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Industrial Consumption of Energy (ICE) Survey **Summary Report of Energy Use in the Canadian Manufacturing Sector**

1995–2010



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Summary Report of Energy Use in the Canadian Manufacturing Sector, 1995–2010

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1 Foreword

Every year, Statistics Canada conducts the Industrial Consumption of Energy (ICE) survey,¹ which collects energy use data from establishments² in Canada's Manufacturing sector.³ The ICE survey is currently co-sponsored by the Office of Energy Efficiency (OEE) of Natural Resources Canada and Environment Canada. The survey is an essential tool for monitoring the evolution of energy consumption by manufacturing industries and helps to fulfill part of the OEE's mandate to strengthen and expand Canada's commitment to energy conservation and energy efficiency.

To learn more about this survey, consult Statistics Canada's Web site at www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=5047&lang=en&db=imdb&adm=8&dis=2.

This report examines energy consumption patterns for the Canadian Manufacturing sector using the results of the 2010 ICE survey. The estimates are based on the North American Industry Classification System (NAICS) and include all 21 subsectors of the Manufacturing sector (NAICS 31 to 33).⁴

Contents of this report

This report is structured as follows:

- Chapter 2, the executive summary, provides key findings of the 2010 ICE survey and compares energy consumption, gross domestic product and energy intensity of the Manufacturing sector and the seven most energy-consuming subsectors from 1995 to 2010.
- Chapter 3 discusses other industrial energy data and sources, along with factors influencing industrial energy demand.
- Chapter 4 takes a closer look at energy consumption and energy intensity for the Manufacturing sector as a whole, as well as for the seven most energy-consuming subsectors. In addition, it compares energy sources used in the sector from 1995 to 2010.
- Chapter 5 provides information on each of the seven selected subsectors, including energy consumption, output and energy intensity trends, comparison of capacity utilization rates among the sector and subsectors, trends by industry and energy sources used by each subsector.
- Chapter 6 provides conclusions about the analysis of the findings.
- Appendix A provides detailed tables to support the charts and figures.
- Appendix B is a glossary of key terms.
- Appendix C discusses the North American Industry Classification System.
- Appendix D describes the methodology employed by the ICE survey.

¹ Although entitled the Industrial Consumption of Energy survey, data published from the ICE survey does not cover the entire Industrial sector, but rather the Manufacturing portion only. In fact, mining (including oil and gas extraction), forestry and construction are not included in the ICE survey estimates, because several other data initiatives already gather information on these sectors.

² See Appendix B, Glossary, for a more in-depth description.

³ See Appendix C, North American Industry Classification System.

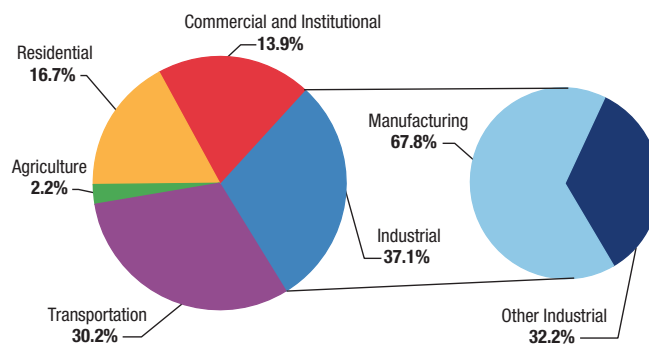
⁴ See Appendix B, Glossary, for a definition and Appendix C, North American Industry Classification System, for details.

In 2009...

...the Manufacturing sector accounted for the largest share of energy in the industrial sector (67.8 percent).

Figure 1 illustrates how Canada's secondary energy consumption⁵ by the residential, agricultural, commercial/institutional, industrial and transportation sectors was distributed in 2009. Total energy use by the industrial sector accounted for 37.1 percent of the total secondary energy use in Canada. The Manufacturing industries accounted for the largest share of energy in the industrial sector (67.8 percent).

Figure 1. Canada's secondary energy consumption by sector, 2009



Source: Natural Resources Canada (2012), *Energy Efficiency Trends in Canada, Trends for 1990–2009*.

This report was prepared by Diane Friendly, of the Demand Policy and Analysis Division of the OEE. Samuel Blais was the project manager, and overall direction was provided by Andrew Kormylo. An electronic version of this report is available at oee.nrcan.gc.ca/corporate/statistics/publications.

