet their commitments. These include International Emissions Trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI).

- **CLEAN DEVELOPMENT MECHANISM (CDM)** projects can be undertaken in developing countries. In addition to reducing GHG emissions, they must also contribute to the sustainable development of the host country.
- **JOINT IMPLEMENTATION (JI)** projects can be undertaken in industrialized countries that have committed to GHG emission reduction targets.

The CDM and JI help industrialized countries, including Canada, to achieve their Kyoto commitments in a cost-effective manner. In addition, these mechanisms provide opportunities for Canadian organizations and enterprises, enabling those that participate in international projects to obtain emission reduction credits.

## WHAT ARE THE BENEFITS OF PARTICIPATION?

Recognizing that emission reduction costs are often lower in developing countries and countries with economies in transition (such as Eastern Europe), the two mechanisms allow Canadian organizations and enterprises the flexibility to reduce GHG emissions in more cost-effective ways than may be open to them in Canada.

The CDM and JI provide opportunities for Canadian organizations and enterprises to pursue international projects that reduce GHG emissions, while contributing to international efforts to address climate change. In addition, the two mechanisms provide several benefits for the host countries.

### OPPORTUNITIES FOR CANADIAN INDUSTRY CAN INCLUDE:

- generation of emission reduction credits;
- access to new markets and investment opportunities;
- an opportunity to demonstrate the viability of a voluntary approach; and
- a showcase for environmental leadership.

### OPPORTUNITIES FOR HOST COUNTRIES CAN INCLUDE:

- reduced dependence on fossil fuels;
- reduced energy costs;
- improved energy efficiency;
- health benefits resulting from improvements in local air quality;
- access to climate-friendly technologies;
- increased investment in priority sectors of the economy; and
- socio-economic benefits due to enhanced infrastructure and improved employment opportunities.

### WHO CAN PARTICIPATE?

Canadian industry, non-governmental organizations and all levels of governments can participate in CDM and JI projects.

### WHAT TYPE OF PROJECT IS ELIGIBLE?

Substantial opportunities exist for private and public sector involvement in projects that result in reductions in GHG emissions or removals by carbon sequestration activities. For example, initiatives may relate to:

- energy efficiency (e.g. in transportation, buildings and industrial processes);
- renewable energy;
- electricity production and distribution;
- oil and gas production;
- switching to alternative fuels;
- waste management; and
- sustainable agriculture and forestry.

Negotiations on the international rules and procedures to govern the use of the CDM and JI are likely to conclude by the spring of 2001. However, the following project criteria have already been established:

- All projects must achieve emission reductions that would not have otherwise occurred in the absence of the project.
- Projects must be approved by both countries involved.
- CDM projects must generate real, measurable and long-term benefits related to the mitigation of climate change.

*In the current pilot phase of joint implementation, launched in 1995, projects are referred to as "ACTIVITIES IMPLEMENTED JOINTLY" (AIJ). These activities are being pursued mainly with the objective of gaining experience and do not generate emission reduction credits. The Office also addresses projects submitted under the AIJ.*

### HOW CAN CANADA'S CDM AND JI OFFICE ASSIST YOU?

The federal government has established the Clean Development Mechanism and Joint Implementation Office to enhance Canada's capacity to take advantage of the opportunities offered by these mechanisms. The Office provides the following services:

- acts as the day-to-day federal government contact point on the CDM and JI, with links to other federal government programs, expertise and resources;
- facilitates Canada's participation in the CDM and JI by assisting Canadian project proponents with host country approval and exploring strategic co-operation arrangements with host countries; and
- provides technical guidance to companies participating in the CDM and JI.

The Office works closely with several federal government programs and agencies that are involved in climate change issues, including the Climate Change Secretariat, Environment Canada, Natural Resources Canada, the Canadian International Development Agency, Industry Canada, and Agriculture and Agri-Food Canada.



