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EnviroStats

Winter 2009 Vol. 3, no. 4

In this issue:

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Population 2007 to 2008 Percentage change	1.2%	Particulate matter ($PM_{2.5}$) 2000 to 2006	No significant trend
Gross domestic product, monthly September 2009 Percentage change	0.4%	Ground-level ozone 1990 to 2006 Median percent change per year	0.7%
Greenhouse gas emissions 2006 to 2007 Percentage change	4.0%	Natural resource wealth 2007 to 2008 Percentage change	45.3%

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published

The Canadian manufacturing industry: Investments and use of energy-related processes or technologies

Sheri Vermette, Environment Accounts and Statistics Division

Energy is essential in all facets of today's society. However, energy use is one of the primary contributors to environmental degradation and climate change. In Canada, total energy production and consumption accounted for over 80% of its greenhouse gas (GHG) emissions in 2006.[1] As a result the Government of Canada has committed to reducing the country's GHG emissions by 20% from 2006 levels by 2020.[2]

The use of energy-related processes or technologies (Text box: Concepts and definitions) enables businesses to reduce their GHG emissions in one of two ways: by reducing the amount of energy used by improving energy efficiency, or by using 'cleaner' energy sources that produce fewer pollutants and GHG emissions for the same amount of energy use.

In 2006, the manufacturing sector accounted for 23% of the energy used in Canada.[3] This article will focus on the manufacturing sector's use of energy-related processes and technologies and related investment.

Within the manufacturing sector the largest investor in energy-related processes and technologies was the paper manufacturing industry, followed closely by the wood products industry. Combined, these two industries accounted for over 40% of the total capital invested by the manufacturing sector in energy-related processes or technologies for 2006.

Energy consumption

Canada is one of the largest energy users in the world. The vast distances, cold climate, energy-intensive industrial base, and relatively low energy prices all contribute to the country's high energy consumption.[4]

Within the manufacturing sector, the paper manufacturing, primary metals, and petroleum and coal products manufacturing industries were the largest energy consumers. Combined, these three industries accounted for 65% of the total energy used by the manufacturing sector in 2006.[5]

The paper manufacturing industry used more energy than any other industry in the sector, consuming 678,627 terajoules (TJ) of energy in 2006. One thousand terajoules equals roughly the amount of

What you should know about this study

Data sources

The primary data source for this paper is the 2006 Survey of Environmental Protection Expenditures (SEPE). The purpose of the survey is to provide a measure of the expenditures made by Canadian industry for environmental protection in response to or in anticipation of environmental regulations, conventions and voluntary agreements.

In addition to collecting information on the cost to comply with environmental regulations, respondents were also asked to report on the following: their use of energy-related processes or technologies; the associated operating and capital costs; and the obstacles and drivers affecting decisions to adopt the technology. This article will analyse the results of these questions for the 2,559 manufacturing establishments that were sampled for the 2006 survey.

The survey underwent a thorough redesign for the 2006 reference year to improve the overall methodology and data quality indicators, as well as to improve the coverage for smaller businesses. The redesign prevents comparisons with previous survey results. This article focuses solely on the 2006 estimates.

Additional data for the manufacturing sector were used including:

- Total annual energy consumption by industry group from the Industrial Consumption of Energy Survey
- Total capital expenditures on machinery and equipment from the 2006 Capital Repair and Expenditures Survey.

1. Environment Canada, 2008, *Canada's Greenhouse Gas Emissions: Understanding the Trends, 1990–2006,* Catalogue no. En81-4/2006-2E, www.ec.gc.ca/pdb/GHG/inventory_report/2008_trends/trends_eng.cfm (accessed November 4, 2009).
2. Environment Canada, 2009, *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act – May 2009,* Gatineau, Quebec, www.ec.gc.ca/doc/ed-es/KPIA2009/tdm-toc_eng.htm (accessed November 4, 2009.
3. Statistics Canada, CANSIM table 128-0009 (accessed July 15, 2009).
4. Environment Canada, 2002, *Environmental Signals: Canada's National Environmental Indicator Series 2003,* Catalogue no. En40-755/2002E, www.ec.gc.ca/soer-ree (accessed April 7, 2009).
5. Statistics Canada, CANSIM table 128-0006 (accessed July 15, 2009).

Concepts and definitions

Energy-related processes or technologies are processes and technologies that can either reduce the amount of energy used for a process, or reduce the amount of GHG emissions and air pollutants produced through the production and use of energy. In the second case, this could mean switching from one fuel type to another, which does not necessarily equate to a reduction in energy consumption, but may lead to a reduction in air pollutants or GHG emissions.

For the purpose of this paper, energy-related processes or technologies are limited to the list below. Respondents to the Survey of Environmental Protection Expenditures were asked if they used any of the following energy-related processes or technologies:

- **Cogeneration:** systems and equipment used to produce both heat and electricity from biomass (organic matter from forest and agricultural sources), waste and industrial residues and other fuel sources.
- **Alternative fuel systems or equipmen**t: process equipment for production or use of biofuels (ethanol, biodiesel); clean fuel systems (reformulated fuel and oxygenated fuels); fuel cell technologies; hydrogen (production, storage, distribution and use, infrastructure); and advanced batteries. Also included are industrial equipment and engine systems that use alternative fuels.
- **Fuel substitution systems or equipment:** switching from a carbon fuel such as coal or petroleum to a lower carbon (such as natural gas) or carbon-free fuel.
- **Waste energy recovery/reuse:** a conservation system whereby some space heating or water heating is done by actively capturing by-product heat that would otherwise be ejected into the environment.
- **Energy management or monitoring systems to improve energy efficiency:** an energy conservation feature that uses computers, instrumentation, control equipment and software to manage a building's energy use for heating, ventilation, air-conditioning, lighting and business-related processes.
- **Performed an energy audit in the last three years (2004 to 2006):** an analysis of the energy consuming systems within a facility and the identification of potential areas for reducing energy consumption.

Renewable energy sources:

- **Small, mini or micro-hydroelectric facility:** classifications are based on the amount of energy generated by the facility. Small hydro = 1 MW to 25 MW of energy (50 MW in BC), mini-hydro = 100 kW to 1000 kW, and micro-hydro = less than 100 kW of energy.
- **Solar energy systems or equipment:** active and passive solar systems; photovoltaic; solar thermal generators; solar water and space heating systems.
- **Wind energy systems or equipment:** horizontal and vertical axis turbines; towers and other types of equipment used to generate energy.
- **Biomass energy:** systems and equipment (turbines, boilers, process equipment) that use organic matter such as forest and agricultural residues to produce electricity, steam or heat.
- **Geothermal:** hot water or steam extracted from the Earth's interior and used for geothermal heat pumps, water heating or electricity generation.

