Greenhouse Gas Emissions from Industrial Companies in Canada: 1998

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Pembina Institute
for Appropriate Development

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Summary and Conclusions

1. Canada's largest greenhouse gas (GHG) emitters are industrial companies, responsible for over 60 percent of Canada's total emissions. It is of major public interest to examine how they are responding to that responsibility on a company-specific basis. We have therefore extracted company-specific emissions data from the only current organized source of such data—the Voluntary Challenge and Registry (VCR) program. We found that 115 private sector and/or industrial entities made submissions to the VCR by June 30, 2000 stating their 1998 emissions (see table 1 for the largest emitters).

2. Setting aside an exceptional increase in emissions at Ontario Hydro and an exceptional decrease at DuPont Canada, our company-specific analysis shows that most industrial sectors experienced relatively small changes in emissions between 1997 and 1998, in keeping with the one percent rise in Canada's total emissions (see table 2). However, significantly more companies reporting to the VCR experienced large increases in emissions between 1997 and 1998 than experienced large decreases (see tables 3-6).

3. Between 1990 and 1998, a period during which Canada's total emissions rose by 13 percent, our company-specific analysis shows similar increases among integrated oil and gas production and refining companies and in the mining and metals sector. Emissions from the electricity generation and oil and gas production sectors rose much more quickly than Canada's total emissions, while emissions from the pipeline sector rose four times more quickly than the national total. Emissions from natural gas utilities were nearly stable, while emissions from the chemicals sector (excluding DuPont Canada) fell by a small amount. The forest products sector stands out for its large decrease in emissions over this period, although this decrease is only real if industrial extraction of wood from Canada's forests is sustainable (see table 2).

4. Between 1990 and 1998, far more companies experienced large increases in emissions than experienced large decreases (see tables 9-12, especially tables 9 and 11). Sixteen companies actually increased their emissions intensity (emissions per unit of production), out of the 58 for which it was possible to do this calculation. These 16 include some of Canada's largest emitters (see table 13). Only ten companies out of the 58 reduced their emissions intensity at an average rate of more than four percent per year—roughly the rate of reduction in emissions intensity that Canada's economy as a whole needs to achieve to meet our commitment under the Kyoto Protocol through domestic emission reductions (see table 14).

5. Since 1995, Canada's governments have relied largely on voluntary initiatives to influence GHG emissions. During this period, the VCR has been, and remains to this day, the flagship national program to address climate change. The previous three points make clear that the VCR has utterly failed to bring about the kinds of emissions reductions that Canada will need to meet its Kyoto commitment—to reduce GHG emissions by six percent from 1990 levels during the 2008-2012 period. Indeed, companies reporting their emissions to the VCR, which are presumably the Canadian companies most engaged in the climate change issue, have as a group been increasing their emissions substantially (see table 2).

6. Five years after the VCR program was launched, a lengthy catalogue still exists of variations and inconsistencies in the methodology used by companies to calculate the emissions they report. This clearly indicates that voluntary reporting of GHG emissions cannot provide information about company-specific emissions at an adequate level of data quality (see section 3). There is also widespread double counting of emissions among companies reporting emissions to the VCR. If

and when a dollar value is placed on emissions, for example by a future domestic emissions trading system (see point 8 below), an emissions accounting system will need to be in place that includes clear and sensible rules for how to account for and allocate emissions (see section 3.1.)

7. Our analysis shows that, overall, the level of meaningful participation of Canada's major industrial greenhouse gas emitters in the VCR program is inadequate and showing no signs of improving significantly. VCR participants reporting their greenhouse gas emissions likely represent no more than half of Canada's industrial GHG emissions, and possibly somewhat less than half. Five years after the VCR was launched, only about one-sixth of participants are managing to take the basic step of reporting their emissions. Some of Canada's largest GHG emitters do not report their emissions to the VCR. No companies at all from the aluminum, cement, and iron and steel sectors made VCR submissions by June 30, 2000 stating their emissions for 1998. Several major Canadian companies with substantial GHG emissions reported their 1997 emissions to the VCR but then failed to report their 1998 emissions (see section 4.)

8. The previous two points make abundantly clear that reporting of GHG emissions by significant industrial emitters should be mandatory in Canada, with requirements for consistent methodology and clear and sensible rules for how to account for and allocate emissions. Company-specific reporting of emissions of toxic substances is already mandatory under the National Pollutant Release Inventory; it is inexplicable that reporting of GHG emissions, which are responsible for what many agree is the world's most serious environmental threat—that is, climate change—should be optional. Canada will, in any case, have to move to comprehensive tracking of GHG emissions on a company-specific level if it is to introduce a major economic instrument, such as domestic emissions trading, as part of its national strategy on climate change. There is already widespread and increasing acceptance that such an instrument will be required.

9. In view of points 5 and 8 above, federal and provincial Energy and Environment ministers, meeting in Quebec City on October 16 and 17, 2000, must commit to:
    - adopt complementary financial incentives and regulatory instruments capable of bringing about the meaningful reductions in Canada's industrial GHG emissions that voluntary programs are incapable of achieving on their own; and
    - implement mandatory, consistent and clear reporting of GHG emissions by significant industrial emitters.

1. Introduction

According to mainstream scientific opinion, as reported by the Intergovernmental Panel on Climate Change and many other authorities:

- emissions of greenhouse gases (GHG) from human activity, principally carbon dioxide, are the largest current driver of climate change;
- if emissions continue upwards according to plausible "business as usual" scenarios, profound changes, unprecedented in the past 10,000 years, are expected to affect the earth's climate, oceans and ecosystems during the 21st century;
- emissions need to be reduced from current levels by over 50 percent if concentrations of GHG in the atmosphere are to stop rising.[1]

Governments have responded to these findings by adopting the United Nations Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997). The ultimate objective of the Framework Convention, which entered into force in 1994, is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-caused] interference with the climate system." As a first step towards this objective, the Kyoto Protocol subjects industrialized countries to legally-binding emissions limitation targets that add up to a five percent reduction of emissions from their 1990 level during the five-year period 2008-2012. The Protocol has not yet entered into force, and many of its operational details remain to be decided at the sixth Conference of the Parties (COP 6) to the Framework Convention, which will take place November 13-24, 2000 in The Hague, Netherlands. A successful COP 6 should open the way for industrialized countries to ratify the Protocol. Fifty-five countries, including countries accounting for 55 percent of industrialized country carbon dioxide emissions in 1990 must ratify the Protocol in order for it to enter into force.

Under the Kyoto Protocol, Canada must reduce its GHG emissions by six percent from their 1990 level during 2008-2012. Although the Protocol is not yet in force, the federal government has publicly committed to achieve Canada's Kyoto target.[2] However, according to Environment Canada's most recent report on Canada's GHG emissions,[3] those emissions rose by 13 percent between 1990 and 1998. And the latest official projections show Canada's emissions rising to 27 percent above their 1990 level by 2010 if current government policies remain unchanged.[4]

This situation underlines the importance of the meeting of federal and provincial Energy and Environment ministers in Quebec City on October 16-17, 2000. At this meeting, ministers have agreed to give "final consideration" to a National Implementation Strategy on Climate Change, and to discuss a first three-year business plan of "specific actions" under the Strategy. The Quebec City meeting comes after a two-year National Climate Change Process, under which stakeholders from government, industry, environmental groups and universities identified over 300 measures that Canada could implement to reduce its GHG emissions. Modelling conducted under the National Process has shown that various combinations of these measures would allow Canada to reach its Kyoto target. However, there is doubt as to whether ministers have the political will to put even a significant subset of them into

[1] See the Pembina Institute's website http://www.climatechangesolutions.com/english/science/ for a broader presentation of climate change science, with full references.
[2] For example: in the most recent Speech from the Throne (October 1999).
[3] Environment Canada (September 2000), *Backgrounder - Greenhouse Gas Emissions 1990-1998*. Available at http://www.ec.gc.ca/press/000906_e.pdf.
[4] National Climate Change Process Analysis and Modelling Group (December 1999), *Canada's Emissions Outlook: An Update*. Available at http://www.nrcan.gc.ca/es/ceo/update.htm.

effect. As documented in recent studies by the Pembina Institute,[5,6] Canada's federal and provincial governments have spent the past decade talking about climate change but doing very little to address it.