## 12 Appendix 2 – Select Cooperation Agreements Between Canada and China

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**STATEMENT OF INTENT  
BETWEEN  
THE DEPARTMENT OF NATURAL RESOURCES CANADA  
AND  
THE MINISTRY OF WATER RESOURCES  
PEOPLE'S REPUBLIC OF CHINA  
TO COOPERATE ON THE RENEWABLE ENERGY  
AND ENERGY EFFICIENCY TECHNOLOGIES  
INCLUDING JOINT IMPLEMENTATION INITIATIVES  
UNDER THE FRAMEWORK CONVENTION  
ON CLIMATE CHANGE**

This Statement of Intent between the Department of Natural Resources (Canada) and the Ministry of Water Resources (People's Republic of China) -- hereinafter referred to as the "Parties" -- recognizes that through joint cooperation on increased energy efficiency, increased use and development of small and medium hydroelectric power options, and the adoption of community energy systems, both Parties wish to achieve economic and environmental benefits associated with the reduction of greenhouse gas emissions. The Parties wish to develop a formal arrangement under which they will cooperate in these areas and investigate, with the relevant authorities of each country, the possibilities for mutually supporting activities under the joint implementation initiative of the Framework Convention on Climate Change.

Therefore, the Parties will negotiate a Memorandum of Understanding, or other formal arrangement between them, which will provide for cooperation in such areas as:

1. exploration of opportunities in rural communities and the residential, commercial, industrial, and electric generation sectors, to enhance trade and scientific exchanges between Canada and China in energy efficient products and processes, small and medium hydroelectric power, and community energy systems, through joint projects;
2. joint research and information exchanges to facilitate mutual understanding of the options for, and experience with, energy efficiency, and small and medium hydroelectric power policies and programs,
3. promotion and facilitation of activities implemented jointly among the governmental organizations and the business community, including dissemination of information about the national criteria of the Parties for activities implemented jointly, exchange of information on methodologies for determination of baselines, monitoring and external verification of net greenhouse gas emissions, and the tracking and attribution of such reductions associated with the development of small and medium hydroelectric power projects; and

4. any other areas of mutual interest with respect to renewable and energy efficiency technologies.

All activities under this Statement of Intent will be developed by the Parties or their designated representatives, such as Hangzhou International Centre (HIC) and the Canada Centre for Mineral and Energy Technology (CANMET), and will be carried out in accordance with the scope of authority of the Parties and the other designated representatives of both Parties.

SIGNED at Ottawa, Canada, this 15th day of August, 1996.



**FOR THE DEPARTMENT  
OF NATURAL RESOURCES  
MRS. JEAN C. MCCLOSKEY  
DEPUTY MINISTER  
CANADA**



**FOR THE MINISTRY OF  
WATER RESOURCES  
MR. ZHU DENGQUAN  
VICE-MINISTER  
PEOPLE'S REPUBLIC  
OF CHINA**



## 13 Appendix 3 –Emission Reduction Options in the Canadian Industrial Sector

Source: National Climate Change Process. *Distillation of Phase One Proposals from Issues Tables – Discussion Document*. May/June 2000.

The following table outlines the Canadian emission reduction investment options that were identified by the “Industry Issue Table” along with the cost of emission mitigation and the potential magnitude of emissions reductions where identified.<sup>49</sup>

<b>Industrial Sector</b>	<b>Emission Reduction Measure</b>	<b>Cost Per Tonne (CAN\$/tonne)</b>	<b>GHG Reduction in 2010 (kt)</b>
Metals and Minerals	Energy audits of electric melting, combustion analysis of gas-coke and oil-fired furnaces. Technical support to foundries on process variables, with the emphasis on scrap reduction.	N/A	N/A
Aluminum	New technologies to reduce PFC emissions: \$5-\$8million per smelter for a reduction of 0.8 million tonnes in 2010	\$6.25 - \$10/tonne	800
Aluminum	Point Breaker Feeders to reduce PFCs	\$222/tonne	900
Cement and Concrete	Process upgrades – inefficient processes to modern, efficient, preheating/ calcinating processes	\$25/tonne	520
Aluminum	Support for lightweight vehicles, improved infrastructure for recycling	N/A	N/A
Cement and Concrete	Reduce the clinker content of cement – alternative feed to reduce limestone	-\$10/tonne	1500
Industrial metals	Operator education for optimizing kiln operations		3
Forestry sector	Improve maintenance of steam producing equipment	-\$61.30/tonne	850
Forestry sector	Improved process thermal integration in pulp and paper mills	-\$31.80	1250
Forestry sector	Select energy efficient process technologies	-\$24.1	2680
Forestry sector	Improve maintenance of existing auxiliary equipment	-\$64.10	360
Forestry sector	Select energy efficient auxiliary technology	-\$90.8	650
Forestry sector	Select high energy efficiency technologies	\$4.4	330
Forestry sector	Optimizing recovery boilers	-\$15.2	390
Metals and Minerals	Employ alternative fuels (replace fossil in clinker with organic wastes)	N/A	120
Chemicals	Natural gas cogeneration	N/A	N/A
Forestry	Increase wood waste cogeneration	-\$11.1	2460

