Summary

CANADA'S 2003 GREENHOUSE GAS INVENTORY

2003 GHG Emission Trends

- Total GHG emissions in Canada in 2003, expressed as "CO_2 equivalent," (CO_2 eq) were 740 Mt. This represents a 3.0 percent increase over the 2002 total of 719 Mt and a 24 percent increase over the 1990 total of 596 Mt. The increase from 2002 to 2003 was primarily due to a colder than average winter, coupled with increases in electricity production, vehicle transport and mining activity. From 2002 to 2003 Canada's GDP grew 1.7 percent.
- Canada's overall GHG emissions intensity – the amount of GHG's emitted per unit of economic activity – was 1.2 percent higher in 2003 than 2002. Since 1990 the economy has grown by more than 42.8 percent (based on GDP), compared to a 24 percent increase in GHG emissions resulting in an average decrease in Canada's GHG emissions intensity of 1 percent per year (see Table 1). The recent positive year-over-year change in GHG intensity is a result of total GHG's growing more than total GDP over the same period.

Major changes from the previous National Inventory Report

Owing to changes in the United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines, carbon dioxide emissions from agricultural soils and non-CO_2 emissions from forest fires are now reported within the Land Use, Land-Use Change and Forestry (LULUCF) sector (previously known as Land-use Change and Forestry). Since the national inventory totals exclude the greenhouse gas emissions and removals from the (LULUCF) sector, these categories, previously included in the national totals, are now excluded. In addition, estimates for emissions from the aluminum production industry, which appear under Industrial Processes - Metal Production, have been revised, as well as the method of allocating emissions between domestic and international aviation. Taken together, these changes are the primary contributors to the revised national GHG estimates.

As a result, total GHG emissions previously reported for 1990 have been revised downward from 609[1] Mt to 596 Mt while emission estimates previously reported for 2002 have been revised downward from 731 Mt to 719 Mt. The overall impact of these changes is that emission growth over the period 1990-2002, previously reported to be 20.1%, is now estimated to be 20.7%.

Table 1 Annual Growth in Canada's GHG Emissions, Economy and GHG Intensity

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
GHG	-1.2%	2.9%	0.4%	3.5%	2.7%	2.6%	1.8%	1.0%	2.0%	3.5%	-1.1%	1.0%	3.0%
GDP	-2.1%	0.9%	2.3%	4.8%	2.8%	1.6%	4.2%	4.1%	5.5%	5.3%	1.9%	3.3%	1.7%
GHG Intensity	0.9%	2.0%	-1.9%	-1.2%	-0.1%	1.0%	-2.3%	-3.0%	-3.4%	-1.7%	-3.0%	-2.2%	1.2%

- Between 2002 and 2003, emissions from almost all sectors were up. Energy, Industrial Process, Solvent, Agriculture and Waste were up by 2.9 percent, 2.0 percent, 0.9 percent, 4.7 percent and 2.2 percent, respectively.
- Between 1990 and 2003, significant growth in exports of natural gas to the United States resulted in a dramatic increase in the emissions associated with the production and transportation of natural gas. In 2003, these emissions were 25.6 Mt, a 101 percent increase over the 1990 level of 12.7 Mt.

Short Term Comparisons: 2002-2003 (figure 1)