1.1 Company-Specific Emissions

Canada's largest GHG emitters are industrial companies. Industrial stationary sources, including electricity generation, directly accounted for 51 percent of Canada's GHG emissions in 1998 (the latest year for which data are available). If emissions from heavy duty and off road vehicles, domestic marine and rail transportation are included—on the basis that these modes of transportation are used overwhelmingly by industrial operations and to take industrial products to market—the proportion rises to 61 percent. This figure still excludes emissions from commercial buildings and agribusiness, both of which arguably fall under the heading "industry."[7]

Canada's success in addressing climate change therefore depends first and foremost on what happens to the GHG emissions of its industrial companies. Leading industrial GHG emitters hold a large share of responsibility for Canada's emissions, and it is of major public interest to examine how they are responding to that responsibility on a company-specific basis. In addition, public access to information about individual corporate polluters is a key mechanism for encouraging emission reductions.

These considerations led the Pembina Institute to publish the first ever comprehensive study of Canada's company-specific industrial GHG emissions in March 2000. That study, which examined emissions over the period 1990-97, was included in our report *Five Years of Failure: Federal and Provincial Government Inaction on Climate Change During a Period of Rising Industrial Emissions*.[8] The present study applies the methodology used in the "Five Years of Failure" report to 1998 emissions.

Our approach is to compile data from submissions made by companies to the Voluntary Challenge and Registry (VCR) program. The VCR, established in 1995, encourages private and public sector organizations to voluntarily limit their net GHG emissions. During a period in which Canada's governments have relied largely on voluntary initiatives to influence GHG emissions, the VCR has been, and remains to this day, the flagship national program to address climate change. Participating organizations, mostly industrial companies, submit publicly accessible action plans and progress reports that can be downloaded from the VCR website.[9] For the present study we verified all the VCR submissions made by private sector and/or industrial entities up to June 30, 2000 in order to identify those reporting their emissions for 1998. We then analyzed all the submissions reporting 1998 emissions in order to extract additional information, where available, about emissions for 1990 and 1997 as well as production data for all three years.

Voluntary reporting of emissions, as solicited by the VCR, has two large and obvious drawbacks, which are discussed in more detail in sections 3 and 4. First, a significant number of major emitters as well as numerous smaller emitters simply do not report their emissions (see section 4). Second, there is no requirement that companies use a standard method of calculating emissions data, nor even that they provide clear explanations of how data were calculated (see section 3). These drawbacks unfortunately affect the quality of the results presented in section 2.

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[5] Robert Hornung and Matthew Bramley (March 2000), *Five Years of Failure: Federal and Provincial Government Inaction on Climate Change During a Period of Rising Industrial Emissions*, Pembina Institute. Available at http://www.pembina.org/pubs/fiveyears.htm.

[6] Pembina Institute (October 2000), *Provincial Government Performance on Climate Change: 2000*. Available at http://www.pembina.org/pubs/ReportCard.htm.

[7] Environment Canada, *op. cit.*

[8] Robert Hornung and Matthew Bramley, *op. cit*.

[9] http://www.vcr-mvr.ca/AlphaList.cfm.

2. Results

The reader is referred to sections 3 and 4 for discussion, respectively, of the quality and completeness of the data presented here. Data for 1990 and 1997 (below) may differ from those we have published previously[10] as some companies have changed their greenhouse gas emission calculation methodology. Emissions are reported in units of megatonnes (millions of tonnes, Mt) or kilotonnes (thousands of tonnes, kt) of "carbon dioxide equivalent" (CO_2E).[11]

2.1 Canada's Largest Emitters

By June 30, 2000, 115 private sector and/or industrial entities had made submissions to the VCR, stating their 1998 emissions. The largest emitters are shown in table 1.

A few of Canada's top GHG emitters do not report to the VCR and may therefore be missing from table 1. The most likely omissions are among aluminum, cement, and iron and steel producers, none of which reported 1998 emissions to the VCR, and in the chemicals sector, in which only six companies reported their 1998 emissions. However, missing companies are likely to have emissions closer to 5 than 10 Mt CO_2E. See section 4 for further discussion on this point.

2.2 Overall and Sectoral Emission Changes

Of the 115 companies reporting 1998 emissions to the VCR, 71 also reported their 1990 emissions calculated in a comparable manner, and 68 companies reported both 1990 and 1997 emissions. Emissions trends for these 68 companies are analyzed by industrial sector in table 2.

It should be emphasized that with the exception of electricity generation, a sector where the vast majority of Canada's emissions are reported to the VCR, sectors' trends shown in table 2 are not necessarily representative of the national trends for those sectors. This is because, as we conclude in section 4, companies reporting emissions to the VCR likely represent no more than half of Canada's industrial GHG emissions, and possibly somewhat less than half. On the other hand, as noted above, most of Canada's leading GHG emitters are included here.

[10] Robert Hornung and Matthew Bramley, *op. cit.*

[11] A mixture of different greenhouse gases is expressed as a carbon dioxide equivalent (CO_2E) by multiplying the amount of each gas other than CO_2 by its "global warming potential" (GWP) which measures how much more strongly it contributes to the greenhouse effect than CO_2. For example, methane has a GWP of 21, which means that one tonne of methane represents 21 tonnes of CO_2E.

Table 1. GHG emissions of those companies that made a VCR submission by June 30, 2000 stating their emissions for 1998, and whose emissions exceeded 5 Mt CO_2E.

Company	Sector	1998 emissions (Mt CO_2E)	1997 emissions (Mt CO_2E)	1990 emissions (Mt CO_2E)	% change 1997-98	% change 1990-98
Ontario Hydro	Electricity generation	31.0	22.8	26.0	36	19
TransAlta	Electricity generation	23.4	24.1	25.8	-3	-10
TransCanada	Pipelines; electricity generation	17.3	16.6	10.4	4	66
SaskPower	Electricity generation	14.7	14.4	10.6	2	39
Imperial Oil	Oil and gas production and refining; chemicals	10.8	11.5	10.8	-5	0
New Brunswick Power	Electricity generation	9.7	8.6	6.3	13	54
ATCO Electric	Electricity generation	9.5	10.1	7.7	-6	23
Syncrude Canada	Oil and gas production	8.9	8.5	7.2	5	23
EPCOR	Electricity generation	8.6	7.5	3.5	14	149
Nova Scotia Power	Electricity generation	8.0	7.8	6.8	2	17
Shell Canada	Oil and gas production and refining	7.3	7.6	7.6	-4	-4
Petro-Canada	Oil and gas production and refining	6.9	7.3	6.9	-6	0
Amoco Canada Petroleum	Oil and gas production	6.6	n/a	6.3	n/a	6
Husky Oil Operations	Oil and gas production and refining	6.5	6.5	3.8	1	70
Suncor Energy	Oil and gas production and refining	6.2	5.7	5.0	9	24
DuPont Canada[a]	Chemicals	5.4	10.4	11.2	-48	-52
Westcoast Energy[b]	Pipelines; natural gas utility; electricity generation	5.2	5.4	4.1	-4	26

[a] Data exclude emissions associated with electricity sold to Ontario Hydro

[b] Data probably include emissions associated with purchased electricity but this is not stated explicitly in the company's submission

Table 2. GHG emissions in 1990, 1997 and 1998 by industrial sector from companies that made a VCR submission by June 30, 2000 stating their emissions for all three years.