<sup>49</sup> For more information, <http://www.nccp.ca/html/table.htm>

The following table outlines specific emission reduction activities in the Pulp and Paper sector, all of which indicate a negative financial cost of implementation (cost saving).<sup>50</sup>

Measure	Cost/Efficiency	Incremental Cost (1997\$)			Electric. Revenue (M\$/yr) <sup>3</sup>	Cost Effectiveness 1997\$/tCO <sub>2</sub> (10% disc.) <sup>4</sup>	GHG Emission Reduction or Offset MtCO <sub>2</sub>		Incentive to realize measure <sup>7</sup> (40% disc.)	Other Considerations
		Capital (M\$)	O&M	Fuel			2010	2020		
			(M\$/yr)							
<b>Energy Efficiency</b>										
1.	High energy-efficiency auxiliary technologies in p&p mills	48.1	-111.5			-90.8	0.65	11.0	0	Appropriate capital cost allowance will accelerate implementation of these four energy efficiency measures.
2.	Improved maint. and use of existing p&p mill equipment	0	-32.7			-64.1	0.36	3.6	0	
3.	Improved maint. and use of p&p mills steam equipment	0	-73.0 lifetime			-61.3	0.85	8.5	0	
4.	Improved process thermal integration	197.5	4.0	-98.8		-31.8	1.25	18.7	0	
<b>Fuel Switching</b>										
5.	Adopt black liquor integrated gasification and combined cycle cogeneration (BLIGCC) techn.	-23.6 <sup>2</sup>	10.4		56.9	-21.1	1.09	21.8	0	Support in R&D and commercial-ization are needed as well as electricity deregulation.
<b>SUB-TOTAL Industry measures to reach Kyoto target</b>						<b>Net saving</b>	<b>4.20</b>	<b>63.5</b>	<b>0</b>	
6.	Increase wood waste co-generation in p&p industry	662.8	20.6	-31.8	118.0	-11.1	2.46	49.1	247	Electricity deregulation needed Avail. of wood residue is a key consideration
7.	Fuel-switching - lumber and panelboard mills	666.5	-88.8			-5.4	1.51	30.2	356	
8.	Increase number of hog fuel boilers - 12 mills	234.4	-35.6 lifetime			-3.4	1.33	39.4	111	
<b>SUB-TOTAL Industry measures with incentive</b>						<b>Net saving</b>	<b>5.3</b>	<b>118.7</b>	<b>714</b>	
<b>GHG emission reduction potential</b>						<b>Net saving</b>	<b>9.50<sup>5</sup></b>	<b>182.3<sup>6</sup></b>	<b>714</b>	

<sup>1</sup> All figures in this table are from the Forest Sector option paper. They have not been validated by CPPA and are presented only as an indication of costs.

<sup>2</sup> Capital cost of black liquor recovery powerplant costs less than a conventional powerplant unit. Thus, the negative figure.

<sup>3</sup> Assumes electricity sold at 4 cents per kWh.

<sup>4</sup> Lifetime NPV/lifetime GHG reduction (2020)

<sup>5</sup> More than 2 times higher than reduction target for the forest sector.

<sup>6</sup> Over 20 years, almost reaches total national reduction objectives that can be as high as 185 MtCO<sub>2</sub>e

<sup>7</sup> Estimated incentive for realization is the value of the incentive that would have to be provided to make an action financially attractive from the perspective of industry.

For energy actions, it is equal to the Net Present Value (NPV) of the action, derived using a 40% discount rate.

<sup>50</sup> Industry Table, Overview Report. February 2000.

## 14 Appendix 4 – List of Canadian Trades of GHG Emission Reduction Offsets

The table below provides an overview of greenhouse gas offset investments made to date by Canadian companies. It shows the magnitude of offset purchases by Canadian firms, and provides an estimate of the price paid. Most of these offset trades have occurred in the last two years.