Energy efficiency refers to using less energy to provide the same level of energy service.
Energy intensity is the ratio of energy consumption to gross domestic product (GDP).

energy required to operate the Montréal subway system for one year. A large portion of the energy used by the paper manufacturing industry is in the pulping process.[6]

However, it is not enough to simply look at the total amount of energy consumed by an industry. There are a number of factors that can influence the amount of energy used by a particular industry, such as its level of economic activity, its structure and how efficiently it uses energy.[7]

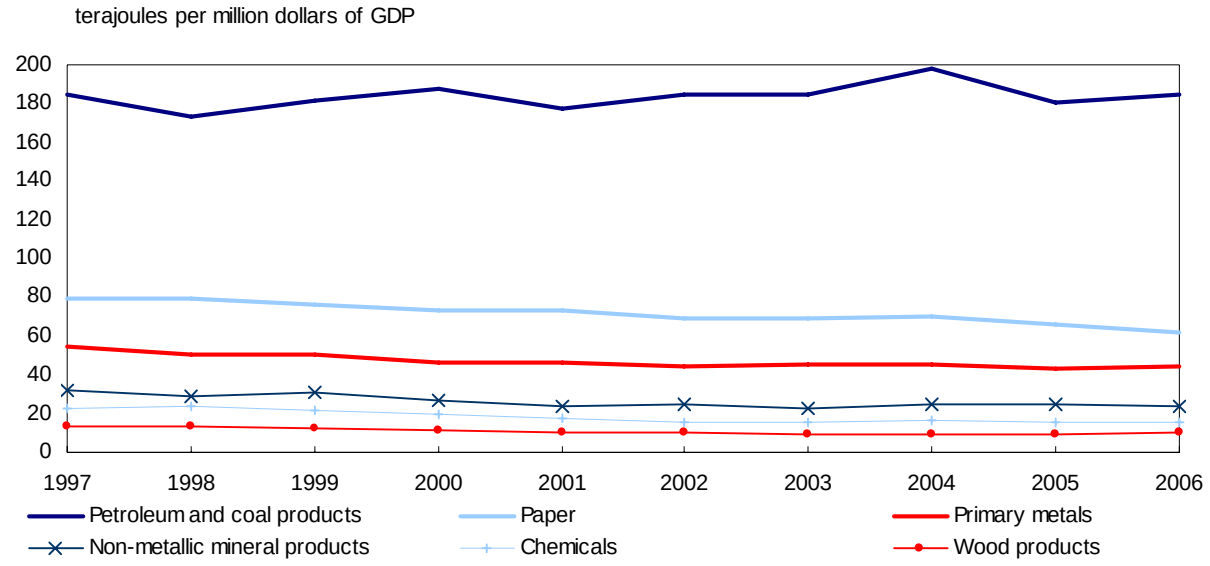
The manufacturing sector is composed of a diverse range of industries which can make comparisons difficult. But one way to do so is to look at the "intensity" of energy use.

Energy intensity, for the purpose of this study, is the ratio of the amount of energy used by an industry per million dollars of GDP it produces. Industries in the manufacturing sector have been classified according to their energy intensity in 2006 as follows:

- **Energy-intensive industries used over 40 TJ per million dollars of GDP.** The petroleum and coal products, paper, and primary metals

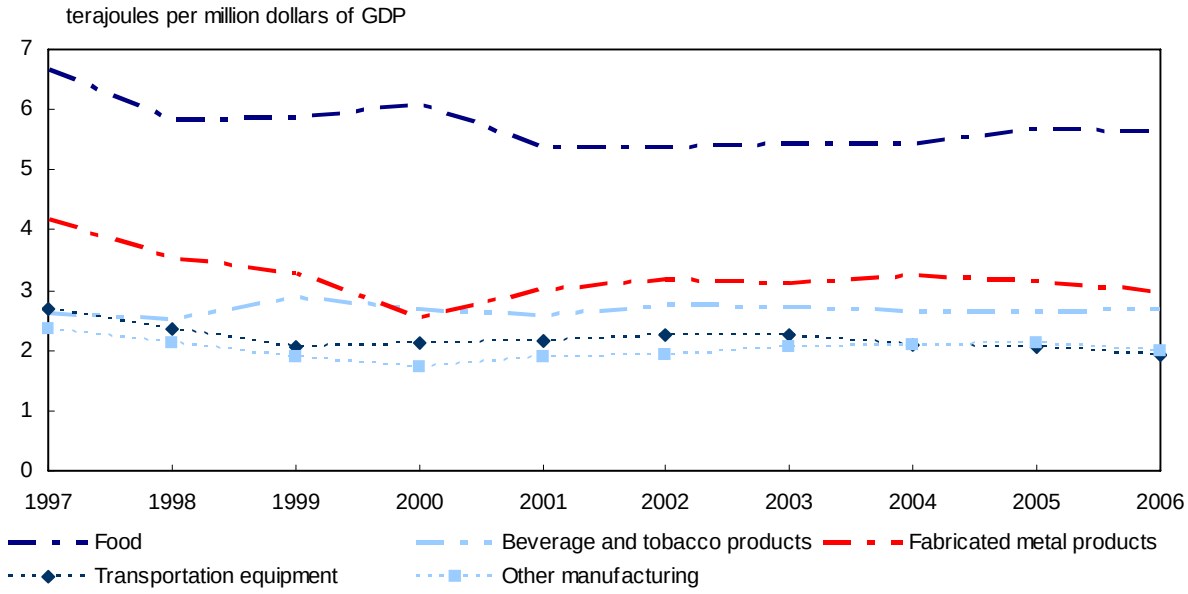
6. Natural Resources Canada, 2008, *Industrial Consumption of Energy (ICE) Survey, Summary Report of Energy Use in the Canadian Manufacturing Sector, 1995-2005,* Catalogue no. M144-154/2007E, http://oee.nrcan.gc.ca/Publications/statistics/ice05/index.cfm?attr=0 (accessed November 4, 2009).
7. Natural Resources Canada, 2006, *Energy Efficiency Trends in Canada 1990 to 2004,* Office of Energy Efficiency, Catalogue no. M141-1/2004, http://oee.nrcan.gc.ca/publications/statistics/trends06/index.cfm?attr=0 (accessed November 4, 2009).

Chart 1
Energy intensity of 'intensive' and 'moderately-intensive' manufacturing industries, 1997 to 2006



Note(s):
For the purposes of this study, energy-intensive industries used over 40 TJ per million dollars of GDP and moderately-energy-intensive industries used 10 to 39 TJ per million dollars of GDP.
Source(s):
Statistics Canada, CANSIM tables 128-0006 and 379-0017 (accessed July 15, 2009).

Chart 2
Energy intensity of 'non-intensive' manufacturing industries, 1997 to 2006



Note(s):
For the purpose of this study, non-energy-intensive industries used less than 10 TJ per million dollars of GDP.
Source(s):
Statistics Canada, CANSIM tables 128-0006 and 379-0017 (accessed July 15, 2009).

manufacturing industries are included in this group.

- **Moderately-energy-intensive industries used 10 to 39 TJ per million dollars of GDP.** Included in this group are the non-metallic mineral products, chemicals, and wood products manufacturing industries.
- **Non-energy-intensive industries used less than 10 TJ per million dollars of GDP.** This group is composed of the food, fabricated metal products, beverage and tobacco products, and transportation equipment industries, as well as the 'other manufacturing' category.