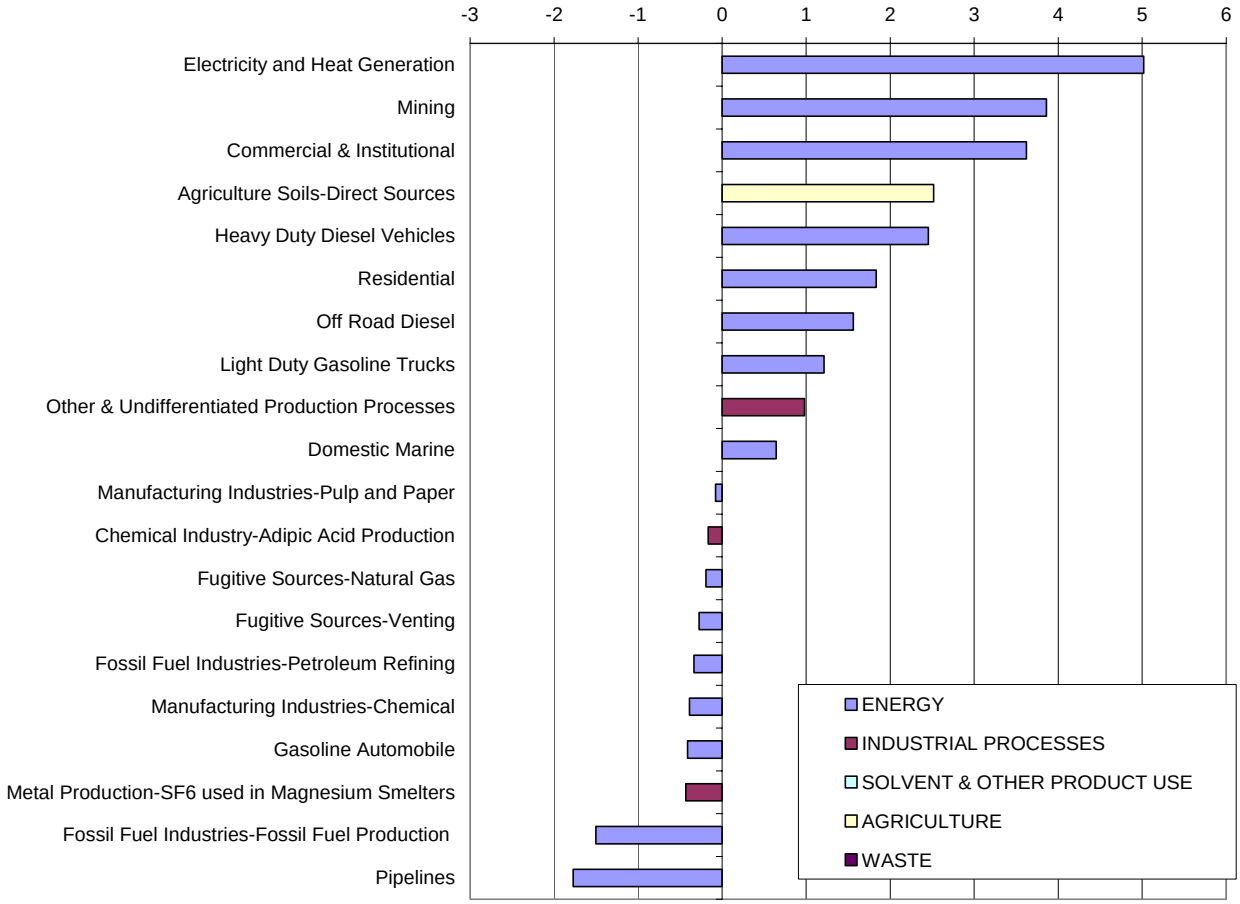
Although year-to-year comparisons do not necessarily indicate a long-term trend, there are some short-term comparisons worth noting:

- On average, Canadian homes and businesses required more energy for space heating in the winter of 2003 than in the winter of 2002 due to either colder temperatures or prolonged cold spells or both. In 2003, Heating Degree Days, an indicator of the necessity for space heating due to the severity of cold weather, were up 5.2 percent when compared to 2002. This fact almost certainly had a large impact on fossil fuel consumption, including the commercial/institutional and residential sectors, where emissions rose by a sum of almost 5.5 Mt from 2002. Overall, activities related to energy production and consumption were responsible for the vast majority of the total year-to-year increase in emissions, accounting for 16.9 Mt of the 21.3 Mt increase.

- The short term growth in emissions from 2002 can be attributed to a 3.9% increase in the combustion emissions from Electricity and Heat Generation, a 33% increase from the combustion emission from Mining, a 10% and 4.2% increase in the commercial/institutional and residential sectors respectively.