Sector	Number of companies	1998 emissions (Mt CO_2E)	1997 emissions (Mt CO_2E)	1990 emissions (Mt CO_2E)	% change 1997-98	% change 1990-98
Electricity generation, total	11	109.1	98.3	90.0	11	21
- excluding Ontario Hydro	*10*	*78.1*	*75.5*	*64.0*	*3*	*22*
Oil and gas production and refining	6	37.7	38.5	34.1	-2	10
Pipelines	4	23.6	23.2	15.4	2	53
Oil and gas production only	9	16.8	16.6	13.9	1	21
Chemicals, total	6	14.7	20.0	21.0	-26	-30
- excluding DuPont Canada	*5*	*9.3*	*9.6*	*9.7*	*-2*	*-4*
Forest products	14	5.3	5.9	6.7	-10	-21
Mining and metals	7	3.2	3.0	2.9	6	10
Natural gas utilities	5	1.9	2.0	1.9	-2	2
Manufacturing	6	0.8	0.9	1.3	-9	-35
Total excluding electricity generation	57	104.1	110.1	97.2	-6	7
Total for Canada[12]		692	685	612	1	13

Some of the companies included in table 2 have operations that span more than one of the industry sectors shown; such companies have been assigned to the sector that corresponds (or appears to correspond) to the majority of their emissions.[13] Most companies include in their corporate emissions total the emissions associated with the generation of the electricity they purchase. This means that the emissions from the electricity generation sector cannot simply be added to the emissions from other sectors, because that would involve double counting of some of the electricity emissions. This double counting problem also makes it impossible to assess exactly what proportion of Canada's total emissions these 68 companies are responsible for. See section 3.1 for further discussion of the double counting issue.

Before drawing conclusions from Table 2 about emission trends, it should be noted that the changes from 1997 to 1998 in the electricity and chemicals sectors are dominated in each case by one company. Ontario Hydro's emissions rose by 8.3 Mt from 1997 to 1998—most of the change in the electricity sector—because of the shutdown of nuclear facilities and their replacement by coal-fired generation. And DuPont's emissions fell by 5.1 Mt from 1997 to 1998—almost the entire change in the chemicals sector—because of the installation of new technology to cut emissions of nitrous oxide, a greenhouse gas that is over 300 times more powerful than carbon dioxide and is generated during the production of adipic acid.

[12] Environment Canada, *op. cit.*

[13] Imperial Oil, placed in the oil and gas production and refining sector, also produces chemicals; SaskEnergy/TransGas, categorized as a natural gas utility, also has pipeline operations; Westcoast Energy, placed in the pipelines category, is also a natural gas utility and electricity generator. Elf Atochem Canada has been placed in the oil and gas production and refining sector, although it only has oil and gas refining operations; however, its emissions are relatively tiny. All other companies fall clearly into a single category.

Setting aside these two somewhat exceptional changes, most sectors experienced relatively small changes in emissions between 1997 and 1998, in keeping with the one-percent rise in Canada's total emissions. There were small increases in electricity generation (excluding Ontario Hydro) and among pipeline and oil and gas production companies; and small decreases among integrated oil and gas production and refining companies, chemical producers (excluding DuPont) and natural gas utilities. However, there were larger decreases among companies in the forest products and manufacturing sectors; and a relatively large increase among companies in the mining and metals sector.

Between 1990 and 1998, Canada's total emissions rose by 13 percent, and table 2 shows similar increases among integrated oil and gas production and refining companies and companies in the mining and metals sector. Emissions from companies in the electricity generation and oil and gas production sectors rose much more quickly than Canada's total emissions, while emissions from companies in the pipeline sector rose four times more quickly than the national total. Emissions from natural gas utilities were nearly stable, while emissions from companies in the chemicals sector (excluding DuPont) fell by a small amount. The forest products and manufacturing sectors stand out for their large decreases in emissions over this period. However, the group of manufacturing companies included here is too small to be representative of national trends. It should also be noted that much of the reduction in emissions in the forest products sector resulted from the replacement of fossil fuels by fuels derived from wood waste. Under international guidelines,[14] carbon dioxide produced by burning wood waste is assumed to be entirely re-absorbed by growing forests and is therefore not counted in emissions totals. This assumption is questionable in light of the considerable concern that exists as to whether current rates of industrial extraction of wood from Canada's forests are in fact sustainable.

2.3 Emission Changes from 1997-98

Changes in companies' GHG emissions between adjacent years can be influenced by many factors and do not necessarily indicate longer-term emission trends. However, companies with year-on-year emissions increases must accept responsibility for those increases and be prepared to justify them. Companies with emissions decreases can take credit for those decreases if they result from deliberate emission reduction measures. Of the 115 companies reporting 1998 emissions to the VCR, 103 also reported 1997 emissions calculated in a comparable manner. The greatest changes in emissions that occurred between 1997 and 1998 are identified in tables 3-6. Tables 3 and 5 highlight absolute changes, which are most relevant to the impact on the climate. Tables 4 and 6 highlight relative changes, which relate more closely to countries' emission reduction commitments under the Kyoto Protocol (which are expressed as percentages), and draw attention to smaller companies with lower total emissions that are nonetheless changing rapidly.

[14] As established by the Intergovernmental Panel on Climate Change and recommended by the VCR.

Table 3. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1997 and 1998, and whose emissions increased by more than 300 kt CO_2E between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Change 1997-98 (kt CO_2E)
Ontario Hydro	Electricity generation	31,031	22,815	8,215
New Brunswick Power	Electricity generation	9,700	8,600	1,100
EPCOR	Electricity generation	8,582	7,499	1,083
BC Hydro	Electricity generation	2,007	1,244	763
Renaissance Energy	Oil and gas production	2,618	1,870	748
Manitoba Hydro	Electricity generation	1,036	355	681
TransCanada	Pipelines; electricity generation	17,269	16,646	623
Suncor Energy	Oil and gas production & refining	6,160	5,678	482
Syncrude Canada	Oil and gas production	8,900	8,500	400
SaskPower	Electricity generation	14,707	14,366	340
Poco Petroleums	Oil and gas production	889	570	319

Table 4. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1997 and 1998, and whose emissions increased by more than one-quarter between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	% change 1997-98
Genesis Exploration	Oil and gas production	44	10	329
Manitoba Hydro	Electricity generation	1,036	355	192
Northrock Resources	Oil and gas production	354	123	187
Triumph Energy	Oil and gas production	38	21	82
BC Hydro	Electricity generation	2,007	1,244	61
Poco Petroleums	Oil and gas production	889	570	56
Placer Dome North America	Mining and metals	140	95	48
Cambior	Mining and metals	6	4	47
Startech	Oil and gas production	85	60	43
Renaissance Energy	Oil and gas production	2,618	1,870	40
Ontario Hydro	Electricity generation	31,031	22,815	36
Husky Injection Molding Systems	Manufacturing	14	11	31
Talisman Energy	Oil and gas production	1,146	910	26

Table 5. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1997 and 1998, and whose emissions decreased by more than 300 kt CO_2E between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Change 1997-98 (kt CO_2E)
DuPont Canada[a]	Chemicals	5,387	10,443	-5,056
TransAlta	Electricity generation	23,359	24,096	-737
Imperial Oil	Oil and gas production and refining; chemicals	10,830	11,450	-620
ATCO Electric	Electricity generation	9,500	10,096	-596
Abitibi-Consolidated[b]	Forest products	1,531	2,001	-471
Ranger Oil	Oil and gas production	997	1,430	-433
Petro-Canada	Oil and gas production and refining	6,931	7,338	-407
Shell Canada	Oil and gas production and refining	7,265	7,600	-335

[a] Data exclude emissions associated with electricity sold to Ontario Hydro
[b] Data appear to exclude emissions associated with some purchased electricity

Table 6. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1997 and 1998, and whose emissions decreased by more than one-quarter between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	% change 1997-98
DuPont Canada[a]	Chemicals	5,387	10,443	-48
Pacifica Papers	Forest products	261	379	-31
Ranger Oil	Oil and gas production	997	1,430	-30
Conoco Canada	Oil and gas production	81	113	-28
Kimberly-Clark Nova Scotia[b]	Forest products	65	89	-27

[a] Data exclude emissions associated with electricity sold to Ontario Hydro
[b] Data exclude emissions associated with purchased electricity

Although what counts for protecting the climate is reducing emissions, emissions intensity (emissions per unit of production) is a good indicator of how much effort companies are making to lessen their impact on the climate, independent of whether their level of commercial activity is rising or falling. Of the 115 companies reporting 1998 emissions to the VCR, 88 also reported their 1997 emissions as well as the production figures for both years that are necessary to calculate emissions intensities. Tables 7 and 8 show respectively the worst and best performers in terms of emissions intensity.[15]

[15] Where companies have more than one product, the emissions intensity has calculated for the product that has the highest absolute level of associated emissions.