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Note to readers: Statistics Canada regularly revises the ICE survey estimates to improve their quality. Therefore, some of the results in this report may differ slightly from previous versions. Due to rounding, the numbers in this summary report may not add up to the totals shown in the tables or to 100 percent, where applicable.

⁵ The energy used by final consumers in various sectors of the economy.

2 Executive summary

The Industrial Consumption of Energy (ICE) survey is an annual survey of Canada's Manufacturing sector. This summary report examines energy consumption patterns for the Canadian Manufacturing sector from 1995 to 2010, using the results of the ICE survey.

The seven Manufacturing subsectors examined in this report...

- Paper Manufacturing
- Primary Metal Manufacturing
- Petroleum and Coal Product Manufacturing
- Chemical Manufacturing
- Wood Product Manufacturing
- Food Manufacturing
- Non-Metallic Mineral Product Manufacturing

In 2010...

...these seven subsectors accounted for 91.0 percent of the sector's energy consumption and 44.5 percent of the sector's GDP.

The following are some of the key findings from the 2010 ICE survey:

- From 1995 to 2010, the Manufacturing sector's energy use decreased by 14.3 percent (or 355.8 petajoules [PJ]), which is approximately equal to the combined energy used in the retail trade, wholesale trade, transportation and warehousing, and arts, entertainment and recreation subsectors of the Commercial/Institutional sector across Canada in 2009.⁶
- From 1995 to 2010, The Manufacturing sector's energy intensity declined 23 percent, from 17.8 megajoules per dollar of gross domestic product (MJ/\$GDP) to 13.7 MJ/\$GDP.
- In 2003, electricity overtook natural gas as the most used energy source in the Manufacturing sector, although the gap between both these energy sources narrowed in 2010. For a breakdown of the share of energy consumption in the Manufacturing sector by energy source from 1995 to 2010, refer to Table A.9 in Appendix A of this report.
- Although there are 21 subsectors within the Manufacturing sector, seven subsectors accounted for 91.0 percent of all energy consumption in the sector in 2010. These subsectors (in order of their share of energy consumption) are Paper Manufacturing, Primary Metal Manufacturing, Petroleum and Coal Product Manufacturing, Chemical Manufacturing, Wood Product Manufacturing, Food Manufacturing and Non-Metallic Mineral Product Manufacturing. This summary report examines key findings among these seven subsectors in greater detail.

From 1995 to 2010

Table 1 (and Table A.1 in Appendix A) compares energy consumption, output (as measured by GDP⁷) and energy intensity⁸ of the overall Manufacturing sector and the seven greatest energy users of the sector from 1995 to 2010. It shows that, from 1995 to 2010, energy consumption in the sector decreased while its output increased; this resulted in an improvement in energy intensity.

⁶ Natural Resources Canada, Comprehensive Energy Use Database, 1990-2009, Commercial Sector, Table 2. oec.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/com_ca_2_e_4.cfm.

⁷ In this report, GDP figures are reported in constant 2002 prices.

⁸ Energy intensity is the amount of energy used per unit of activity. See Appendix B, Glossary, for a more in-depth description.

From 1995 to 2010...

... energy consumption in the Manufacturing sector decreased while its production increased; this resulted in an improvement in energy intensity

... the Paper Manufacturing subsector's energy consumption declined by 354.5 PJ (or 39.3 percent); this was the largest decrease among the seven subsectors.

Table 1. Comparison of energy consumption, GDP and energy intensity of the Manufacturing sector and selected subsectors, 1995–2010

	Total Manufacturing (NAICS 31–33)	Paper Manufacturing (NAICS 322)	Primary Metal Manufacturing (NAICS 331)	Petroleum and Coal Product Manufacturing (NAICS 324)	Chemical Manufacturing (NAICS 325)	Wood Product Manufacturing (NAICS 321)	Food Manufacturing (NAICS 311)	Non-Metallic Mineral Product Manufacturing (NAICS 327)
Change in energy consumption	-14.3% -355.8 PJ	-39.3% -354.5 PJ	-11.0% -55.6 PJ	15.5% 45.5 PJ	1.9% 5.2 PJ	18.5% 20.0 PJ	20.7% 17.5 PJ	-18.2% -21.5 PJ
Change in GDP	11.0% \$15.5 billion	-16.9% -\$1.8 billion	14.7% \$1.2 billion	16.4% \$0.5 billion	11.2% \$1.3 billion	28.0% \$2.2 billion	34.5% \$5.0 billion	51.6% \$1.7 billion
Change in energy intensity	-22.8%	-27.0%	-22.6%	-0.7%	-8.9%	-7.5%	-10.3%	-47.2%