- Road transportation as a whole showed a modest increase in greenhouse gas emissions of 2.4 percent, with a 0.8% decrease in emissions from light duty gasoline cars offsetting a 3.0% increase in those from light duty gasoline trucks including pickup trucks, SUVs and some vans. Heavy duty diesel On-Road vehicles increased 6.2% while Off-Road emissions for both gasoline and diesel fueled sources each increased 12%.

Figure 1- Short Term (2002-2003) Changes in Selected Sectors (Mt CO_2 eq)



Long Term Comparisons: 1990-2003 (figure 2)

Sector Trends

Between 1990 and 2003, the net increase in Canada's annual GHG emissions totaled about 144 Mt. Over the same period, emissions from the Energy Industries and Transportation sector increased by 123 Mt, accounting for most of the overall increase.

Within these two sectors, the greatest contributors to the overall increase were the 41 percent increase in emissions from the Electricity and Steam Generation sector (38.9 Mt), and a 25 percent increase from Vehicles (33.1 Mt). Petroleum Industries also contributed significantly, with a total increase in GHG emissions of almost 50 percent between 1990 and 2003. Almost all of the increase in the Petroleum Industries sector is attributable to the rapid growth in crude oil and natural gas exports to the United States over the period.

Some of the growth in these sectors was mitigated by reduced emissions from the Industrial Process sector.

Energy Industries

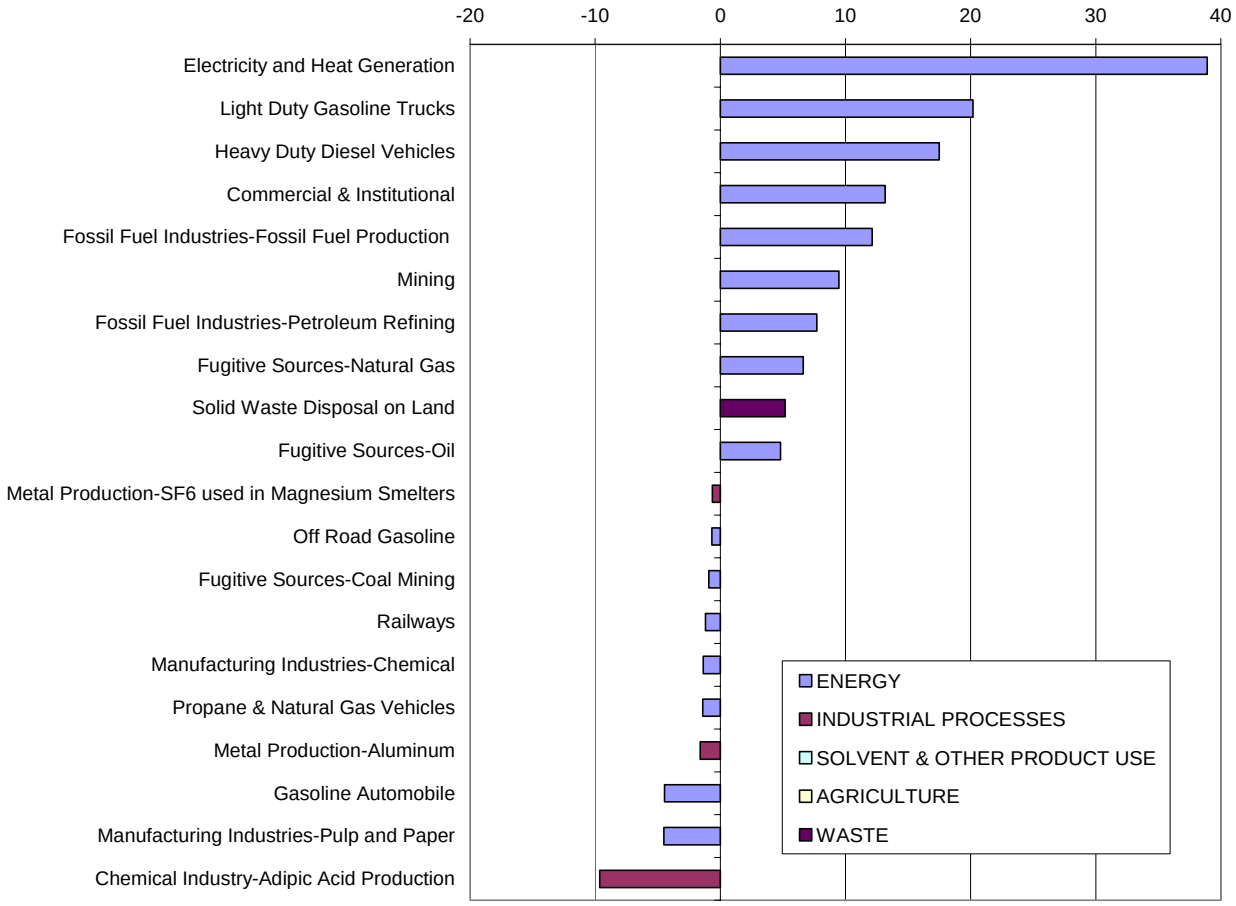
Emissions from Energy Industries (including Fossil Fuel Industries, Electricity and Steam Generation, Mining, Fugitive releases and Combustion emissions from pipelines) rose by about 86.5 Mt between 1990 and 2003. Forty-five percent of that increase (38.9 Mt) was in Electricity and Steam Generation, a result of greater electricity demand coupled with continuing increases in the use of coal-fired generation over the period.