Table 7. Companies that made a VCR submission by June 30, 2000 stating their emissions and production for 1997 and 1998, and whose emissions intensity increased by more than 10% between those two years.

Company	Sector	1998 emissions (kt CO_2E)	% change in emissions intensity 1997-98
Manitoba Hydro	Electricity generation	1,036	230
Northrock Resources	Oil and gas production	354	141
Genesis Exploration	Oil and gas production	44	102
BC Hydro	Electricity generation	2,007	62
Ontario Hydro	Electricity generation	31,031	40
Renata Resources	Oil and gas production	58	37
Newport Petroleum	Oil and gas production	215	28
Placer Dome North America	Mining and metals	140	25
Daishowa, Division de Québec	Forest products	134	12
Alberta Energy	Oil and gas production; pipelines	2,277	11
Weldwood of Canada	Forest products	370	11
Abitibi-Consolidated[a]	Forest products	1,531	10

[a] Data appear to exclude emissions associated with some purchased electricity

Table 8. Companies that made a VCR submission by June 30, 2000 stating their emissions and production for 1997 and 1998, and whose emissions intensity decreased by more than 10% between those two years.

Company	Sector	1998 emissions (kt CO_2E)	% change in emissions intensity 1997-98
DuPont Canada[a]	Chemicals	5,387	-46
Elf Atochem Canada - Oakville plant	Oil and gas refining	1	-33
Pacifica Papers	Forest products	261	-26
Encal Energy[b]	Oil and gas production	241	-24
Star Oil & Gas	Oil and gas production	170	-23
Poco Petroleums	Oil and gas production	889	-19
Startech	Oil and gas production	85	-18
Mobil Canada	Oil and gas production	1,636	-18
Orenda Aerospace	Manufacturing	8	-18
PrimeWest Energy	Oil and gas production	170	-17
St. Lawrence Corp.	Manufacturing	7	-17
Murphy Oil	Oil and gas production	628	-17
Dow Chemical Canada	Chemicals	2,239	-17
Bayer Rubber Division - Sarnia Site[c]	Chemicals	418	-16
Imperial Oil	Oil and gas production and refining; chemicals	10,830	-14
Paramount Resources[d]	Oil and gas production	348	-13
Spruce Falls[b]	Forest products	82	-11
Ranger Oil	Oil and gas production	997	-11
NOVA Chemicals[b]	Chemicals	3,827	-10

[a] Data exclude emissions associated with electricity sold to Ontario Hydro
[b] Data exclude emissions associated with purchased electricity
[c] It is unclear whether data include emissions associated with purchased electricity
[d] Data appear to exclude emissions associated with purchased electricity

2.4 Emission Changes from 1990-98

The year 1990 is the standard baseline year against which GHG emission reduction efforts are compared, notably those mandated by the Kyoto Protocol. Changes in companies' emissions between 1990 and 1998 indicate medium-term emission trends and are a more reliable measure of companies' climate protection performance than the year-on-year changes reported in section 2.3. As noted in section 2.2, of the 115 companies reporting 1998 emissions to the VCR, 71 also reported their 1990 emissions calculated in a comparable manner. The greatest changes in emissions that occurred between 1990 and 1998 are identified in tables 9-12. Tables 9 and 11 highlight absolute changes, which are most relevant to the impact on the climate. Tables 10 and 12 highlight relative changes, which relate more closely to countries' emission reduction commitments under the Kyoto Protocol (which are expressed as percentages), and draw attention to smaller companies with lower total emissions that have nonetheless changed significantly.

Table 9. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1990 and 1998, and whose emissions increased by more than 500 kt CO_2E between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1990 emissions (kt CO_2E)	Change 1990-98 (kt CO_2E)
TransCanada	Pipelines; electricity generation	17,269	10,396	6,873
EPCOR	Electricity generation	8,582	3,450	5,132
Ontario Hydro	Electricity generation	31,031	26,000	5,031
SaskPower	Electricity generation	14,707	10,585	4,122
New Brunswick Power	Electricity generation	9,700	6,300	3,400
Husky Oil Operations	Oil and gas production and refining	6,483	3,804	2,679
ATCO Electric	Electricity generation	9,500	7,746	1,754
Syncrude Canada	Oil and gas production	8,900	7,220	1,680
Suncor Energy	Oil and gas production and refining	6,160	4,969	1,191
BC Hydro	Electricity generation	2,007	863	1,144
Nova Scotia Power	Electricity generation	7,969	6,830	1,139
Westcoast Energy[a]	Pipelines; natural gas utility; electricity generation	5,218	4,141	1,077
Canadian Occidental Petroleum Oil and Gas Division	Oil and gas production	2,980	2,300	680
Agrium[b]	Chemicals	2,851	2,291	560
Manitoba Hydro	Electricity generation	1,036	525	511

[a] Data probably include emissions associated with purchased electricity but this is not stated explicitly in the company's submission

[b] Data appear to exclude emissions associated with purchased electricity

Table 10. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1990 and 1998, and whose emissions increased by more than one-third between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1990 emissions (kt CO_2E)	% change 1990-98
Enbridge Pipelines (Saskatchewan)	Pipelines	34	14	151
EPCOR	Electricity generation	8,582	3,450	149
BC Hydro	Electricity generation	2,007	863	133
EOG Resources	Oil and gas production	178	77	131
Manitoba Hydro	Electricity generation	1,036	525	97
Husky Injection Molding Systems	Manufacturing	14	7	96
Murphy Oil	Oil and gas production	628	366	72
Husky Oil Operations	Oil and gas production and refining	6,483	3,804	70
TransCanada	Pipelines; electricity generation	17,269	10,396	66
New Brunswick Power	Electricity generation	9,700	6,300	54
Stora Enso Port Hawkesbury[a]	Forest products	246	163	51
Potash Corporation of Saskatchewan, Allan Division	Mining and metals	147	101	45
SaskPower	Electricity generation	14,707	10,585	39

[a] Data exclude emissions associated with purchased electricity

Table 11. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1990 and 1998, and whose emissions decreased by more than 500 kt CO_2E between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1990 emissions (kt CO_2E)	Change 1990-98 (kt CO_2E)
DuPont Canada[a]	Chemicals	5,387	11,239	-5,852
TransAlta	Electricity generation	23,359	25,827	-2,468
Newfoundland and Labrador Hydro	Electricity generation	1,051	1,620	-569

[a] Data exclude emissions associated with electricity sold to Ontario Hydro

Table 12. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1990 and 1998, and whose emissions decreased by more than one-third between those two years.