**Table 10 Canadian Investments in Greenhouse Gas Offsets – up to September, 2000**

<b>Project Proponents (buyer – seller)</b>	<b>Type of Project (all in Canada unless specified)</b>	<b>Emission Trading Mechanism *</b>	<b>Amount of Offset (tonnes) **</b>	<b>Estimated Price (\$/tonne)***</b>
BC Gov't – Taylor Munro Energy	Solar Thermal Energy	GERT Pilot	45/yr	
E7 electric utilities – Indonesia	Renewable energy (Indonesia)	Canada CDM/JI	13,130 total	
E7 electric utilities – Jordan	Electricity plant (Jordan)	Canada CDM/JI	645,000 total	
E7 electric utilities – Zimbabwe	Rural Electrification with Renewable energy	Canada CDM/JI	Unknown	
Environment Canada – ENMAX	Wind power	GERT Pilot	31,104 total	Approx. \$50
GEMCO – IFC Fuel Cell	Landfill gas electricity (U.S.)	Bilateral	13,000/yr	
GEMCO – Norseman Eng.	Landfill gas for sawmill	GERT Pilot	15,000/yr	
GEMCO – IGF Insurers	Soil sequestration (U.S.)	ERT	2,800,000 total	
OPGI – S.C Edison	Electricity projects (U.S.)	PERT	10,000/yr	Approx. \$4
OPGI – CHI Canada	Small hydro plant	GERT Pilot	84,000 total	
OPGI – DuPont	Reduction of N <sub>2</sub> O at a chemical plant	PERT	100,000 total	
Pacifica Paper (no buyer)	Wood cogeneration of heat and power at a pulp mill	GERT	150,000 / year	For sale
Pan Canadian Petroleum (buyer and seller)	Injection of CO <sub>2</sub> in an Oil Well from a Coal Use	Canada CDM/JI	18,000,000 total	
Suncor – Vision Quest Wind	Wind power	Bilateral	1,750 total	Approx. \$50
Suncor – Niagara Mohawk	Electricity projects (U.S.)	ERT	100,000 total	Approx. \$1

*Canada's Potential Role in the Clean Development Mechanism*

<b>Project Proponents (buyer – seller)</b>	<b>Type of Project (all in Canada unless specified)</b>	<b>Emission Trading Mechanism *</b>	<b>Amount of Offset (tonnes) **</b>	<b>Estimated Price (\$/tonne)***</b>
Suncor – Nature Conservancy	Tree planting (Belize)	US JJI	500,000 total	Approx. \$1.50
SaskPower – Sask Energy Resources and Mines (SERM)	Forest management	GERT Pilot	22,000,000 total	
TransAlta – Multiple sellers	Soil sequestration	Bilateral	1.4 MT/yr	Approx. \$1
TransAlta – City of Edmonton	Waste management (compost)	Bilateral	204,000 total	Approx. \$20
TransAlta – Cement Companies	Coal ash use in cement	Bilateral	Unknown	
TransAlta – India	Agricultural livestock methane reduction	US JJI	14,800/yr	
TransAlta – Uganda	Cow Feed – methane reduction	In progress	30,000,000 total	
West Kootenay Power – Vision Quest Wind	Wind power	Bilateral	20 total	Approx. \$50

\* Greenhouse Gas Emission Reduction Trading (GERT) Pilot, Canadian CDM/JI Office, U.S Initiative on Joint Implementation (USIJI), Bilateral Trades between firms, Environmental Resources Trust (ERT) of the Environmental Defense Fund, Pilot Emission Reduction Trading (PERT) Program in Canada.

\*\* All values are for CO<sub>2</sub>-equivalents.

\*\*\* These prices were either publicly communicated by the proponents or estimated through other publicly available information (e.g., total investment in offsets was disclosed as well as the total emission reductions associated with the offset).

## 15 Appendix 5 – List of Potential Investors in CER Credits

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While only a few Canadian companies have actually purchased GHG emission reductions, a number of companies are actively exploring the possibility. For example, the following companies have all indicated in their reports to the Voluntary Challenge and Registry Program<sup>51</sup> that they are either purchasing or exploring the possibility of purchasing GHG emission reductions to meet their voluntary corporate commitments on climate change. These commitments can be viewed by downloading recent climate change “Action Plans” and/or “progress reports” for each firm from <http://www.vcr-mvr.ca/>

- Alberta Energy Company
- ATCO Limited
- BC Hydro
- Canadian Forest Products
- Enbridge
- E.B. Eddy Forest Products
- EPCOR
- Husky Oil
- Norcen Energy Resources
- NOVA Chemicals
- Nova Scotia Power
- Producers Pipelines
- Ontario Power Generation
- SaskEnergy / Transgas
- SaskPower
- Suncor Energy
- Talisman
- TransAlta Utilities
- TransCanada Pipelines
- Westcoast Energy
- Weyerhaeuser