The petroleum and coal products manufacturing industry was by far the most energy-intensive industry in the manufacturing sector, consuming on average almost 200 TJ of energy per million dollars of GDP (Chart 1). In 2006, this industry had an energy intensity three times higher than the next most energy-intensive industry, paper manufacturing.

In comparison, non-energy-intensive industries used less than 6 TJ per million dollars of GDP in 2006 (Chart 2). To put it another way, these industries each used less than one thirtieth of the energy used by the petroleum and coal products industry for the year.

Energy-related process or technology use by the manufacturing sector

In 2006, almost a quarter of establishments in the manufacturing sector used some form of energy-related process or technology (Table 1). The most widely reported were the use of waste energy recovery technologies, energy management or monitoring systems, and the implementation of an energy audit.

Renewable energy technologies were less likely to be reported by the manufacturing sector. One notable exception was the use of biomass energy technology in both the wood products and paper manufacturing industries. Biomass, in the form of sawdust, bark and other wood wastes, is produced as a by-product during the manufacturing processes used by both these industries, making it a convenient source of alternative fuel.

The manufacturing sector spent close to a billion dollars on energy-related processes or technologies in 2006 (Table 2). Most of this amount was allocated to day to day operations. Businesses in the manufacturing sector that reported high operating expenditures (over $5 million), also reported the use of cogeneration and waste energy recovery technologies.

The capital this sector invested on energy-related processes or technologies represented 1.8% of the total capital spent by manufacturers on machinery and equipment in 2006 (Table 3).

Drivers and obstacles to improving energy efficiency

The adoption of energy-related processes or technologies is one way industries can reduce energy consumption and the resulting GHG emissions. However, these are not the only reasons a business would adopt such practices. High energy costs may also motivate businesses to look for alternative, cheaper sources of energy, or to adopt energy-saving technologies. Some studies have shown that businesses with a history of investing in practices such as using alternative energy sources and reducing waste and emissions tend to perform better then those who do not.[8]

Manufacturers reported that a sufficient return on investment was the most important driver when deciding to adopt a technology to improve their energy efficiency, while the high cost of equipment was the most important obstacle. Overall, a higher percentage of energy-intensive industries reported drivers to improve energy efficiency than moderate or non- energy-intensive industries. Interestingly, the same was true for the obstacles.

Energy-intensive industries: are they doing more?

Overall, 46% of establishments in energy-intensive industries used an energy-related process or technology, compared to just under 20% in non-energy-intensive industries. Energy-intensive industries tended to use several different energy-related processes or technologies. Over 20% of each of these industries used more than two energy-related processes or technologies (Chart 3). In particular, over 12% of the paper manufacturing industry used five or more technologies.

8. Mahler, D., J. Barker, L. Besland, and O. Schulz, 2009, *"Green" Winners: The performance of sustainability-focused companies during the financial crisis,* http://atkearney.com (accessed April 15, 2009).

Table 1
Distribution of energy-related process or technology use by the manufacturing sector, by industry, 2006

	Cogeneration	Alternative fuel systems or equipment	Fuel substitution	Waste energy recovery/ reuse	Use of energy management or monitoring systems	Performed energy audit past three years (2004-2006)	Other systems, equipment or employee training
	percent[1]						
Total	**2**	**2**	**2**	**12**	**10**	**9**	**5**
Petroleum and coal products	4	7	21	36	28	24	25
Paper	11	8	11	28	22	29	6
Primary metals	1	4	3	24	37	33	20
Non-metallic mineral products	0	2	5	8	9	10	4
Chemicals	4	5	6	23	14	16	15
Wood products	8	5	5	26	12	7	2
Food	1	1	2	19	17	22	13
Fabricated metal products	0[s]	1	0[s]	4	8	4	2
Beverage and tobacco products	0	13	x	24	34	10	5
Transportation equipment	x	1	x	9	20	14	7
Other manufacturing	1	0[s]	2	8	5	5	3

Table 1 continued…

	Renewable energy technologies						
	Small, mini- or micro-hydroelectric facility	Solar energy systems or equipment	Wind energy systems or equipment	Biomass energy[2]	Geothermal	Other renewable energy systems or equipment	**Total[3]**
	percent[1]						
Total	**0[s]**	**0[s]**	**0[s]**	**2**	**0[s]**	**1**	**24**
Petroleum and coal products	0	x	0	x	0	0	59
Paper	3	x	x	16	0	1	42
Primary metals	1	0	0	x	0	1	49
Non-metallic mineral products	0	1	0	1	0	x	24
Chemicals	0	0	0	x	x	1	35
Wood products	0	1	0	21	1	1	47
Food	0	x	0	1	0	1	41
Fabricated metal products	0	0	0	0[s]	0	x	15
Beverage and tobacco products	0	0	0	0	0	x	38
Transportation equipment	0	0[s]	7	0	0[s]	0	32
Other manufacturing	0	x	0	x	0[s]	1	13

1. Percentage of establishments using each technology.
2. Examples include energy crops and waste-to-energy.
3. Percentage of establishments that used at least one energy-related process or technology.

Source(s):
Statistics Canada, Environment Accounts and Statistics Division.

Table 2
Total operating and capital expenditures on energy-related processes or technologies by the manufacturing sector, by industry, 2006

	Operating	Capital	**Total**
	million dollars		
Total	**633.7**	**305.6**	**939.3**
Petroleum and coal products	22.4	33.6	**56.0**
Paper	266.6	69.5	**336.1**
Primary metals	5.2	14.1	**19.4**
Non-metallic mineral products	3.5	4.3	**7.9**
Chemicals	113.7	19.4	**133.1**
Wood products	158.0	59.5	**217.5**
Food	38.3	36.7	**75.0**
Fabricated metal products	1.6	F	**F**
Beverage and tobacco products	4.0	F	**7.2**
Transportation equipment	14.9	4.6	**19.5**
Other manufacturing	5.5	31.9	**37.4**

Note(s):
Figures may not add up to totals due to rounding.
Source(s):
Statistics Canada, Environment Accounts and Statistics Division.

Combined, the petroleum and coal products, paper, and primary metal manufacturing industries accounted for 38% of the total capital invested by the manufacturing sector for energy-related processes or technologies. These industries represent less than 10% of the businesses in the manufacturing sector, and account for approximately 14% of the sector's GDP.