Company	Sector	1998 emissions (kt CO_2E)	1990 emissions (kt CO_2E)	% change 1990-98
Elf Atochem Canada - Oakville plant	Oil and gas refining	1	2	-59
DuPont Canada[a]	Chemicals	5,387	11,239	-52
Pacifica Papers	Forest products	261	520	-50
Solutia Canada[b]	Chemicals	9	17	-47
Spruce Falls[c]	Forest products	82	152	-46
Conoco Canada	Oil and gas production	81	144	-44
General Motors of Canada	Manufacturing	695	1,131	-39
Newfoundland and Labrador Hydro	Electricity generation	1,051	1,620	-35
Donohue Forest Products[c]	Forest products	379	576	-34

[a] Data exclude emissions associated with electricity sold to Ontario Hydro
[b] Data appear to exclude emissions associated with purchased electricity
[c] Data exclude emissions associated with purchased electricity

Although what counts for protecting the climate is reducing emissions, emissions intensity (emissions per unit of production) is a good indicator of how much effort companies are making to lessen their impact on the climate, independent of whether their level of commercial activity is rising or falling. Of the 115 companies reporting 1998 emissions to the VCR, 58 also reported their 1990 emissions as well as the production figures for both years that are necessary to calculate emissions intensities. Tables 13 and 14 show the worst and best performers in terms of emissions intensity.[16] Table 14 uses a four-percent average annual reduction in emissions intensity as a cutoff. This is roughly the rate of reduction in emissions intensity that Canada's economy as a whole needs to achieve to meet our commitment under the Kyoto Protocol through domestic emission reductions.[17]

[16] Where companies have more than one product, the emissions intensity has calculated for the product that has the highest absolute level of associated emissions.
[17] National Climate Change Process Analysis and Modelling Group, *op. cit.*, p.59.

Table 13. Companies that made a VCR submission by June 30, 2000 stating their emissions and production for 1990 and 1998, and whose emissions intensity increased between those two years.

Company	Sector	1998 emissions (kt CO_2E)	% change in emissions intensity 1990-98
Elf Atochem Canada - Oakville plant	Oil and gas refining	1	272
Placer Dome North America	Mining and metals	140	177
BC Hydro	Electricity generation	2,007	106
Stora Enso Port Hawkesbury[a]	Forest products	246	43
Chevron Canada Resources	Oil and gas production	1,548	34
Manitoba Hydro	Electricity generation	1,036	30
Murphy Oil	Oil and gas production	628	20
Enbridge Pipelines	Pipelines	1,110	16
Imperial Oil	Oil and gas production and refining; chemicals	10,830	14
Canadian Hunter Exploration	Oil and gas production	473	12
SaskPower	Electricity generation	14,707	9
Weyerhaeuser Canada	Forest products	201	5
Pine Falls Paper	Forest products	143	4
Nova Scotia Power	Electricity generation	7,969	3
Abitibi-Consolidated[b]	Forest products	1,531	1
TransCanada	Pipelines; electricity generation	17,269	1

[a] Data exclude emissions associated with purchased electricity

[b] Data appear to exclude emissions associated with some purchased electricity

Table 14. Companies that made a VCR submission by June 30, 2000 stating their emissions and production for 1990 and 1998, and whose emissions intensity decreased between those two years at an average rate of more than 4% per year (i.e., by more than 32% in total).

Company	Sector	1998 emissions (kt CO_2E)	% change per year in emissions intensity 1990-98
DuPont Canada[a]	Chemicals	5,387	-8.1
Husky Injection Molding Systems	Manufacturing	14	-7.9
Dow Chemical Canada	Chemicals	2,239	-7.2
Spruce Falls[b]	Forest products	82	-6.3
Donohue Forest Products[b]	Forest products	379	-6.0
Nexfor[c]	Forest products	592	-5.5
General Motors of Canada	Manufacturing	695	-5.2
Weldwood of Canada	Forest products	370	-5.0
Pacifica Papers	Forest products	261	-4.7
Newfoundland and Labrador Hydro	Electricity generation	1,051	-4.2

[a] Data exclude emissions associated with electricity sold to Ontario Hydro

[b] Data exclude emissions associated with purchased electricity

[c] It is not entirely clear whether data include emissions associated with purchased electricity

3. Data Quality

An important drawback of voluntary reporting of emissions, as solicited by the VCR, is that there is no requirement for companies to use a standard method of calculating emissions data, nor that they even provide clear explanations of how data were calculated. The VCR does offer guidance to participants but it is not comprehensive and is often not followed.[18]

We have encountered the following variations in the methodology used by companies in calculating the emissions they report to the VCR. They are in no particular order.

- Some companies report emissions from facilities they own, while others report emissions from facilities they operate (but do not necessarily wholly own).
- Some companies arbitrarily exclude certain of their facilities from their emissions calculations.
- Most companies include in their emissions total the emissions associated with the generation of the electricity they purchase, but some do not. In the case of electricity producers, it is often not clear how purchases from or sales to other electricity producers have been treated.
- A few companies use non-standard global warming potentials (GWPs) to calculate the carbon dioxide equivalent (CO_2E) amount of gases other than carbon dioxide.
- There are wide discrepancies in the kinds of activities included in emissions calculations. Some companies include emissions associated with their buildings, vehicles and other mobile equipment, and private landfills; many do not.
- Some companies do not report emissions of methane and nitrous oxide, and many companies do not consider emissions of the other three gases covered under the Kyoto Protocol.[19]
- Some companies do not report data for previous years, preventing an assessment of trends. With little justification, several companies have adopted a base year other than 1990, which is the standard. A few companies report emissions for fiscal rather than calendar years.
- Some companies report their emissions or production data only in graphical form, as changes in percentage, or in terms of emissions intensity.
- There are wide variations in the types of GHG offsets (emission reductions or enhancements to GHG "sinks" realized outside the company's normal operations) that companies subtract from their internal emissions. VCR submissions typically provide scant details of offsets and of how they have been quantified. In some cases it is impossible to tell whether an emissions reduction has been achieved inside or outside a company's operations and, in some such cases, the reduction appears to have been counted twice. In addition, there is currently no government-sanctioned certification of offsets. The Pembina Institute therefore makes no assumptions about the quality and credibility of the offsets that have been subtracted from companies' internal emissions in this study. Offsets are further discussed below.
- Some companies adjust their data for previous years by including acquisitions and excluding dispositions made subsequent to those respective years; others do not.[20]

[18] Even when companies follow international guidelines for reporting GHG emissions, the results can be questionable. Most notably, carbon dioxide produced by burning wood waste is assumed to be entirely re-absorbed by growing forests and is therefore not counted in emissions totals. Yet considerable concern exists as to whether current rates of industrial extraction of wood from Canada's forests are in fact sustainable.

[19] Perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride.

[20] Such an adjustment is desirable and helps to clarify emissions trends, because adjusted data for all years apply to the company's *current* operations, even if the company's actual operations were different in the past. Emissions from sold operations should be accounted for by the new owners.

- However, some companies make so many adjustments to their actual internal emissions to account for acquisitions, dispositions, offsets and so on, without clearly documenting them, that it becomes impossible to tell what their actual internal emissions are.
- Companies frequently do not provide production data needed to calculate emissions intensity (emissions per unit of production), a key indicator of how much effort they are making to lessen their impact on the climate.
- Companies with more than one product sometimes fail to report the emissions associated with each product, thereby preventing calculation of a meaningful emissions intensity.
- Companies in the same industrial sector often use different and irreconcilable measures of production, preventing a comparison of their emissions intensities.

The fact that this lengthy catalogue of inconsistencies still exists five years after the VCR program was launched clearly indicates that voluntary reporting of GHG emissions cannot provide information about company-specific emissions at an adequate level of data quality. It is obvious that mandatory reporting is needed.

Since mandatory reporting does not yet exist, we have attempted to partially correct for some of these inconsistencies and generally ensure the best possible data quality in the circumstances by adopting the following guidelines when compiling the results presented in section 2.