Fugitive releases (e.g. methane leaks from pipelines) contributed just as significantly to GHG emissions. The current estimates show an increase of 16 Mt between 1990 and 2003, a growth of about 42 percent. Most of this increase is the result of greater traffic through energy pipelines, largely due to higher crude oil and natural gas exports to the United States.

Transportation Sector

Emissions in the Transportation sector rose by about 36.7 Mt, or 26 percent from 1990 to 2003. Of particular note in this sector is a 20.2 Mt increase in emissions from light duty gasoline trucks, reflecting the growing popularity of sport utility vehicles. Emissions from heavy-duty diesel vehicles increased 17.5 Mt over the period, indicative of greater heavy truck transport. Offsetting these increases were reductions in emissions attributed to gasoline and alternatively fueled cars of 4.5 Mt and 1.4 Mt respectively.

Figure 2 Long Term (1990-2003) Changes in Selected Sectors (Mt CO_2 eq)



Region **CANADA**
Year **1990**
Table ***Sectoral Greenhouse Gas Emission Summary***

Greenhouse Gas Categories	Greenhouse Gases								
	CO_2	CH_4	CH_4	N_2O	N_2O	HFCs	PFCs	SF_6	TOTAL
Global Warming Potential			21		310				
Unit	kt	kt	kt CO_2 eq	kt	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
TOTAL	**460,000**	**3,500**	**73,000**	**170**	**52,000**		**6,300**	**4,900**	**596,000**
ENERGY	**428,000**	**2,000**	**30,000**	**30**	**8,000**				**469,000**
a. Stationary Sources	**276,000**	**200**	**4,000**	**7**	**2,000**				**282,000**
Electricity and Heat Generation	94,700	1.8	38	2	500				95,300
Fossil Fuel Industries	50,000	80	2,000	1	400				52,000
Petroleum Refining	26,000	0.4	9	0.4	100				26,000
Fossil Fuel Production	23,600	80	2,000	0.7	200				25,000
Mining	6,160	0.1	3	0.1	40				6,200
Manufacturing Industries	54,400	3	60	2	500				54,900
Iron and Steel	6,420	0.2	5	0.2	60				6,490
Non Ferrous Metals	3,210	0.1	1	0.1	10				3,230
Chemical	7,060	0.15	3.0	0.1	40				7,100
Pulp and Paper	13,400	2	40	0.8	200				13,600
Cement	3,570	0.1	1	0.1	10				3,590
Other Manufacturing	20,700	0.4	9	0.4	100				20,900
Construction	1,860	0.03	0.7	0.1	20				1,880
Commercial & Institutional	25,700	0.5	10	0.5	200				25,800
Residential	41,300	100	2,000	2	500				44,000
Agriculture & Forestry	2,400	0.04	0.8	0.1	20				2,420
b. Transportation	**142,000**	**30**	**600**	**20**	**6,000**				**150,000**
Domestic Aviation	6,220	0.5	10	0.6	200				6,400
Road Transportation	103,000	16	350	12	3,600				107,000
Light Duty Gasoline Vehicles	51,600	9.0	190	6.3	2,000				53,800
Light Duty Gasoline Trucks	20,300	4.0	83	4.2	1,300				21,700
Heavy Duty Gasoline Vehicles	2,990	0.42	8.8	0.44	140				3,140
Motorcycles	225	0.18	3.8	0.00	1.4				230