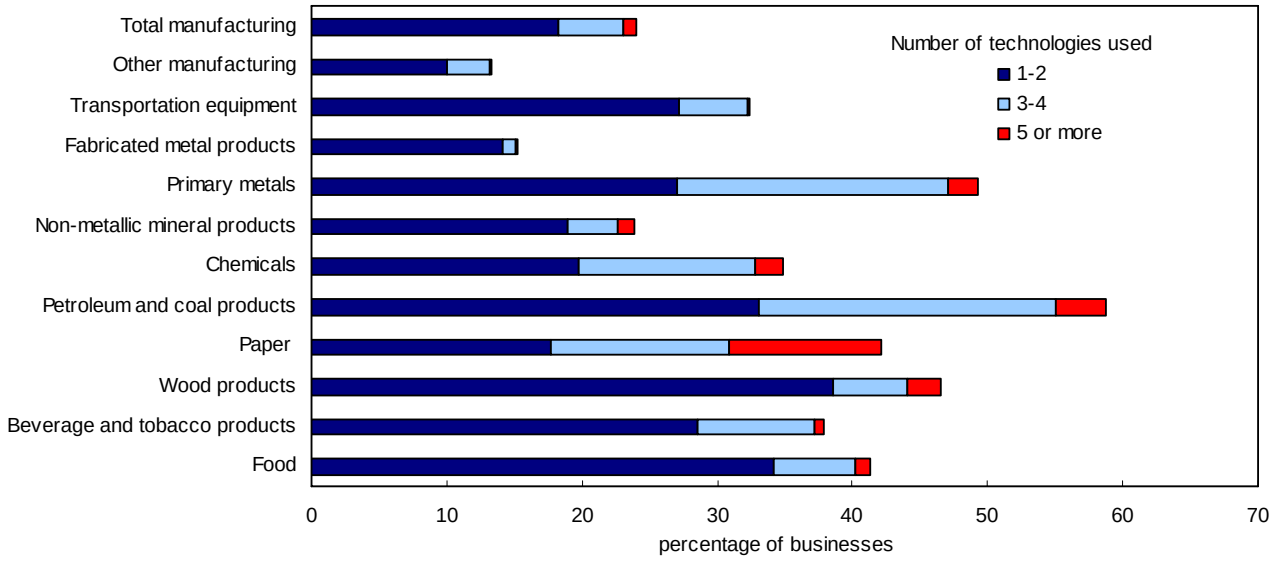
However, the paper manufacturing industry was the only energy-intensive industry to direct over 2% of its total capital spending to energy-related processes or technologies (Table 4). Less energy-intensive industries, such as wood, chemicals and food manufacturing, directed a larger proportion of their total capital spending for energy-related purposes than both the petroleum and coal products, and the primary metals manufacturing industries.

Petroleum and coal products manufacturing

The energy intensity of the petroleum and coal products manufacturing industry decreased by 0.2 TJ per million dollars GDP from 1997 to 2006 (Chart 1).

Almost 60% of this industry indicated the use of at

Chart 3
Distribution of establishments in the manufacturing sector using energy-related processes or technologies, 2006



Source(s):
Statistics Canada, Environment Accounts and Statistics Division.

least one energy-related process or technology in 2006. Between 21% and 36% of businesses in the petroleum and coal products industry reported using waste energy recovery, energy management or monitoring, fuel substitution and the implementation of an energy audit (Table 1).

The petroleum and coal products industry invested $34 million in energy-related processes or technologies in 2006 (Table 2). This amount represents 1.4% of the total capital the industry spent on machinery and equipment for the year. However, reducing energy consumption is not the only competitor for this industry's environmental investment dollar.

Pollution prevention is also a priority for the petroleum and coal products manufacturing industry. The 2006 SEPE results show that investments in pollution prevention by the petroleum and coal industry totalled $533 million in 2006,[9] representing 89% of their total overall investment in environmental protection. The industry is required by federal regulations to produce cleaner fuels with lower sulphur and benzene content. In 2006, new restrictions were introduced, setting gradually more restrictive limits on sulphur content of diesel fuel starting in 2007 through to 2012.[10]

Table 3
Capital expenditures for the manufacturing sector, by industry, 2006

	Capital expenditures		Percentage of capital spent on energy-related processes or technologies
	Machinery and equipment	Energy-related process or technology	
	million dollars		percent
Total	**16,687**	**306**	**1.8**
Petroleum and coal products	2,380	34	1.4
Paper	1,232	70	5.6
Primary metals	1,193	14	1.2
Non-metallic mineral products	637	4	0.7
Chemicals	932	19	2.1
Wood products	1,192	60	5.0
Food	1,281	37	2.9
Fabricated metal products	692	F	F
Beverage and tobacco products	408	F	F
Transportation equipment	3,764	5	0.1
Other manufacturing	2,976	32	1.1

Note(s):
Figures may not add up to totals due to rounding.
Source(s):
Statistics Canada, Environment Accounts and Statistics Division.
Statistics Canada, CANSIM table 029-0009 (accessed July 15, 2009).

Paper manufacturing

Between 1997 and 2006, the paper manufacturing industry reduced its energy intensity by 17 TJ per million dollars of GDP (Chart 1). This was mostly achieved through the substitution of biomass for fossil fuels and the use of small hydro-electric facilities.[11] This industry reported the highest use of cogeneration technology. It was also one of the few industries to use renewable energy sources, using both biomass and hydroelectric energy technologies (Table 1). For more information on use of renewable fuels by the pulp and paper industry, please see Text box: Pulp and Paper.

Pulp and paper

This subset of the paper manufacturing industry is the largest industrial energy consumer in the manufacturing sector.

The pulp and paper industry adopted a strategy to substitute biomass for fossil fuel and use more self-generated energy. These sources provide 60% of the industry's energy, making pulp and paper Canada's greatest industrial user of renewable energy sources.[1]

Looking only at pulp and paper businesses in the paper manufacturing industry, 51% used biomass energy technologies and 10% used small hydro-electric facilities in 2006.

1. Natural Resources Canada, 2007, *Canadian Industry Program for Energy Conservation, Annual Report 2007: Seven ideas that can change your world,* Catalogue no. M141-3-2006E.

9. Statistics Canada, 2008, *Environmental Protection Expenditures in the Business Sector 2006*, Catalogue. no. 16F0006X.
10. Canadian Environmental.com, 2006, *Canadian Environmental Regulation and Compliance News,* Vol.17. no 2, www.canadianenvironmental.com/marketplace/marketplace_detail.cfm?RecordID=2517 (accessed November 4, 2009).
11. Natural Resources Canada, 2007, *Canadian Industry Program for Energy Conservation, Annual Report 2007: Seven ideas that can change your world,* Catalogue no. M141-3-2006E, http://oee.rncan.gc.ca/publications/infosource/pub/cipec/annualreport-2007/index.cfm?attr=4 (accessed November 4, 2009).

Table 4
Investments in energy-related processes or technologies by energy intensity and industry, 2006

Industry by energy intensity classification	Energy intensity	Capital spent on energy-related processes or technologies as a proportion of total capital spent on machinery and equipment
	TJ per million dollars of GDP	percent
High		
Petroleum and coal products	184	1.4
Paper	62	5.6
Primary metals	44	1.2
Moderate		
Non-metallic mineral products	24	0.7
Chemicals	15	2.1
Wood products	11	5.0
Non-intense		
Food	6	2.9
Fabricated metal products	3	F
Beverage and tobacco products	3	F
Transportation equipment	2	0.1
Other manufacturing	2	1.1
Total, all manufacturing industries	**14**	**1.8**

Note(s):
For the purpose of this study, energy-intensive industries used over 40 TJ per million dollars of GDP, moderately-energy-intensive industries used 10 to 39 TJ per million dollars of GDP and non-energy-intensive industries used less than 10 TJ per million dollars of GDP.
Source(s):
Statistics Canada, Environment Accounts and Statistics Division.
Statistics Canada, CANSIM tables 128-0006, 379-0017 and 029-0009 (accessed July 15, 2009).