- If a company's VCR submission reporting 1998 data does not contain data calculated in a comparable manner for the years 1990 or 1997, we have attempted to obtain it from previous VCR submissions.
- Where companies have used non-standard global warming potentials (GWPs) for gases other than carbon dioxide, we have replaced them by the standard GWPs[21] wherever emissions are disaggregated by gas.
- Where a company possesses GHG offsets (emission reductions or enhancements to GHG "sinks" realized outside the company's normal operations), we have calculated emissions by subtracting claimed offsets from the internal emissions stated in (or deduced from) the submission.[22] In no particular order, offsets that we have subtracted include: sales of flyash for use in cement production; tree planting; landfill gas capture; avoided landfilling of wood waste; composting; recycling; mine land reclamation; agricultural soil enhancement; measures to reduce methane emissions from livestock; and gas-fired cogeneration that displaces coal-fired electricity generation. Very rarely, we excluded an offset, for example, when it was based on rejecting standard GWP values. Table 15 lists the companies that most heavily relied on offsets in 1998.

[21] As established by the Intergovernmental Panel on Climate Change and recommended by the VCR.
[22] VCR submissions typically provide scant details of offsets. In addition, there is currently no government-sanctioned certification of offsets. The Pembina Institute therefore makes no assumptions about the quality and credibility of the offsets we have subtracted from companies' internal emissions in this study.

Table 15. Companies that made a VCR submission by June 30, 2000 stating their emissions for 1998, and which possessed offsets that we subtracted from their internal 1998 emissions exceeding 1% of those internal emissions.

Company	Sector	1998 net emissions after subtracting offsets (kt CO_2E)	Total offsets subtracted (kt CO_2E)	Offsets as % of internal emissions
Husky Injection Molding Systems	Manufacturing	14	9	38
Westcoast Energy	Pipelines; natural gas utility; electricity generation	5,218	571	10
TransAlta	Electricity generation	23,359	1,663	7
EPCOR	Electricity generation	8,582	259	3
Nova Scotia Power	Electricity generation	7,969	86	1

Note: Ontario Hydro's submission states only gross emissions for 1998 (31,031 kt CO_2E), but it describes several offset projects that are expected to amount to 2,400 kt CO_2E in 2000; it is not clear what proportion of these offsets were active in 1998.

3.1 Double Counting of Emissions

The issue of GHG offsets raises the problem of double counting of emissions and emission reductions. If a coal-fired electricity producer sells flyash as a lime substitute to a cement producer, allowing the cement producer to reduce its emissions, which of them "owns" the emission reduction? If the reduction is both assigned to the former as an offset and to the latter as an internal emission reduction, then it has been counted twice. Or if a natural gas supplier generates electricity using highly efficient gas-fired cogeneration, displacing electricity generated in a much more GHG-intense manner from coal, should the reduction be assigned to the former as an offset or to the latter as an internal emission reduction? Currently, there is widespread double counting, amounting to disputed "ownership" of these kinds of emission reductions. In the case of some of the actions of electricity producers to reduce their customers' consumption, the resulting emission reductions appear to have been counted twice by the *same* company—once as a reduction in the company's internal emissions, and a second time as an offset.

The most significant form of double counting among companies reporting emissions to the VCR relates not to offsets but to the fact that most companies include in their corporate emissions total the emissions associated with the generation of the electricity they purchase. These emissions are counted once by the company purchasing the electricity and once by the electricity producer. This is usually accepted to be a desirable convention since it encourages companies to reduce their consumption of energy from all sources.

However, all double counting undermines the mathematical integrity of emissions reporting and exaggerates (by counting twice) the real impact of emissions reductions on the climate. If and when a dollar value is placed on emissions—for example, by a future domestic emissions trading system—an emissions accounting system will need to be in place that includes clear and sensible rules for how to account for and allocate emission reductions. Such an accounting system should be introduced via mandatory emissions reporting.

4. Availability of Company-Specific GHG Emissions Data

Presently, the only organized source of Canadian company-specific GHG emissions data is the website of the Voluntary Challenge and Registry (VCR) program.[23] The government of Québec's ÉcoGESte program,[24] which, like the VCR, encourages voluntary action to reduce emissions by corporations, provides no mechanism for public access to participating companies' submissions, many of which are subject at least in part to confidentiality agreements between the government and the companies.[25] Although there are plans to publish some company-specific ÉcoGESte data,[26] the program remains for the moment essentially a private discussion between bureaucrats and company employees.

This study of VCR submissions and our previous one[27] show that, overall, the level of meaningful participation of Canada's major industrial greenhouse gas emitters in the VCR program is inadequate and showing no signs of improving significantly.

- Of the companies that made a VCR submission by June 30, 2000 stating their emissions for 1998, total emissions for that year were 109.1 Mt CO_2E for the 11 electricity producers, and 131.0 Mt CO_2E for the other 104 companies. These two numbers cannot straightforwardly be added since the latter figure includes a substantial amount of emissions associated with electricity generation that have already been included in the former figure. However, by adding the two we obtain an upper bound for emissions associated with VCR participants who have reported their 1998 emissions: 240 Mt. In section 1.1, we saw that industrial stationary sources (including electricity generation) directly accounted for 51 percent of Canada's GHG emissions in 1998; if emissions from heavy duty and off road vehicles, domestic marine and rail transportation are included—on the grounds that these modes of transportation are used overwhelmingly by industrial operations and to take industrial products to market—the proportion rises to 61 percent. This figure still excludes emissions from commercial buildings and agribusiness, both of which arguably fall under the heading "industry." Yet our upper bound for the emissions of VCR participants who have reported their 1998 emissions is only 35 percent of Canada's total emissions (692 Mt in 1998). We can therefore conclude that companies that are participating meaningfully in the VCR likely represent no more than half of Canada's industrial GHG emissions, and possibly somewhat less than half.
- One hundred companies made a VCR submission during 1998 (12-month period) stating their emissions for 1997;[28] in the current study we have found that 115 companies made a VCR submission by June 30, 2000 (18-month period) stating their emissions for 1998. This is not a significant increase, given the extra six months allowed in this study for companies to report to the VCR. In addition, at the time this study was being conducted, the VCR was claiming over 700 organizations with "Action Plans registered." Five years after the VCR was launched, only about one-sixth of participants are managing to take the basic step of reporting their emissions.

[23] http://www.vcr-mvr.ca/AlphaList.cfm.
[24] http://www.menv.gouv.qc.ca/air/changement/ecogeste.htm.
[25] Roberte Robert, Ministère de l'Environnement du Québec, personal communication.
[26] Roberte Robert, *op. cit*.
[27] Robert Hornung and Matthew Bramley, *op. cit*.
[28] Our report *Five Years of Failure...* (see footnote 4), covering 1997 emissions, lists 106 companies. However, two companies that should have been included escaped our attention (Daishowa, Division de Québec, and Tembec), and we unwittingly included eight companies who made VCR submissions in early 1999 stating 1997 emissions.

- Some of Canada's largest GHG emitters do not report their emissions to the VCR. No companies at all from the aluminum, cement, and iron and steel sectors made VCR submissions by June 30, 2000 stating their emissions for 1998. Yet in 1997 (the most recent year for which full Canadian inventory data is available[29]), emissions in Canada from aluminum production were 10 Mt CO_2E; emissions from cement, lime and soda ash production over 8 Mt, and emissions from iron and steel production also 8 Mt. These figures are for process emissions only and do not include fuel combustion, which is likely to account for many additional megatonnes. In the chemicals sector, only six companies reported their 1998 emissions to the VCR. Most of the others simply submitted the Canadian Chemical Producers' Association report, *Reducing Emissions*, which provides no company-specific emissions data.
- Several major Canadian companies with substantial GHG emissions reported their 1997 emissions to the VCR but then failed to report their 1998 emissions (see table 16).

Table 16. Canadian companies that made a VCR submission stating 1997 emissions exceeding 500 kt CO_2E but did not make a VCR submission by June 30, 2000 stating their emissions for 1998.