The Paper Manufacturing subsector's energy consumption declined by 354.5 PJ (or 39.3 percent) between 1995 and 2010. This was the largest decrease among the seven subsectors. It was also the only subsector that experienced a decrease in GDP (16.9 percent) during this period. Despite a decrease in GDP since 2005, energy use decreased faster, partially as a result of the least efficient pulp and paper plants being closed first. This would help explain the significant reduction in energy intensity for this subsector from 2005 to 2010 (see Table A.12 in Appendix A).

Even though four of the seven subsectors saw increases in their energy consumption during this period, all seven subsectors experienced a decrease in energy intensity from 1995 to 2010, due to larger increases in output. The decreases in energy intensity ranged from 47.2 percent for the Non-Metallic Mineral Product subsector to the smallest decrease of 0.7 percent for the Petroleum and Coal Product subsector.⁹

From 2009 to 2010

Following the recessionary conditions from 2008 to 2009, the Manufacturing sector rebounded in 2010 with a 7.0 percent increase in GDP from the previous year. All seven key Manufacturing subsectors exhibited growth in output over this period. Even though overall energy consumption for the sector grew slightly during that period (3.1 percent), energy intensity decreased for all subsectors, except for the Chemical and Wood Product industries.

⁹ This very slight decrease in energy intensity could be due in part to the introduction of federal regulations aimed at reducing air pollutants. Adhering to these regulations required further refinement of crude oil by the petroleum refineries, which in turn required more energy. (Source: Environment Canada, Fuel Regulations, 2009. www.ec.gc.ca/energie-energy/default.asp?lang=En&n=EE068DA8-1.)

From 2009 to 2010...

...output grew for all seven subsectors

...energy intensity decreased for all subsectors, except for the Chemical and Wood Product industries.

Table 2. Comparison of energy consumption, GDP and energy intensity of the Manufacturing sector and selected subsectors, 2009–2010

	Total Manufacturing (NAICS 31–33)	Paper Manufacturing (NAICS 322)	Primary Metal Manufacturing (NAICS 331)	Petroleum and Coal Product Manufacturing (NAICS 324)	Chemical Manufacturing (NAICS 325)	Wood Product Manufacturing (NAICS 321)	Food Manufacturing (NAICS 311)	Non-Metallic Mineral Product Manufacturing (NAICS 327)
Change in energy consumption	3.1% 63.9 PJ	-0.4% -2.0 PJ	4.8% 20.7 PJ	-5.4% -19.3 PJ	16.6% 40.2 PJ	13.0% 14.8 PJ	-0.9% -0.9 PJ	5.9% 5.4 PJ
Change in GDP	7.0% \$10.2 billion	1.0% \$0.1 billion	13.3% \$1.1 billion	2.0% \$0.1 billion	4.7% \$0.6 billion	11.1% \$1.0 billion	1.5% \$0.3 billion	10.7% \$0.5 billion
Change in energy intensity	-3.7%	-1.0%	-7.8%	-7.3%	10.5%	1.7%	-2.4%	-5.0%

3

Industrial energy data and sources

The Government of Canada, and Natural Resources Canada (NRCan) in particular, have worked with Canadian industry for more than 30 years to promote energy efficiency in industrial practices. The availability of good quality data on the Manufacturing sector's energy consumption is essential to effectively monitor the energy efficiency of the sector.

Other data sources

NRCan works with various data sources to publish information on energy use in all sectors of the Canadian economy. For additional data, analysis and reports on the industrial sector, consult the following: Industrial Consumption of Energy (ICE) survey, Report on Energy Supply and Demand in Canada (RES-D), Canadian Industry Program for Energy Conservation (CIPEC), Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), and NRCan's Demand and Policy Analysis Division (DPAD).

Sources for many of the charts and tables included in this report are taken from the following:

- Statistics Canada. *Table 128-0006 - Energy fuel consumption of manufacturing industries in gigajoules, by North American Industry Classification System (NAICS), annual (gigajoules)*, CANSIM (database) (www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&id=1280006&pattern=1280006&searchTypeByValue=1&p2=42).
- Statistics Canada. *Table 379-0027 - Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), monthly (dollars)*, CANSIM (database) (www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3790027&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=).