Light Duty Diesel Vehicles	657	0.02	0.4	0.1	10				672
Light Duty Diesel Trucks	578	0.02	0.3	0.04	10				591
Heavy Duty Diesel Vehicles	24,300	1	30	0.7	200				24,500
Propane & Natural Gas Vehicles	2,160	2	40	0.04	10				2,200
Railways	6,320	0.3	7	3	800				7,000
Domestic Marine	4,730	0.4	7	1	300				5,000
Others	22,000	10	300	4	1,000				20,000
Off Road Gasoline	5,000	6	100	0.1	30				5,000
Off Road Diesel	10,000	0.5	10	4	1,000				10,000
Pipelines	6,700	6.7	140	0.2	60				6,900
c. Fugitives	**9,800**	**1,300**	**28,000**						**37,900**
Coal Mining		90	2,000						2,000
Oil and Natural Gas	9,800	1,200	26,000						36,000
Oil	26.9	410	8,500						8,600
Natural Gas	19	820	17,000						17,000
Venting	4,500								4,500
Flaring	5,290	23.6	496						5,800
INDUSTRIAL PROCESSES	**31,700**			**37.1**	**11,500**		**6,300**	**4,900**	**54,400**
a. Mineral Production	**7,800**								**7,800**
Cement	5,600								5,600
Lime	2,000								2,000
Limestone and Soda Ash Use	440								440
b. Chemical Industry	**5,000**			**37.1**	**11,500**				**17,000**
Ammonia Production	5,000								5,000
Nitric Acid Production				2.5	780				780
Adipic Acid Production				34.6	10,700				10,700
c. Metal Production	**9,700**						**6,300**	**3,110**	**19,100**
Iron and Steel Production	7,060								7,060
Aluminum Production	2,600						6,300		8,930
SF_6 Used in Magnesium Smelters and Casters								3,110	3,110
d. Consumption of Halocarbons and SF_6								**1,800**	**1,800**
e. Other & Undifferentiated Production	**9,200**								**9,200**
SOLVENT & OTHER PRODUCT USE				**1.3**	**420**				**420**
AGRICULTURE		**1,040**	**21,800**	**98**	**30,000**				**52,000**
a. Enteric Fermentation		890	18,700						18,700
b. Manure Management		150	3,100	11	3,500				6,600
c. Agriculture Soils				87	27,000				27,000
Direct Sources				70	22,000				22,000
Indirect Sources				20	5,000				5,000
WASTE	**250**	**900**	**19,000**	**3**	**900**				**20,000**
a. Solid Waste Disposal on Land		880	19,000						19,000
b. Wastewater Handling		17	360	3	900				1,200
c. Waste Incineration	250	0.4	9	0.2	50				320
Land Use, Land-use Change and Forestry[1]	**-160,000**	**40**	**830**	**2.3**	**730**				**-150,000**
a. Forest Land	-190,000	40	830	2.3	730				-190,000
b. Cropland[2]	23,000								23,000
c. Grassland	5,000								5,000
d. Wetlands									
e. Settlements	6,000								6,000

Notes:
[1]National totals exclude all GHGs from the Land Use, Land-use Change and Forestry sector. CO_2 from agricutural soils and non-CO_2 emissions from forest fires, which were previously included in national totals, are now excluded.
[2] CO_2 estimates from Cropland include about 16 Mt CO_2 of annual emissions due to land conversion to Cropland
Totals may not add due to rounding.