Company	Sector	1997 emissions (kt CO_2E)[30]
Canadian Natural Resources	Oil and gas production	2,593
Celanese Canada	Chemicals	1,448
Dofasco	Iron and steel	4,376
Domtar	Forest products	504
Gulf Canada Resources	Oil and gas production	2,381
Methanex	Chemicals	1,070
Noranda	Mining and metals	741
Shell Chemicals Canada	Chemicals	458
St. Lawrence Cement	Cement	1,669
Teck	Mining and metals	659

The analysis presented in this section clearly indicates that voluntary reporting cannot provide information about an adequate proportion of company-specific industrial GHG emissions in Canada. Mandatory reporting is obviously needed.

[29] Neitzert, F., K. Olsen and P. Collas (1999), *Canada's Greenhouse Gas Inventory: 1997 emissions and removals with trend*s, Environment Canada. Available at http://www.ec.gc.ca/press/ghg_m_e.htm.
[30] Data taken from Robert Hornung and Matthew Bramley, *op. cit.*

Appendix. All 115 companies who, by June 30, 2000, made a VCR submission stating their emissions for 1998.

The following table summarizes all the data gathered in this study. Some of the more significant qualifications are made in the notes at the end of the table, but it has not been possible to list here in their entirety the many quirks and variations of the data for individual companies. The most significant of these relate to: exclusion of certain facilities from a company's emissions; treatment of GHG offsets; and adjustment of data for acquisitions and dispositions. See section 3 for a discussion of these issues. We have also not reproduced production data here, except indirectly via emissions intensity changes. Please contact the Pembina Institute if you are interested in gaining access to the complete database from which this table has been drawn.

Except for the column specifying base years, blank spaces in the table indicate that data were not available in a company's VCR submissions, or could not be calculated because data were missing from those submissions.

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Base year emissions (kt CO_2E)	Base year if not 1990	Change in emissions 1997-98 (kt CO_2E)	Change in emissions 1997-98 (%)	Change in emissions intensity 1997-98 (%)	Change in emissions base year -1998 (kt CO_2E)	Change in emissions base year -1998 (%)	Change in emissions intensity base year -1998 (%)
3M Canada	Manufacturing	58	59	60		-2	-3		-2	-4	
Abitibi-Consolidated[a]	Forest products	1,531	2,001	1,998		-471	-24	10	-468	-23	1
Agrium[b]	Chemicals	2,851	2,905	2,291		-54	-2	-5	560	24	-8
Alberta Energy	Oil and gas production; pipelines	2,277	2,035	1,214	1994	242	12	11	1,063	88	-9
Amber Energy	Oil and gas production	527			1998						
Amoco Canada Petroleum	Oil and gas production	6,639		6,263					376	6	
Anderson Exploration	Oil and gas production	2,060	1,875	1,735	1994	185	10	6	325	19	7
ATCO Electric	Electricity generation	9,500	10,096	7,746		-596	-6	-6	1,754	23	-2
ATCO Gas	Natural gas utility	437	476	461		-38	-8	-8	-24	-5	-5
ATCO Pipelines	Pipelines	199		149					50	33	-2
Battle Mountain Canada - Golden Giant Mine	Mining and metals	31	31	29		0	-1		2	8	
Bayer Rubber Division - Sarnia Site[c]	Chemicals	418	517	522		-99	-19	-16	-104	-20	-25
BC Gas Utility	Natural gas utility	196	198	172		-3	-1	-6	24	14	-13
BC Hydro	Electricity generation	2,007	1,244	863		763	61	62	1,144	133	106
Bison Transport	Freight transport	84	70	64	1996	14	19		20	30	
Cabre Exploration	Oil and gas production	150			1998						
Cambior	Mining and metals	6	4	2	1995	2	47		4	163	

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Base year emissions (kt CO_2E)	Base year if not 1990	Change in emissions 1997-98 (kt CO_2E)	Change in emissions 1997-98 (%)	Change in emissions intensity 1997-98 (%)	Change in emissions base year -1998 (kt CO_2E)	Change in emissions base year -1998 (%)	Change in emissions intensity base year -1998 (%)
Canadian Hunter Exploration	Oil and gas production	473	501	406		-27	-5	-5	67	17	12
Canadian Occidental Petroleum Oil & Gas Division	Oil and gas production	2,980	2,826	2,300		155	5	-3	680	30	
Canlan Ice Sports	Leisure services	12	10	6	1994	2	17	-2	6	97	-38
Canor Energy	Oil and gas production	33			1998						
Chevron Canada Resources	Oil and gas production	1,548	1,629	1,433		-81	-5	6	115	8	34
Cominco	Mining and metals	304	297	458	1989	6	2	-4	-154	-34	-32
Conoco Canada	Oil and gas production	81	113	144		-32	-28		-63	-44	
Crestar Energy	Oil and gas production	1,743	1,685	1,185	1994	58	3	-5	558	47	-14
Crestbrook Forest Industries	Forest products	198	197	226		1	1	4	-28	-12	-28
Daishowa, Division de Québec	Forest products	134	123	170		11	9	12	-36	-21	-5
Donohue Forest Products[d]	Forest products	379	399	576		-20	-5	-6	-197	-34	-48
Dow Chemical Canada	Chemicals	2,239	2,271	2,622		-32	-1	-17	-383	-15	-57
DuPont Canada[e]	Chemicals	5,387	10,443	11,239		-5,056	-48	-46	-5,852	-52	-65
Elf Atochem Canada - Oakville plant	Oil and gas refining	1	1	2		0	-20	-33	-1	-59	272
Enbridge Consumers Gas	Natural gas utility	354	365	440		-11	-3	-5	-86	-20	-28
Enbridge Pipelines	Pipelines	1,110	1,131	895		-21	-2	-1	215	24	16
Enbridge Pipelines (Saskatchewan)	Pipelines	34	34	14		0	0	6	21	151	-9
Encal Energy[d]	Oil and gas production	241	269	181	1994	-28	-10	-24	60	33	-39
EOG Resources	Oil and gas production	178	170	77		8	5	-4	101	131	-12
EPCOR	Electricity generation	8,582	7,499	3,450		1,083	14		5,132	149	
Falconbridge	Mining and metals	672	630	605		42	7	0	67	11	-10
Federated Co-operatives	Oil and gas refining; freight transport; forest products	1,108	1,057	1,021	1994	51	5		87	9	
Fletcher Challenge Energy Canada[f]	Oil and gas production	502	504	149	JUL90-JUN91	-2	0	-6	352	236	-32
Ford Motor Company of Canada	Manufacturing	553	683	604	1995	-130	-19	1	-51	-8	-15
Gaz Métropolitain[d]	Natural gas utility	152	154	158		-1	-1		-6	-4	-14
General Motors of Canada	Manufacturing	695	770	1,131		-74	-10	8	-435	-39	-42
Genesis Exploration	Oil and gas production	44	10	10	1997	34	329	102	34	329	102
Husky Injection Molding Systems	Manufacturing	14	11	7		3	31	0	7	96	-63
Husky Oil Operations	Oil and gas production and refining	6,483	6,450	3,804		33	1		2,679	70	
IBM Canada	Manufacturing	73	89	101	1995	-16	-18		-28	-28	
Imperial Oil	Oil and gas production and refining; chemicals	10,830	11,450	10,845		-620	-5	-14	-15	0	14