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<sup>51</sup> <http://www.vcr-mvr.ca/>

## 16 Appendix 6 – Canadian Actions in GHG Emission Reduction

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This section outlines specific emission reduction activities of several Canadian firms in the oil, gas and electricity sectors. These activities provide clues on potential areas of expertise for technology transfer to developing countries under the CDM. The specific actions are summarized on the Pembina Institute web site called Climate Change Solutions: <http://www.climatechangesolutions.com>

### 16.1 Upstream Oil and Gas Producers

#### 16.1.1 Energy Efficiency

##### **Installing electric-powered variable frequency drives saves energy - Petro-Canada**

Petro-Canada installed a variable frequency drive on an amine regenerator Reflux cooler to improve energy efficiency. As a result, energy demand and related upstream GHG emissions were reduced by 2.1 kilotonnes (kt) in 1998.

##### **Improving performance of fin fan coolers reduces energy demand - Mobil Oil Canada**

Mobil Oil Canada improved the operating efficiency of fin fan coolers by the simple extension of a roof layout. The alteration significantly reduced energy requirements and resulted in a 6 kt per year reduction in GHG emissions.

##### **Dynamometer surveys can improve operating performance at pumping units - Mobil Oil Canada**

Acting on findings from dynamometer surveys, Mobil Oil Canada altered a number of its pumping units. The changes improved the units' operating performance and reduced GHG emissions by 0.67 kt per year.

##### **Matching power needs to pumpjack operations - Mobil Oil Canada**

The horsepower requirement for numerous pumpjack installations was reduced to better match their site requirements. This change reduced power generation-related GHG emissions by 1.2 kt per year.

##### **Rebuilding compressors improves operating efficiency - BP Amoco**

BP Amoco rebuilt two compressors to improve their operating efficiency. The improvements reduced electric driver loads by 500,000 kWh/month and reduced related power generation emissions in Alberta by 6.2 kt CO<sub>2</sub>-equivalent per year.

##### **Using special gas sweetening solvents reduces energy demands - Petro-Canada**

Petro-Canada has changed the chemicals it uses to strip the hydrogen sulphide and CO<sub>2</sub> from the natural gas stream that flows through its gas sweetening system. The new solvent requires less energy to sweeten the same volume of gas, resulting in fuel savings. The improved additive lowered the system's GHG emissions from energy use by 11.3 kt in 1998.

### 16.1.2 Methane Emission Reduction

#### **Implementing strategies to reduce gas well blowdown emissions - PanCanadian**

Various strategies have been used to eliminate emissions from gas wells, including the use of siphon strings (coiled tubing), plunger lift systems, and in-line testing. By implementing a combination of such initiatives, PanCanadian reduced vented emissions by 127 kt in 1996, and an additional 48 kt CO<sub>2</sub>-equivalent through to 1998.

#### **Endless tubing installations prevent well case venting - Fletcher Challenge**

Small-volume gas wells are fitted with endless tubing to remove liquid from the system. The tubing eliminates the need for blowdowns to atmosphere. This practice resulted in a reduction of 7.7 kt of GHG emissions in 1998.

#### **Vapour recovery and gas compression reduce emissions - Northstar Energy Corporation**

Northstar installed a vapour recovery unit to collect solution gas from an oil battery tank farm, and redirected it to a flare. They also added a booster gas compressor to collect solution gas that previously had been flared from the treaters, enabling recovered gas to be sold through the Nova Gas Transmission System. The two actions reduce GHG emissions by about 3 kt per year, illustrating simple, cost-effective changes that could be made at other large oil battery facilities and similar operations.

#### **Chemical gas sweetening process reduces flaring volumes - Alberta Energy Company Ltd.**

Alberta Energy Company Ltd. uses chemicals to strip hydrogen sulphide from the natural gas stream. The special chemicals clean the waste hydrogen sulphide product to such an extent that it can be used as fuel gas instead of being flared. The resulting displacement of fuel gas and reduction in flaring volume led to GHG emission reductions of 2.65 kt in 1998.

#### **Innovative completion technique reduces ghg emissions - Alberta Energy Company Ltd.**

During the 1998 operating year, "Coil Fracture Stimulation," an innovative completion technique developed by Alberta Energy Company Ltd., prevented about 41 kt of GHG emissions from being released into the atmosphere.