Region CANADA
Year 2002
Table ***Sectoral Greenhouse Gas Emission Summary***

Greenhouse Gas Categories	Greenhouse Gases								
	CO_2	CH_4	CH_4	N_2O	N_2O	HFCs	PFCs	SF_6	TOTAL
Global Warming Potential			21		310				
Unit	kt	kt	kt CO_2 eq	kt	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
TOTAL	**568,000**	**4,500**	**94,000**	**150**	**48,000**	**3,100**	**2,710**	**4,000**	**719,000**
ENERGY	**528,000**	**2,000**	**40,000**	**30**	**10,000**				**583,000**
a. Stationary Sources	**338,000**	**200**	**5,000**	**8**	**3,000**				**346,000**
Electricity and Heat Generation	128,000	4.7	99	2	700				129,000
Fossil Fuel Industries	70,000	100	2,000	2	500				73,000
Petroleum Refining	34,000	0.5	10	0.5	100				34,000
Fossil Fuel Production	36,200	100	2,000	1	300				39,000
Mining	11,700	0.2	5	0.3	90				11,800
Manufacturing Industries	48,600	3	60	2	500				49,100
Iron and Steel	6,420	0.2	5	0.2	60				6,490
Non Ferrous Metals	3,210	0.07	1	0.05	20				3,220
Chemical	6,090	0.12	2.6	0.1	30				6,130
Pulp and Paper	8,900	2	40	0.9	300				9,210
Cement	4,170	0.08	2	0.05	20				4,180
Other Manufacturing	19,800	0.4	8	0.4	100				19,900
Construction	1,230	0.02	0.5	0.03	9				1,240
Commercial & Institutional	35,200	0.6	10	0.7	200				35,400
Residential	41,000	90	2,000	2	500				44,000
Agriculture & Forestry	2,090	0.03	0.7	0.06	20				2,110
b. Transportation	**174,000**	**30**	**600**	**30**	**8,000**				**180,000**
Domestic Aviation	6,580	0.4	9	0.6	200				6,800
Road Transportation	131,000	12	260	17	5,300				137,000
Light Duty Gasoline Vehicles	47,600	4.0	84	6.7	2,100				49,700
Light Duty Gasoline Trucks	37,900	4.5	95	8.6	2,700				40,700
Heavy Duty Gasoline Vehicles	3,950	0.55	12	0.59	180				4,140
Motorcycles	222	0.18	3.7	0.00	1.3				227
Light Duty Diesel Vehicles	667	0.02	0.4	0.05	20				683
Light Duty Diesel Trucks	738	0.02	0.4	0.05	20				755
Heavy Duty Diesel Vehicles	39,200	2	40	1	400				39,600
Propane & Natural Gas Vehicles	819	1	30	0.02	5				850
Railways	5,280	0.3	6	2	700				6,000
Domestic Marine	5,150	0.4	8	1	300				5,500
Others	26,000	20	300	5	2,000				30,000
Off Road Gasoline	4,000	4	90	0.08	20				4,000
Off Road Diesel	12,000	0.6	10	5	2,000				10,000
Pipelines	10,600	11	220	0.3	90				10,900
c. Fugitives	**16,000**	**1,900**	**39,000**						**54,500**
Coal Mining		50	1,000						1,000
Oil and Natural Gas	16,000	1,800	38,000						53,500
Oil	37.4	640	13,000						13,000
Natural Gas	29	1,100	24,000						24,000
Venting	8,100								8,100
Flaring	7,380	31.1	654						8,000
INDUSTRIAL PROCESSES	**39,200**			**6.65**	**2,060**	**3,100**	**2,710**	**3,960**	**51,000**
a. Mineral Production	**8,600**								**8,600**
Cement	6,700								6,700
Lime	2,000								2,000
Limestone and Soda Ash Use	230								230
b. Chemical Industry	**6,200**			**6.65**	**2,060**				**8,300**
Ammonia Production	6,200								6,200
Nitric Acid Production				2.6	810				810
Adipic Acid Production				4.03	1,250				1,250
c. Metal Production	**12,000**						**2,690**	**2,910**	**17,100**
Iron and Steel Production	7,110								7,110
Aluminum Production	4,400						2,690		7,110
SF_6 Used in Magnesium Smelters and Casters								2,910	2,910
d. Consumption of Halocarbons and SF_6						**3,100**	**19**	**1,000**	**4,200**
e. Other & Undifferentiated Production	**13,000**								**13,000**
SOLVENT & OTHER PRODUCT USE				**1.5**	**470**				**470**
AGRICULTURE		**1,230**	**25,900**	**110**	**33,000**				**59,000**
a. Enteric Fermentation		1,060	22,200						22,200
b. Manure Management		170	3,700	13	4,100				7,800
c. Agriculture Soils				95	29,000				29,000
Direct Sources				74	23,000				23,000
Indirect Sources				20	6,000				6,000
WASTE	**290**	**1,100**	**24,000**	**3**	**1,000**				**25,000**
a. Solid Waste Disposal on Land		1,100	23,000						23,000
b. Wastewater Handling		19	400	3	1,000				1,400
c. Waste Incineration	290	0.3	7	0.2	60				350
Land Use, Land-use Change and Forestry[1]	**-37,000**	**91**	**1,900**	**7.1**	**2,200**				**-33,000**
a. Forest Land	-62,000	91	1,900	7.1	2,200				-58,000
b. Cropland[2]	15,000								15,000
c. Grassland	5,000								5,000
d. Wetlands									
e. Settlements	6,000								6,000