The paper manufacturing industry spent a total of $336 million on energy-related processes or technologies; most of this was operating expenditures (Table 2). However, the industry did make the largest capital investment in these technologies accounting for 23% of the capital invested by the manufacturing sector. For every $100 of investment this industry made for machinery or equipment in 2006, almost $6 was made for energy-related processes or technologies (Table 3).

Wood products manufacturing, a moderately intensive industry

In 2006, the wood products manufacturing industry used approximately 11 TJ of energy for every million dollars worth of GDP it produced; a reduction of 3 TJ per million dollars from 1997 (Chart 1). Although it has been classified as a moderately intensive industry, almost 50% of businesses in the wood products manufacturing industry used an energy-related technology (Table 1). This industry was the second largest user in percentage terms of cogeneration technology and the largest user of biomass energy technology. In 2005, 46% of the industry's energy was from biomass energy.[12]

This industry spent $217 million in 2006 on energy-related processes or technologies, second only to the paper manufacturing industry (Table 2). Paper manufacturers used over five times more energy to produce a million dollars of GDP than wood products manufacturers. Capital investments in energy-related processes or technologies made by the wood products industry accounted for about 5% of its total capital investments in machinery and equipment in 2006.

Like the paper manufacturing industry, the wood products industry converted a potential waste product from their manufacturing process into an alternative fuel source.

Summary

The energy intensity of Canadian manufacturers in 2006 varied greatly within the sector, from a high of almost 200 TJ per million dollars of GDP in the petroleum and coal products manufacturing industry, to a low of 2 TJ per million dollars of

12. Natural Resources Canada, 2007.

GDP in the transportation equipment manufacturing industry. Similarly, investments in energy-related processes and technologies also varied.

Waste energy recovery technologies, energy management or monitoring systems, and the implementation of an energy audit were most widely reported by businesses throughout the manufacturing sector. Technologies related to renewable energy sources were used more by energy-intensive industries but were less commonly used throughout the rest of the manufacturing sector. The one exception was the wood products manufacturing industry. Although a moderately intensive industry, it was the most frequent user of biomass energy technology.

In 2006, the largest investor in energy-related processes and technologies was the paper and manufacturing industry. For every $100 of capital this industry invested in machinery and equipment, almost $6 was for energy-related processes and technologies. The wood products manufacturing industry followed, investing $5 out of every $100 for energy-related processes or technologies. Combined these two industries accounted for over 40% of the total capital invested by the manufacturing sector in these types of activities.

Ecoregion profile: Lower Mainland of British Columbia

Doug Trant, Hugo Larocque and Giuseppe Filoso, Environment Accounts and Statistics Division

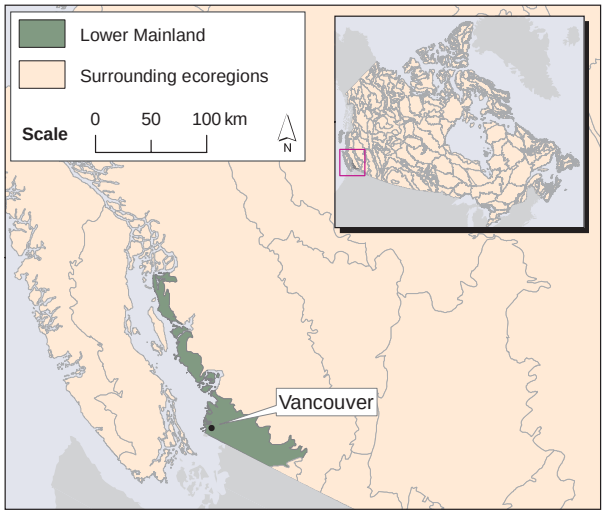
The Lower Mainland ecoregion is one of Canada's 194 ecoregions (Map 1) and will be one of the sites of the Vancouver 2010 Winter Olympics. This relatively small 5,067 square kilometre region is one of Canada's most rapidly changing ecoregions, largely because of its growing population and its evolving socio-economy.

Population in the ecoregion increased by 102% between 1971 and 2006. In comparison, Canada's population grew by 47% (Table 1). The Lower Mainland ecoregion was Canada's most densely populated ecoregion with 473 persons per square kilometre in 2006. The main population centres include the Vancouver and Abbotsford-Mission metropolitan areas. The population of the ecoregion in 2006 was approximately 2.4 million people, representing 7.6% of Canada's population.

The main land uses in the ecoregion are forests, developed land and agriculture (Map 2 and Chart 1). Intensive agriculture occurs on the valley bottoms of the Fraser River valley where it competes with urban development. In 2006, 56,889 hectares of cropland were under operation in the region (Table 1). Coastal salt marshes are important wildlife habitat on the Fraser River delta and adjacent Boundary Bay. Land development continues in the Vancouver area and amongst many communities in the Fraser River valley and along the Sunshine Coast.[1] At the start of the decade, 23% of the region was in developed land. Forests occupied the largest proportion of the region with 44% of the ecoregion's area in various forest types.

Between 1971 and 2006, agricultural land area remained relatively stable, declining by less than 3% (Table 1). Over this period, the number of cattle declined by 12%; however, poultry inventories in the region have gone up significantly, rising by 129% between 1971 and 2006. The region accounts for 13% of Canada's poultry production in 2006.

Map 1
Lower Mainland ecoregion



Source(s):
Environment Canada, 2005, *National Ecological Framework for Canada*, www.environment-canada.ca/soer-ree/English/Framework/default.cfm (accessed October 8, 2009).

1. Environment Canada, 2005, *National Ecological Framework for Canada*, www.environment-canada.ca/soer-ree/English/Framework/default.cfm (accessed October 8, 2009).