### 16.1.3 Alternative Electricity Production/Use

#### **Steam turbo generator helps reduce electrical energy import demand - Suncor Energy**

Suncor Energy installed a condensing steam turbo generator at its oil sands production facilities. The generator was designed to harness the energy liberated when high-pressure steam is converted to low-pressure steam. The change has resulted in the new-found generation of electric power, with a corresponding reduction in demand for power from the provincial grid. The new generator is expected to reduce Suncor's GHG emissions by 67 kt per year in 2000. The reduction is expected to increase to 440 kt of GHG reductions per year in 2002, when the unit begins operating at full capacity.

### 16.1.4 Geological Storage

#### **Injecting acid gas into formation reduces potential GHG emissions - Anderson Exploration**

In the process of recovering sour natural gas supplies, hydrogen sulphide and carbon dioxide must be stripped from the gas stream. Injecting the stripped product – called acid gas – back into the natural formation eliminates the need to handle the acid gas mix, preventing flaring and associated emissions. Adopting this approach at three of Anderson Exploration's locations has eliminated the need for routine acid gas flaring. As of June 1999, the new process had reduced GHG emissions by 3.7 kt.

## 16.2 Pipeline Companies

### 16.2.1 Energy Efficiency

#### **Anti-friction coating in pipelines reduces energy use - Westcoast Energy Inc.**

A coating of special compound inside the pipeline has helped reduce friction losses in the transportation of natural gas. This has reduced power requirements to move the gas, and has already reduced GHG emissions by 9.6 kt.

### 16.2.2 Fugitive Emissions

#### **Comprehensive fugitive emissions management program - TransCanada Transmission**

TransCanada has developed a disciplined and cost-effective measurement and management program to track and reduce fugitive emissions from its pipeline facilities. The award-winning program uses a Hi-Flow Sampler with fast, accurate sampling capabilities and an active fugitive emissions management team to significantly reduce fugitive emissions from TransCanada's entire pipeline network. The program is expected to reduce GHG emissions by 264 kt per year, beginning in the year 2000.

#### **Closing bypass valves reduces ghg emissions - SaskEnergy-TransGas**

SaskEnergy-TransGas have implemented an upgrading program that modifies the bypass valves at various facilities within their systems. Over the three years that the program has been in place, the modifications have reduced fugitive GHG emissions by 12.5 kt.

### 16.2.3 Vented Emissions

#### **In-line testing of wells and reduced flaring to reduce GHG emissions - BP Amoco**

BP Amoco is increasingly testing wells in-line, which results in zero venting and flaring. This in turn reduces the overall volume of gas flared at sites where flaring is required (through gas recovery and other processes). In 1999, BP Amoco reduced GHG emissions by over 10 kt using this approach.

#### **Old odourant pump technology is replaced with new - Enbridge Consumers Gas**

Odourant pumps are commonly found in the distribution end of natural gas supply systems. The pumps release gas with each operating stroke. New systems eliminate this operating problem, and Enbridge has significantly reduced its vented emissions by upgrading to this more efficient technology.

#### **Glycol pump replacements reduce ghg emissions - ATCO Gas**

ATCO Gas has undertaken a program to replace older glycol pumps at its various dehydrator facilities with newer systems that reduce fugitive emissions significantly. In 1998 alone, the initiative reduced GHG emissions by more than 17.5 kt.

#### **Pneumatic device changeovers to air reduce methane emissions - BC Gas**

To reduce methane emissions, BC Gas is replacing continuous-bleed, natural gas-operated pneumatic controllers with low-bleed systems. In other cases, vented emissions are being eliminated by replacing the natural gas used to operate the systems with air. This initiative reduced methane emissions by 4.1 kt of CO<sub>2</sub>-equivalent in 1990.

#### **Reducing purging volumes with line pack pressure reduction - Enbridge Consumers Gas**

To undertake any work on pipelines, the operating pressure often has to be reduced, or the natural gas completely evacuated. Enbridge Consumers Gas reduces the amount of natural gas that is vented in



the pressure-reduction process by first reducing the operating line pressure. If total evacuation of the gas is required, the vented volume at this reduced operating pressure is minimal. This approach significantly reduces GHG emissions, compared to simply venting to reduce operating pressure or purge a line.

**Lower operating pressure at storage facilities reduces emissions - ATCO Gas**

To accommodate changes in supply demands, the operating pressure was decreased at ATCO Gas' underground storage facilities in Carbon, Alberta. The change meant fewer vented emissions from regular operations, with a reduction amounting to 2.2 kt of GHG emissions per year.