Notes:
[1]National totals exclude all GHGs from the Land Use, Land-use Change and Forestry sector. CO_2 from agricutural soils and non-CO_2 emissions from forest fires, which were previously included in national totals, are now excluded.
[2] CO_2 estimates from Cropland include about 16 Mt CO_2 of annual emissions due to land conversion to Cropland
Totals may not add due to rounding.

Region CANADA
Year 2003
Table ***Sectoral Greenhouse Gas Emission Summary***

Greenhouse Gas Categories	Greenhouse Gases								
	CO_2	CH_4	CH_4	N_2O	N_2O	HFCs	PFCs	SF_6	TOTAL
Global Warming Potential			21		310				
Unit	kt	kt	kt CO_2 eq	kt	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
TOTAL	**586,000**	**4,500**	**94,000**	**160**	**50,000**	**3,100**	**2,760**	**4,100**	**740,000**
ENERGY	**546,000**	**2,000**	**40,000**	**30**	**10,000**				**600,000**
a. Stationary Sources	**351,000**	**200**	**5,000**	**9**	**3,000**				**358,000**
Electricity and Heat Generation	133,000	5.0	110	2	800				134,000
Fossil Fuel Industries	69,000	100	2,000	2	500				71,000
Petroleum Refining	34,000	0.5	10	0.5	100				34,000
Fossil Fuel Production	34,800	100	2,000	1	300				38,000
Mining	15,600	0.3	7	0.3	100				15,700
Manufacturing Industries	48,600	3	60	2	500				49,200
Iron and Steel	6,360	0.2	5	0.2	60				6,420
Non Ferrous Metals	3,190	0.07	1	0.05	20				3,200
Chemical	5,700	0.12	2.5	0.1	30				5,740
Pulp and Paper	8,820	2	40	0.9	300				9,130
Cement	4,180	0.08	2	0.05	10				4,200
Other Manufacturing	20,400	0.4	9	0.4	100				20,500
Construction	1,290	0.02	0.5	0.03	9				1,300
Commercial & Institutional	38,800	0.7	10	0.8	200				39,000
Residential	42,800	90	2,000	2	500				45,000
Agriculture & Forestry	2,200	0.04	0.8	0.06	20				2,210
b. Transportation	**179,000**	**30**	**600**	**30**	**8,000**				**190,000**
Domestic Aviation	7,000	0.4	9	0.7	200				7,200
Road Transportation	135,000	12	260	17	5,100				140,000
Light Duty Gasoline Vehicles	47,300	3.7	78	6.3	1,900				49,300
Light Duty Gasoline Trucks	39,200	4.5	94	8.4	2,600				41,900
Heavy Duty Gasoline Vehicles	3,950	0.55	12.0	0.59	180				4,140
Motorcycles	221	0.18	3.7	0.00	1.3				226
Light Duty Diesel Vehicles	706	0.02	0.4	0.05	20				723
Light Duty Diesel Trucks	775	0.02	0.4	0.06	20				793
Heavy Duty Diesel Vehicles	41,600	2	40	1	400				42,000
Propane & Natural Gas Vehicles	780	1	30	0.02	5				810
Railways	5,260	0.3	6	2	700				6,000
Domestic Marine	5,830	0.5	10	1	300				6,100
Others	26,000	10	300	6	2,000				30,000