Factors influencing industrial energy demand

Several factors influence energy demand in the Manufacturing sector. These factors can work alone or in combination to increase or decrease total energy demand. It is difficult to attribute the observed changes to individual factors and even more difficult to produce an exhaustive list of these factors. Nevertheless, the following are some of the key factors that affect energy demand:

- **Activity:** This term refers to production, delivered services or other drivers of energy use in a sector (e.g. gross domestic product – or physical outputs in the industrial sector). Variation in production (activity) of an industry will have a direct influence on its energy consumption. If everything else remains constant, an increase in manufacturing output increases energy use.
- **Price effect:** If everything else remains constant, increases or decreases in production costs of a particular good are expected to reduce or increase demand for the product for various reasons (e.g. exchange rate, depletion of resource). Consequently, the activity level of the specific industry or subsector will be affected.
- **Capacity utilization and scale effect:** Increases or decreases in manufacturing production will cause excess capacity or the utilization of human capital to vary. Economies of scale within a plant can be observed for marginal production. This means that the next unit produced will use less energy than the previous one because the fixed energy needs of the plant are spread over more units of output.

- **Change in the composition of the subsector production (structure effect):** Energy intensity varies across specific manufacturing processes and products within a subsector. Changes in the composition of a subsector based on industry outputs can impact the subsector's overall energy intensity.
- **Energy efficiency measures:** Industries usually undertake energy efficiency measures when the benefits of these actions outweigh the costs. For instance, using less energy for the production of goods gives an industry the ability to face higher energy costs, thus enhancing its competitive position.

However, the ICE report data do not take these influencing factors into account, with the exception of capacity utilization and scale effect. For specific details of the factorization method used to calculate energy intensity and energy efficiency improvements, refer to the *Energy Efficiency Trends in Canada 1990 to 2009* report at oee.nrcan.gc.ca/publications/statistics/trends11/index.cfm.

4

Energy consumption in the Manufacturing sector

The ICE survey collects energy use data from establishments in all 21 subsectors of the Manufacturing sector (NAICS [North American Industry Classification System] 31 to 33). These establishments primarily transform materials or substances into new products.

This summary report examines energy consumption and energy intensity patterns for the Canadian Manufacturing sector. One way to define energy intensity in the Manufacturing sector is the energy use per unit of output; for example, it can be measured as the ratio of energy use to gross domestic product (GDP) in constant 2002 dollars. This ratio, which will be used throughout this summary report, provides a measure of the energy efficiency attained by a subsector that is easily comparable over time and between subsectors. Energy intensity patterns and energy efficiency improvements are discussed in greater detail in the *Energy Efficiency Trends in Canada 1990 to 2009* report at oee.nrcan.gc.ca/publications/statistics/trends11/index.cfm.

Canada's Manufacturing sector...

...used 14.3 percent less energy and produced 11.0 percent more output in 2010 than it did in 1995...

...saw its energy intensity decline 22.8 percent from 1995 to 2010, a 1.5 percent average annual decline.

4.1 Energy intensity and total energy consumption in the Manufacturing sector

In 2010, the Manufacturing sector generated \$155.7 billion in GDP, in constant 2002 dollars, and according to ICE estimates, consumed 2135.9 petajoules (PJ) of energy. To put this into perspective, this amount is roughly equal to the energy consumed for space heating, space cooling, water heating and lighting by all households and all commercial and institutional buildings in Canada in 2009.¹⁰

Canada's Manufacturing sector used 14.3 percent less energy and produced 11.0 percent more output in 2010 than it did in 1995. This translated into a 22.8 percent decline in the sector's overall energy intensity from 17.8 megajoules per dollar of GDP (MJ/\$GDP) to 13.7 MJ/\$GDP, although intensity was briefly on the rise from 2007 to 2009 (see Table A.1 in Appendix A).

Figure 2 and Table A.2 in Appendix A illustrate the indexed growth of energy use, GDP and energy intensity from 1995 to 2010. Between 1995 and 2000, despite significant growth in output, energy use in the Manufacturing sector was virtually unchanged, and therefore the energy intensity of the sector decreased substantially. From 2000 until 2004, there was little change in output and energy use and, consequently, in energy intensity. Between 2004 and 2006, energy intensity decreased because the sector's output grew while energy consumption went in the opposite direction. Both output and energy consumption fell from 2007 to 2008, and continued to fall into 2009, although output fell at a faster rate than energy consumption. From 2009 to 2010, with the economy on an upswing, both output and energy consumption began to rise again, although output grew at a

¹⁰ Natural Resources Canada, Comprehensive Energy Use Database, 1990-2009, Residential Sector, Table 2 oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/res_ca_2_e_3.cfm, and Commercial/Institutional Sector, Table 4, oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/com_ca_4_e_4.cfm.