**Hot tapping and buttering significantly reduce venting emissions - TransCanada**

Hot tapping and buttering make it possible to install a pipe stub onto an existing operating pipeline even when the line is at or near its full pressure. In turn, this kind of installation reduces the need to vent natural gas to the atmosphere. TransCanada expects that adopting this approach will prevent 700 kt of GHG emissions from entering the atmosphere between 1997 and 2000.

#### 16.2.4 Demand Side Management

**Energy efficiency programs for customers help reduce GHG emissions - SaskEnergy**

SaskEnergy participated in several programs designed to improve the energy efficiency of its customers. The programs' sponsors calculated that their efforts have reduced GHG emissions by over 4 kt per year.

**Energy efficiency programs for business and industrial sectors - Westcoast Energy: Union Gas subsidiary**

Through economic incentives and communication programs, Union Gas' efforts to promote high-efficiency water heaters and boiler efficiency workshops in the business and industrial sectors helped generate a 52 kt CO<sub>2</sub>-equivalent saving in 1998 alone. By 2000, total GHG emission reductions attributable to these programs were estimated at 246 kt per year.

**Presenting energy efficiency to the public - BC Gas**

BC Gas has sponsored a program that provides incentives for using natural gas vehicles, and has also provided corporate contributions to support community initiatives to reduce GHG emissions. Current estimates of the greenhouse gas reduction impact of BC Gas' demand side management, energy efficiency education and natural gas for vehicles programs are 10.2 kt CO<sub>2</sub>-equivalent in 1998, with an anticipated increase to 21.7 kt CO<sub>2</sub>-equivalent in the year 2005.

## 16.3 Electricity Suppliers

### 16.3.1 Electrical System Efficiency

#### **District heating in Pangvurtung, Nunavut - Northwest Territories Power Corporation**

This project provides space heating and hot water to several community buildings, using waste heat from NTPC diesel engines.

#### **Improving the efficiency of hydroelectric plants - Manitoba Hydro**

Manitoba Hydro has implemented various retrofits to existing hydroelectricity plants, which has facilitated an increase in the company's annual generation of electricity.

#### **Improving the heat rate of thermal power plants - TransAlta**

TransAlta has implemented various retrofits to existing coal-fired thermal plants, which has increased the electricity production per unit of coal.

#### **Reducing transmission line losses - Nova Scotia Power Inc.**

NPSI has undertaken various actions to reduce transmission line losses, reducing the company's overall consumption of coal and other fossil fuels to serve customer electricity demand.

#### **GHG offsets from the cogeneration of electricity and natural gas - TransAlta**

The construction of new cogeneration plants next to industrial facilities in Ontario has supplied the electricity and heating needs of these facilities, while providing new, low-emission sources of electricity for the Ontario market.

#### **Internal energy efficiency - Ontario Power Generation**

By retrofitting existing nuclear and coal power plants, hydroelectricity facilities, and transmission lines, OPGI has reduced GHG emissions by increasing the overall efficiency with which the electricity system serves customers' loads.

### 16.3.2 Demand Side Management

#### **Rebates for energy efficiency in non-profit institutions - West Kootenay Power**

The company's provision of an energy audit, technology assessment and installation, along with a cost rebate, helped a local seniors home to reduce its energy consumption and operating costs.

#### **PowerSmart Home Improvement Program - BC Hydro**

This comprehensive program for homeowners includes free energy audits, an assessment and installation of energy efficiency retrofits, technology certification, capital cost financing and a warranty.

#### **PowerSense New Home Construction Program - West Kootenay Power**

This program provides a high energy-efficiency standard for new homes, connects people with certified contractors, and includes a low-cost mortgage option.

#### **Industrial Sector Time of Use Rate - TransAlta**

This program offers customers varying rate charges at different times, to reflect the different costs of serving industrial customers at different times of the day and in different seasons.

### 16.3.3 Low Impact Renewable Energy

#### **Emission reduction trading in facilitating Green Power - Ontario Power Generation**

The financial value of GHG emission reduction offsets from the capture and combustion of landfill methane gas has enabled additional landfill gas capture projects to proceed.

#### **Green Power marketing in Calgary - ENMAX**

By paying a price premium, Calgary consumers can elect to get their power supplies from wind energy facilities in southwest Alberta.

#### **Net billing with solar arrays in Toronto - Toronto Hydro**

Owners of solar photovoltaic and wind energy systems in Toronto can receive a credit on their power bill for any excess power generation that is fed back to the grid.