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Base year emissions (kt CO_2E)	Base year if not 1990	Change in emissions 1997-98 (kt CO_2E)	Change in emissions 1997-98 (%)	Change in emissions intensity 1997-98 (%)	Change in emissions base year -1998 (kt CO_2E)	Change in emissions base year -1998 (%)	Change in emissions intensity base year -1998 (%)
Imperital Tobacco Canada	Manufacturing	41			1998						
Inco	Mining and metals	942	876	998		66	8	5	-56	-6	-7
Kimberly-Clark Nova Scotia[d]	Forest products	65	89	90		-24	-27		-25	-28	
Koch Oil	Oil and gas production; pipelines	311		680	1995				-370	-54	-32
Kodak Canada	Manufacturing	30	32	34		-2	-7		-4	-13	
Kraft Canada	Manufacturing	89	90	99	1996	-2	-2		-11	-11	
Kruger	Forest products	564	530	623		34	6	2	-59	-9	-31
Luscar	Mining and metals	1,055	1,063	902		-8	-1	3	154	17	-2
Manitoba Hydro	Electricity generation	1,036	355	525		681	192	230	511	97	30
Mobil Canada	Oil and gas production	1,636	1,668	1,690		-32	-2	-18	-54	-3	-17
Murphy Oil	Oil and gas production	628	834	366		-206	-25	-17	262	72	20
New Brunswick Power	Electricity generation	9,700	8,600	6,300		1,100	13	-2	3,400	54	
Newfoundland and Labrador Hydro	Electricity generation	1,051	1,243	1,620		-192	-15	-6	-569	-35	-34
Newport Petroleum	Oil and gas production	215	180	169	1996	34	19	28	46	27	-2
Nexfor[g]	Forest products	592	629	770		-37	-6	-6	-178	-23	-44
Northrock Resources	Oil and gas production	354	123	123	1997	230	187	141	230	187	141
Northstar Energy	Oil and gas production	984	1,050	1,026	1995	-66	-6	-6	-42	-4	1
Northwest Territories Power[h]	Electricity generation	175	181	203	fiscal 1990-91	-6	-4	1	-28	-14	-7
NOVA Chemicals[i]	Chemicals	3,827	3,872	4,290		-45	-1	-10	-463	-11	
Nova Scotia Power	Electricity generation	7,969	7,793	6,830		176	2	0	1,139	17	3
Numac Energy	Oil and gas production	327	334	230	1996	-7	-2	0	98	42	16
Ontario Hydro	Electricity generation	31,031	22,815	26,000		8,215	36	40	5,031	19	0
Orenda Aerospace	Manufacturing	8	9	8		-1	-12	-18	0	-3	-14
Oxford Properties - Canterra Tower	Real estate	19	20	25	1991	-1	-7	-7	-6	-24	-24
Pacifica Papers	Forest products	261	379	520		-117	-31	-26	-259	-50	-38
Paramount Resources[b]	Oil and gas production	348	334	261		14	4	-13	87	33	-16
Penn West Petroleum	Oil and gas production	645	608	576	1996	37	6	3	68	12	-2
Petro-Canada	Oil and gas production and refining	6,931	7,338	6,909		-407	-6	-8	22	0	-14
Pine Falls Paper	Forest products	143	146	137		-3	-2	-3	6	5	4
Placer Dome North America	Mining and metals	140	95	114		45	48	25	26	22	177
Poco Petroleums	Oil and gas production	889	570	601	1994	319	56	-19	288	48	-23

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Base year emissions (kt CO_2E)	Base year if not 1990	Change in emissions 1997-98 (kt CO_2E)	Change in emissions 1997-98 (%)	Change in emissions intensity 1997-98 (%)	Change in emissions base year -1998 (kt CO_2E)	Change in emissions base year -1998 (%)	Change in emissions intensity base year -1998 (%)
Potash Corporation of Saskatchewan, Allan Division	Mining and metals	147	126	101		21	17	3	46	45	-15
Potash Corporation of Saskatchewan, Cory Division	Mining and metals	201	187	118	1991	14	7	-1	83	70	-20
Potash Corporation of Saskatchewan, New Brunswick Division	Mining and metals	130	132	96	1993	-2	-1	-10	34	36	0
Potash Corporation of Saskatchewan, Patience Lake Division	Mining and metals	93	102	113	1991	-8	-8	0	-20	-18	-17
Potash Corporation of Saskatchewan, Rocanville Division	Mining and metals	223	211	168		12	6	-5	55	33	-10
PrimeWest Energy	Oil and gas production	170	143	143	1997	27	19	-17	27	19	-17
Ranger Oil	Oil and gas production	997	1,430	1,226	1995	-433	-30	-11	-229	-19	-16
Regent Resources	Oil and gas production	0	0	0	1996	0	20	-4	0	18	-57
Renaissance Energy	Oil and gas production	2,618	1,870	974	1993	748	40	9	1,643	169	6
Renata Resources	Oil and gas production	58	72	72	1997	-14	-20	37	-14	-20	37
Repap New Brunswick[c]	Forest products	263	256	239		7	3	0	24	10	-18
Richland Petroleum	Oil and gas production	27			1998						
Rigel Oil & Gas	Oil and gas production	276		336	1996				-60	-18	7
SaskEnergy/TransGas	Natural gas utility; pipelines	807	795	684		12	2	3	123	18	-4
SaskPower	Electricity generation	14,707	14,366	10,585		340	2	-1	4,122	39	9
Shell Canada	Oil and gas production and refining	7,265	7,600	7,570		-335	-4		-305	-4	
Shiningbank Energy	Oil and gas production	36	36	36	1997	1	2	-7	1	2	-7
Signalta Resources	Oil and gas production	86		68	1994				18	27	15
Solutia Canada[b]	Chemicals	9	11	17		-2	-16		-8	-47	
Spruce Falls[d]	Forest products	82	90	152		-8	-9	-11	-71	-46	-51
St. Laurent Paperboard / Cartons St-Laurent	Forest products	501	493	554		8	2	-7	-53	-10	-13
St. Lawrence Corp.	Manufacturing	7	9	10		-2	-22	-17	-2	-26	-22
Star Oil & Gas	Oil and gas production	170	189	278	1991	-19	-10	-23	-108	-39	-22
Startech	Oil and gas production	85	60	60	1997	25	42	-18	25	42	-18
Stora Enso Port Hawkesbury[d]	Forest products	246		163					83	51	43
Suncor Energy	Oil and gas production and refining	6,160	5,678	4,969		482	8	-6	1,191	24	-23
Syncrude Canada	Oil and gas production	8,900	8,500	7,220		400	5	3	1,680	23	-9
Talisman Energy	Oil and gas production	1,146	910	775	1994	236	26	8	371	48	10

Company	Sector	1998 emissions (kt CO_2E)	1997 emissions (kt CO_2E)	Base year emissions (kt CO_2E)	Base year if not 1990	Change in emissions 1997-98 (kt CO_2E)	Change in emissions 1997-98 (%)	Change in emissions intensity 1997-98 (%)	Change in emissions base year -1998 (kt CO_2E)	Change in emissions base year -1998 (%)	Change in emissions intensity base year -1998 (%)
Toronto Dominion Centre Leaseholds	Real estate	113	116	109	1995	-3	-3	-3	3	3	3
TransAlta	Electricity generation	23,359	24,096	25,827		-737	-3	-2	-2,468	-10	-18
TransCanada	Pipelines; electricity generation	17,269	16,646	10,396		623	4	0	6,873	66	1
Triumph Energy	Oil and gas production	38	21	21	1997	17	82	2	17	82	2
Weldwood of Canada	Forest products	370	349	427		21	6	11	-57	-13	-40
Westaim[c]	Manufacturing; software	4			1998						
Westcoast Energy [j]	Pipelines; natural gas utility; electricity generation	5,218	5,428	4,141		-210	-4	-6	1,077	26	-31
Weyerhaeuser Canada[b]	Forest products	201	207	176		-6	-3	-5	24	14	5

[a] Data appear to exclude emissions associated with some purchased electricity
[b] Data appear to exclude emissions associated with purchased electricity
[c] It is unclear whether data include emissions associated with purchased electricity
[d] Data exclude emissions associated with purchased electricity
[e] Data exclude emissions associated with electricity sold to Ontario Hydro
[f] "1997" data are actually for JUL96-JUN97
[g] It is not entirely clear whether data include emissions associated with purchased electricity
[h] "1997" and "1998" data are actually for fiscal years 1997/98 and 1998/99 respectively
[I] Data exclude emissions associated with purchased electricity; for 1998 these were 798 kt CO_2E, but those for 1990 are not stated in the company's submission
[j] Data probably include emissions associated with purchased electricity but this is not stated explicitly in the company's submission