Off Road Gasoline	4,000	5	100	0.09	30				4,000
Off Road Diesel	13,000	0.7	10	5	2,000				20,000
Pipelines	8,850	8.8	190	0.2	70				9,110
c. Fugitives	**15,000**	**1,800**	**39,000**						**54,000**
Coal Mining		50	1,000						1,000
Oil and Natural Gas	15,000	1,800	38,000						53,000
Oil	47.1	630	13,000						13,000
Natural Gas	29	1,100	24,000						24,000
Venting	7,800								7,800
Flaring	7,380	31.2	654						8,000
INDUSTRIAL PROCESSES	**40,200**			**6.1**	**1,890**	**3,100**	**2,760**	**4,070**	**52,000**
a. Mineral Production	**8,700**								**8,700**
Cement	6,800								6,800
Lime	2,000								2,000
Limestone and Soda Ash Use	230								230
b. Chemical Industry	**6,200**			**6.1**	**1,890**				**8,100**
Ammonia Production	6,200								6,200
Nitric Acid Production				2.6	810				810
Adipic Acid Production				3.5	1,090				1,090
c. Metal Production	**12,000**						**2,740**	**2,480**	**16,800**
Iron and Steel Production	7,040								7,040
Aluminum Production	4,600						2,740		7,320
SF_6 Used in Magnesium Smelters and Casters								2,480	2,480
d. Consumption of Halocarbons and SF_6						**3,100**	**19**	**1,600**	**4,700**
e. Other & Undifferentiated Production	**14,000**								**14,000**
SOLVENT & OTHER PRODUCT USE				**1.5**	**480**				**480**
AGRICULTURE		**1,240**	**26,100**	**120**	**36,000**				**62,000**
a. Enteric Fermentation		1,070	22,400						22,400
b. Manure Management		170	3,700	13	4,100				7,800
c. Agriculture Soils				100	32,000				32,000
Direct Sources				82	25,000				25,000
Indirect Sources				20	7,000				7,000
WASTE	**290**	**1,100**	**24,000**	**3**	**1,000**				**25,000**
a. Solid Waste Disposal on Land		1,100	24,000						24,000
b. Wastewater Handling		19	410	3	1,000				1,400
c. Waste Incineration	290	0.3	7	0.2	60				360
Land Use, Land-use Change and Forestry[1]	**-46,000**	**43**	**900**	**3.2**	**1,000**				**-44,000**
a. Forest Land	-71,000	43	900	3.2	1,000				-69,000
b. Cropland[2]	14,000								14,000
c. Grassland	5,000								5,000
d. Wetlands									
e. Settlements	6,000								6,000

Notes:
[1]National totals exclude all GHGs from the Land Use, Land-use Change and Forestry sector. CO_2 from agricutural soils and non-CO_2 emissions from forest fires, which were previously included in national totals, are now excluded.
[2] CO_2 estimates from Cropland include about 16 Mt CO_2 of annual emissions due to land conversion to Cropland
Totals may not add due to rounding.