#### **Ratepayer-funded wind farm in the Gaspé - Hydro Québec and the Government of Québec**

The largest wind energy farm in Canada was funded by the provincial government and electricity consumers who now enjoy some of the lowest power rates in Canada.

#### **Comprehensive Green Power Initiative - Yukon Energy Corporation**

Canada's most comprehensive program for low-impact renewable energy was initiated in the Yukon; the program includes the development of green supplies for remote communities, net metering, green power in schools, wind resource assessment and other features.

#### **Solar electricity in Edmonton - EPCOR**

EPCOR is facilitating the development of grid-connected solar photovoltaic supplies, including a large array mounted on the company's head office building in Edmonton.

#### **Green Power portfolio standard for all new electricity supplies - BC Hydro**

BC Hydro has made a commitment that 10% of all new electricity supplies in the province will be met by "green renewable energy" sources.

#### 16.3.4 Low-Impact Renewable Energy in Remote Areas - Purcell Lodge Example

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 now produced using diesel generators. The diesel fuel needs to be transported to the site, often at a considerable cost. And the fuel produces greenhouse gas emissions when used.

Purcell Lodge is a year-round eco-tourist resort in the Rocky Mountains, located near Golden, B.C. A small hydraulic electricity generation system was installed at the lodge in 1992 to replace a 12 kilowatt (kW) diesel generator, while reducing greenhouse gas emissions and saving 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 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 greenhouse gas 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.

## 17 Appendix 7 – List of Potential Brokers, Verification Agencies, Financers, and Analysts

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- Canadian Commercial Corporation – provides commercial guarantees for exports.  
Tel: +1-613-966-0034, Fax: +1-613-995-2121  
<http://www.ccc.ca>
- Cantor-Fitzgerald Environmental Brokerage Services  
Corinne Boone, Cantor Fitzgerald Canada.  
One First Canadian Place, Suite 2850, Box 446, Toronto, ON M5X 1E4 Canada  
Tel: +1-416-350-2177, Fax: +1-416-350-2985, E-mail: [cboone@cantor.com](mailto:cboone@cantor.com)  
<http://www.emissionstrading.com>  
<http://www.cantor.com/ebs>
- Clean Commodities Inc – Broker.  
Contact: Sid Embree, Tel: 202-337-3779
- Emissions Marketing Association (U.S.) – Information services  
Contact: <http://www.emissions.org>
- Environmental Resources Trust – Broker, Verifier and Registry  
<http://www.ert.net>
- Export Development Corporation – can provide commercial financing for exports.  
Contact: Jim Christie.  
Home Oil Tower, Suite 606, 324-8<sup>th</sup> Avenue SW. Calgary, AB T2P 2Z2 Canada  
Tel: +1-403-292-6898, Fax: +1-403-292-6902, E-mail: [jchristie@edc-see.ca](mailto:jchristie@edc-see.ca)  
<http://www.edc-see.ca>
- Greenhouse Gas Emission Management Consortium (GEMCO)  
Contact: Aldyen Donnelly,  
Suite 101 – 1965 West 4th Avenue, Vancouver, BC V6J 1M8 Canada  
Tel: +1-604-731-4666, Fax: +1-604-731-4664, E-mail: [aldyen@mindlink.bc.ca](mailto:aldyen@mindlink.bc.ca)  
<http://www.gemco.org>
- International Offsets Unlimited Inc. and Carboncorp Management Ltd. – Broker  
Contact: Robert Falls, International Offsets Unlimited Inc.  
Ph: 604-331-5306; E-mail: [carboncorp@axys.com](mailto:carboncorp@axys.com)
- The Pembina Institute – Life-Cycle Value Assessment and Offset Quantification  
Contact: Robert Hornung, 505-124 O'Connor Street, Ottawa, ON K1P 5M9 Canada  
Tel: +1-613-235-6288, Fax: +1-613-235-8118. E-mail: [roberth@pembina.org](mailto:roberth@pembina.org)  
<http://www.pembina.org/>
- Tree Canada Foundation – Broker and aggregators for tree planting projects  
Contact: Chuck Geale, E-mail: [cgeale@treecanada.ca](mailto:cgeale@treecanada.ca)  
<http://www.treecanada.ca>
- Voluntary Challenge and Registry (VCR) Inc – Credit Registry  
<http://www.vcr-mvr.ca/>
- Woodrising Consulting Inc. – Broker  
Contact: Neil Bird, E-mail: [nbird@woodrising.com](mailto:nbird@woodrising.com)