Table 1
Lower Mainland ecoregion

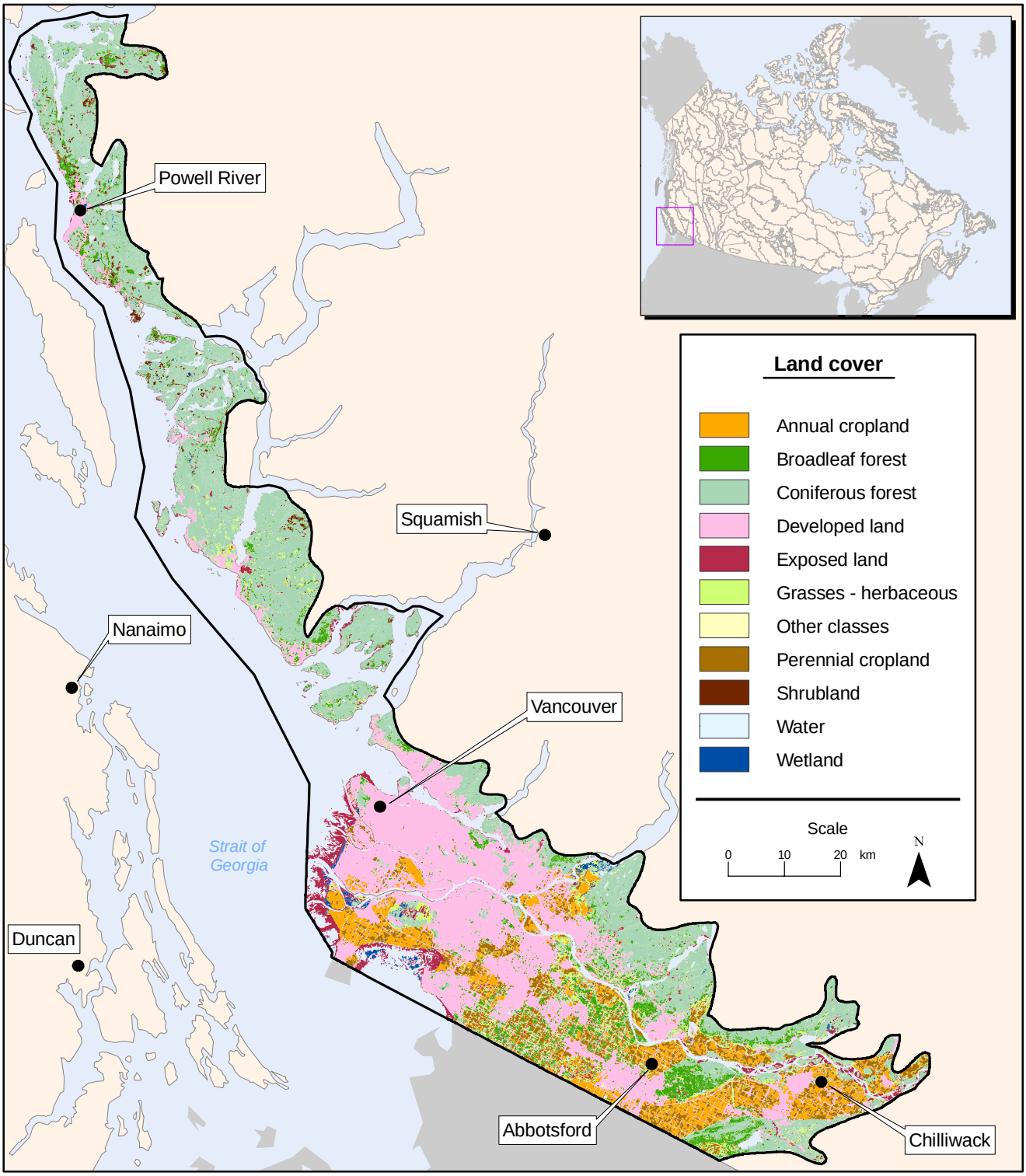
	Lower Mainland ecoregion	Canada	Percentage share of Canada total
Total area (km^2)	**5,067**	**9,976,182**	**0.05**
Land cover circa 2000[1]			
Annual cropland and perennial cropland (km^2)	670	..	…
Forest (km^2)	2244	..	…
Developed land (km^2)	1183	..	…
Water (km^2)	430	..	…
Exposed land (km^2)	191	..	…
Grasses–herbaceous (km^2)	235	..	…
Other classes (km^2)	3	..	…
Shrubland (km^2)	74	..	…
Wetland (km^2)	36	..	…
Agricultural land			
Area of dependable agricultural land[2] (km^2)	661	454,630	0.1
Proportion of area in dependable land (percent)	13.0	4.6	…
Population			
Population in 1971 (number)	1,186,862	21,568,310	5.5
Population in 1981 (number)	1,423,311	24,343,181	5.8
Population in 1991 (number)	1,808,510	27,296,859	6.6
Population in 1996 (number)	2,077,228	28,846,761	7.2
Population in 2001 (number)	2,248,184	30,007,094	7.5
Population in 2006 (number)	2,398,926	31,612,895	7.6
Population density in 2006 (people/km^2)	473	3	…
Population change 1971 to 2006 (percent)	102.1	46.6	…
Agriculture			
Area of farmland in 1971 (hectares)	97,928	68,662,444	0.1
Area of farmland in 2006 (hectares)	95,088	67,586,739	0.1
Change (percent)	-2.9	-1.6	…
Area of cropland in 1971 (hectares)	43,234	27,828,479	0.2
Area of cropland in 2006 (hectares)	56,889	35,912,247	0.2
Change (percent)	31.6	29.0	…
Cattle in 1971 (number)	132,670	13,276,308	1.0
Cattle in 2006 (number)	116,160	15,773,527	0.7
Change (percent)	-12.4	18.8	…
Poultry in 1971 (number)	7,166,565	98,049,591	7.3
Poultry in 2006 (number)	16,412,001	125,314,793	13.1
Change (percent)	129.0	28.7	…

1. Land cover classes are aggregated. Forest area contains all types of forest. Developed land includes built-up areas, lawns, road surfaces, industrial sites and farmsteads. Water area contains some marine water area. Exposed land refers primarily to mudflats in this ecoregion. Other refers to unclassified land types due to shadow and clouds in the satellite imagery. Land cover is based on LANDSAT satellite data from 1996 to 2003.
2. Dependable agricultural land is defined as land designated as Class 1, Class 2 and Class 3 by the Canada Land Inventory.

Source(s):

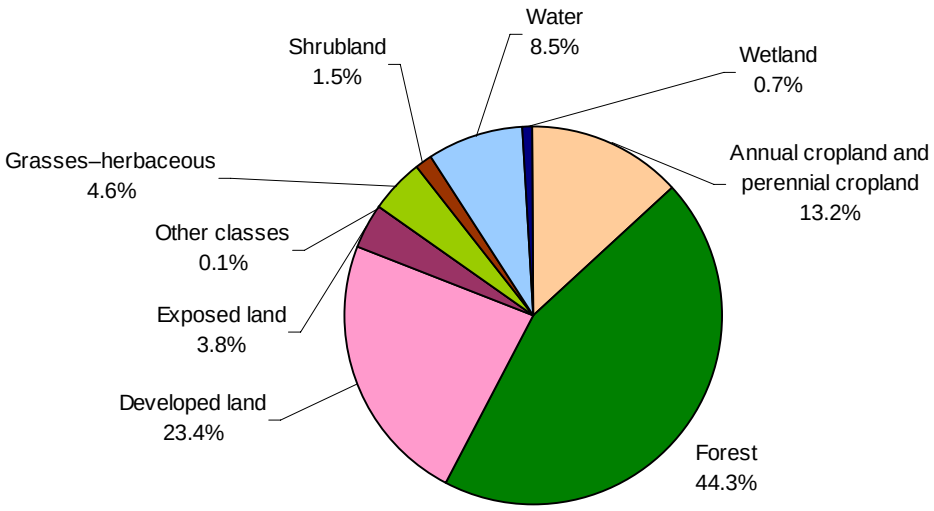
Statistics Canada, CANSIM tables 153-0057 and 153-0058 (accessed October 8, 2009).
Statistics Canada, Census of Population and Census of Agriculture.
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System.
Natural Resources Canada, n.d., *Canada Land Inventory—Land Capability for Agriculture* (1968 to 1990), Earth Sciences Sector, www.geogratis.ca/geogratis/en/collection/cli.html (accessed October 8, 2009).
Natural Resources Canada, 2009, *Land Cover, Circa 2000-Vector (LCC2000-v)*, Earth Sciences Sector, www.geobase.ca (accessed October 8, 2009).
Environment Canada, 2005, *National Ecological Framework for Canada*, www.environment-canada.ca/soer-ree/English/Framework/default.cfm (accessed October 8, 2009).

Map 2
Land cover, Lower Mainland ecoregion, circa 2000



Source(s):
Natural Resources Canada, 2009, *Land Cover, Circa 2000-Vector (LCC2000-v)*, Earth Sciences Sector, www.geobase.ca (accessed October 8, 2009).
Environment Canada, 2005, *National Ecological Framework for Canada*, www.environment-canada.ca/soer-ree/English/Framework/default.cfm (accessed October 8, 2009).

Chart 1
Lower Mainland ecoregion, by type of land cover, circa 2000



Note(s):
Developed land includes built-up areas, lawns, road surfaces, industrial sites and farmsteads. Water area contains some marine water area. Exposed land refers primarily to mudflats in this ecoregion. Other refers to unclassified land types due to shadow and clouds in the satellite imagery. Land cover is based on LANDSAT satellite data from 1996 to 2003.
Source(s):
Natural Resources Canada, 2009, *Land Cover, Circa 2000-Vector (LCC2000-v)*, Earth Sciences Sector, www.geobase.ca (accessed October 8, 2009).

Quick fact: Gasoline-powered snowblower usage

Data from the 2007 Households and the Environment Survey reveal that more than one out of five (22%) households in Canada that were not in apartments used a gasoline-powered snowblower. In 2007, non-apartment households in Newfoundland and Labrador were most likely to have used one (45%), followed by those in New Brunswick (38%).

Table 1
Gasoline-powered snowblower usage, Canada and provinces, 2007

	Households that used a gasoline-powered snowblower
	percentage
Canada	**22**
Newfoundland and Labrador	45
Prince Edward Island	26
Nova Scotia	23
New Brunswick	38
Quebec	27
Ontario	24
Manitoba	31
Saskatchewan	26
Alberta	11
British Columbia	4

Note:
Excludes households that were in apartments.
Source(s):
Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey, 2007.

Environment and sustainable development indicators

Table 1
Population indicators

	2003	2004	2005	2006	2007	2008
Population (number)[1]	31,639,670	31,940,676	32,245,209	32,576,074	32,927,372	33,311,389
Percentage change	0.9	1.0	1.0	1.0	1.1	1.2
Aged 65 and over (percent of total)	12.8	13.0	13.1	13.3	13.5	13.7
Urban (percent of total)	..	..	..	80.2	..	..
Density (per square kilometre)	3.5	3.5	3.6	3.6	3.7	3.7

1. Population data is based on the Estimates of Population program, except for data on urban population, which is based on the Census of Population.

Source(s):
Statistics Canada, CANSIM table 051-0001 (accessed November 5, 2009).
Statistics Canada, 2007, *Population and Dwelling Count Highlight Tables, 2006 Census*, http://www12.statcan.ca/english/census06/data/popdwell/Tables.cfm (accessed November 5, 2009).

Table 2
Economy indicators

	2003	2004	2005	2006	2007	2008
Gross Domestic Product (million chained 2002 dollars)	1,174,592	1,211,239	1,247,807	1,283,419	1,315,907	1,321,360
Percentage change	1.9	3.1	3.0	2.9	2.5	0.4
Per capita (chained 2002 dollars)	37,124	37,922	38,697	39,398	39,964	39,667
Consumer Price Index (2002 = 100)	102.8	104.7	107.0	109.1	111.5	114.1
Unemployment rate (percent)	7.6	7.2	6.8	6.3	6.0	6.1

Source(s):
Statistics Canada, CANSIM tables 380-0017, 051-0001, 326-0021 and 282-0002 (accessed November 5, 2009).

Table 3
Social indicators

	2003	2004	2005	2006	2007	2008
Average household spending[1] (current dollars)						
Total	60,088	62,464	65,575	67,736	69,946	..
Water and sewage	202	204	211	221	253	..
Electricity	1,026	1,040	1,070	1,111	1,147	..
Food	6,618	6,772	6,978	7,046	7,305	..
Gasoline and other motor fuels	1,665	1,854	2,024	2,079	2,223	..
Personal expenditure on consumer goods and services (million chained 2002 dollars)	675,443	697,566	723,146	752,727	787,063	810,723
Residential waste						
Production per capita (kilograms)	..	386	..	399	..	..
Disposal (tonnes)	..	8,961,583	..	9,238,376	..	..
Disposal per capita (kilograms)	..	281	..	284	..	..
Diversion (tonnes)	..	3,363,803	..	3,744,843	..	..
Diversion per capita (kilograms)	..	105	..	115	..	..
Diversion rate (percent of waste production)	..	27	..	29	..	..
Distance driven by light vehicles[2] (million kilometres)	286,803	285,164	289,717	296,871	300,203	294,361
Asthma (percent of population age 12 and over)	8.4	..	8.3	..	8.1	8.4

1. Data on average household spending is based on the Survey of Household Spending (SHS). For information on the difference between the SHS and personal expenditure data please see: Statistics Canada, 2008, *Guide to the Income and Expenditure Accounts*, Catalogue no. 13-017-X.

2. Distance driven for vehicles weighing less than 4.5 tonnes, excluding the territories.

Source(s):
Statistics Canada, CANSIM tables 203-0001, 203-0003, 203-0002, 203-0007, 380-0017, 153-0041, 153-0042, 051-0001, 405-0063 and 105-0501 (accessed November 5, 2009).

Table 4
Energy indicators

	2003	2004	2005	2006	2007	2008
Primary energy availability (terajoules)	11,478,526	11,527,500	11,307,113	11,176,879	11,654,755	..
Primary and secondary energy (terajoules)						
Export	9,444,883	9,810,695	9,641,137	9,833,549	10,246,727	..
Residential consumption	1,338,166	1,313,015	1,296,644	1,243,425	1,344,404	..
Established reserve, closing stock[1]						
Crude bitumen (million cubic metres)	1,720	1,660	1,620	3,340	3,500	4,300
Crude oil (million cubic metres)	590.0	603.8	752.3	712.6	721.8	..
Natural gas (billion cubic metres)	1,469.5	1,497.5	1,553.7	1,577.7	1,534.3	..
Recoverable reserves, closing stock[1]						
Coal (million tonnes)	4,406.4	4,666.3	4,560.4	4,468.8	4,395.1	4,331.5
Uranium (tonnes)	429,000	444,000	431,000	423,400	482,000	..
Total electricity generation (megawatt hours)	564,218,465	571,291,905	597,810,875	585,097,531	603,572,420	601,719,256
Hydro (percent of total)	59.0	58.7	60.1	60.0	60.6	62.0
Nuclear (percent of total)	12.5	14.9	14.5	15.8	14.6	14.7
Generation from fossil fuel and other fuel combustion (percent of total)	28.5	26.4	25.4	24.2	24.8	23.3

1. The size of the reserve at year-end.

Source(s):
Statistics Canada, CANSIM tables 128-0009, 153-0012, 153-0013, 153-0014, 153-0017, 153-0018, 153-0019, 127-0001 and 127-0002 (accessed November 5, 2009).

Table 5
Environment and natural resources indicators

	2003	2004	2005	2006	2007	2008
Total greenhouse gas (GHG) emissions (megatonnes of carbon dioxide equivalent)	741	741	731	718	747	..
GHG emissions per capita (tonnes)	23.4	23.2	22.7	22.0	22.7	..
GHG emissions by final demand						
Total household[1] (megatonnes of carbon dioxide equivalent)	433	425	418[p]	..	..	..
Total household per capita (tonnes)	13.7	13.3	13.0[p]	..	..	..
Direct household[2] (megatonnes of carbon dioxide equivalent)	111	110	108[p]	..	..	..
Indirect household[3] (megatonnes of carbon dioxide equivalent)	323	315	309[p]	..	..	..
Exports (megatonnes of carbon dioxide equivalent)	273	278	276[p]	..	..	..
Annual temperature departures,[4] Canada (degrees Celsius)	1.1	0.1	1.7	2.4	0.9	0.7
Value of selected natural resources (million current dollars)						
Land	1,095,419	1,227,819	1,367,002	1,520,392	1,691,239	1,797,753
Timber	297,474	311,771	283,572	265,640	246,626	237,063
Subsoil resource stocks	465,083	566,179	805,761	931,643	939,060	1,486,234
Average farm pesticide expenditures (current dollars)	7,232	7,602	7,792	8,268	9,147	..
Air quality[5]						
Ozone (population-weighted, parts per billion)	40	36	39	37	..	..
$PM_{2.5}$ (population-weighted, micrograms per cubic metre)	9	9	9	8	..	..

1. Total household greenhouse gas emissions are the sum of direct plus indirect household greenhouse gas emissions.
2. Direct household greenhouse gas emissions include all greenhouse gas emissions due to energy use in the home and for private motor vehicles.
3. Indirect household greenhouse gas emissions are those business-sector emissions due to the production of the goods and services purchased by households. An estimate of the greenhouse gas emissions from foreign companies due to the production of the imported goods purchased by Canadian households is included.
4. Annual departures from the 1951-1980 temperature normals.
5. Ground-level ozone and fine particulate matter ($PM_{2.5}$) are two key components of smog that have been linked to health impacts ranging from minor respiratory problems to hospitalizations and premature death. Exposure studies indicate that adverse health effects can occur even with low concentrations of these pollutants in the air. Annual data are revised, based on the latest release of the *Canadian Environmental Sustainability Indicators* report.

Source(s):
Statistics Canada, CANSIM tables 153-0046, 051-0001, 378-0005 and 002-0044 (accessed November 5, 2009).
Environment Canada, 2009, *Canada's 2007 Greenhouse Gas Inventory – A Summary of Trends*, www.ec.gc.ca/pdb/ghg/inventory_report/2007/som-sum_eng.cfm (accessed November 5, 2009).
Environment Canada, 2009, *Temperature and Precipitation in Historical Perspective*, www.msc-smc.ec.gc.ca/ccrm/bulletin/annual08/national_e.cfm (accessed November 5, 2009).
Environment Canada, 2009, *Canadian Environmental Sustainability Indicators 2008 – Air Quality,* www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=B4B7C8F6-1#AIRchart1Edetails (accessed November 5, 2009).
Statistics Canada, Environment Accounts and Statistics Division, Material and Energy Flow Accounts.

Updates

New releases

Drinking Water Decisions of Canadian Municipal Households

Households in Canadian municipalities often have options when choosing the type of water they drink at home and whether they treat it prior to drinking it. The reasons why they might choose to treat their water could be aesthetic or there might have been problems in the past that are influencing their decisions today. Using data from the 2007 Households and the Environment Survey, the author explores some of the factors governing these decisions for households in a selection of Canadian municipalities.

Released December 9, 2009 (Statistics Canada Catalogue no. 16-001-M2009010).

Survey of Drinking Water Plants

The Survey of Drinking Water Plants is conducted to provide Canadians with national and regional information related to the production of drinking water. The survey is a census of drinking water plants serving 300 or more people, and asks for information on volumes of water drawn and treated, type of treatment, financial aspects of the operation, as well as raw and treated water quality.

Released December 9, 2009 (Statistics Canada Catalogue no. 16-403-X).

Personal Use Vehicles in Canada: Fuel Consumption Profile and Comparative Analysis of the 2007 Canadian Vehicle Survey Results

The Canadian Vehicle Survey (CVS) is a voluntary, vehicle-based survey that provides quarterly and annual estimates of road vehicle activity. In 2007, the sample size of the CVS was increased in order to collect more detailed information and address a data gap regarding consumption of fuel for personal vehicle use. This was seen as a possible solution for getting better insight into the household component of fuel consumption. By differentiating between types of vehicle use, data from the CVS is able to fill this gap.

A technical paper has been prepared that presents a national, annual profile of vehicle fuel consumption by purpose of use: business or personal for 2007. This paper also compares the fuel consumption quantities reported by the CVS with data collected or compiled from other sources.

Released November 5, 2009 (Statistics Canada Catalogue no. 16-001-M2009009).

Households and the Environment Survey: Energy Use 2007

Selected data from the "Households and the Environment Survey: Energy Use" supplement are now available for 2007.

The survey provides information on dwelling characteristics and energy consumption of Canadian households. It also covers factors that affect household energy use and use of selected energy-consuming equipment and appliances.

Released September 21, 2009. To order data, to obtain more information, or to enquire about the concepts, methods or data quality of this release, contact the information officer (613-951-0297; environ@statcan.gc.ca), Environment Accounts and Statistics Division.

CANSIM tables and updates

CANSIM is Statistics Canada's key socio-economic database.

Data for the years 1971 and 1976 can now be found in the following tables on CANSIM:

CANSIM table 153-0037, Selected population characteristics

CANSIM table 153-0039, Selected agricultural activities

Upcoming releases

Industrial Water Survey, 2007

The information collected for the Industrial Water Survey measures, by volume, the sources of water used, the purposes of water use, whether or not water was re-circulated or re-used, where the water was discharged, the types of treatments establishments applied to intake water prior to use and the types of treatments establishments applied to their wastewater prior to discharge. Water acquisition costs, treatment costs and operating and

maintenance expenses related to water intake and discharge are also collected.

The results of this survey are used in the development of environmental accounts, aid in tracking the state of stocks of water and contribute to national indicators of water quality.

To be released in the winter of 2010 (Statistics Canada Catalogue no. 16-401-X).