From 2009 to 2010...

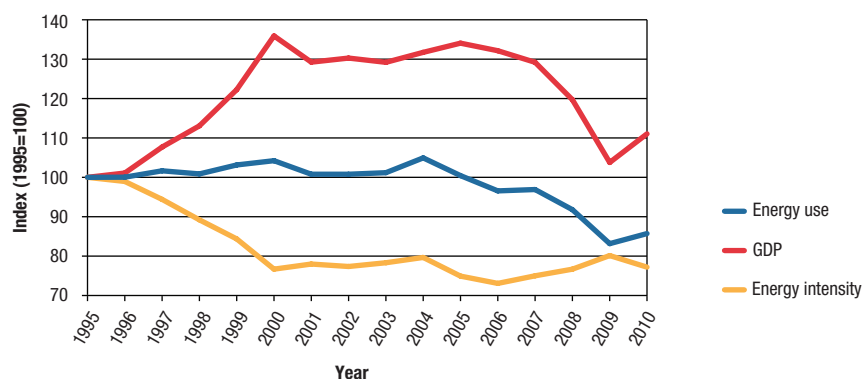
... with the economy on an upswing, both output and energy consumption began to rise again, with energy intensity decreasing by almost 4 percent during that year.

In 2010...

...the subsectors' capacity utilization strengthened to 77.1 percent up from 70.9 percent in 2009.

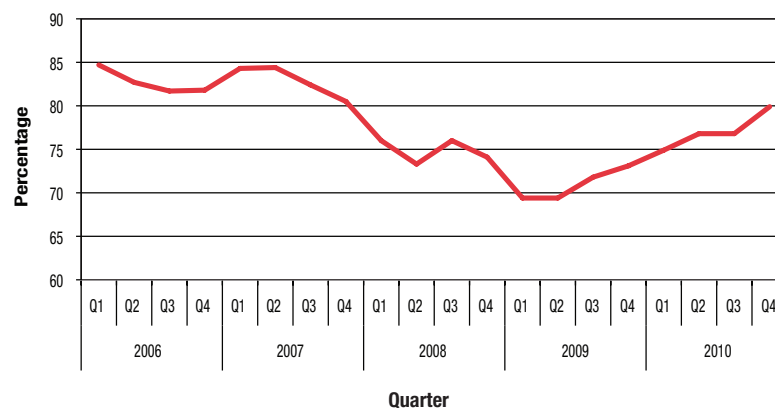
faster rate, causing energy intensity to decrease slightly (3.7 percent) during that year and recapturing some of the economies of scale lost during the recession.

Figure 2. Indexed growth of energy use, GDP and energy intensity for the Manufacturing sector, 1995–2010



After a difficult year in 2009, Canada's Manufacturing sector began a comeback in 2010 with widespread growth and the reversal of many downward trends. In 2010, growth was reported in 19 of the 21 subsectors. Among Manufacturing industries, annual capacity utilization reached 77.1 percent in 2010, up from 70.9 percent in 2009, indicating increased strength in the economy (see Table A.3 in Appendix A). "Capacity utilization rates act as an indicator of overall demand in the economy. Higher capacity utilization rates reflect that resources are in high demand, and may also lead to new capital investments, such as new plants and equipment that promote growth in the future."¹¹

Figure 3. Manufacturing capacity utilization, 2006–2010



¹¹ Taken from the *Capital and Repairs Expenditure* survey done by Statistics Canada.

From 1995 to 2010...

...all seven subsectors experienced a decrease in energy intensity; the largest decrease was the Non-Metallic Mineral Product Manufacturing subsector (47.2 percent).

4.2 Energy intensity and energy consumption by subsector

Figure 4 compares the energy intensity of the seven Manufacturing subsectors that consumed the most energy in 2010, over the study period. In 2010, these seven subsectors accounted for 91.0 percent of the sector's energy consumption and 44.5 percent of the sector's GDP. Their energy intensities ranged from 5.9 MJ/\$GDP for the Food Manufacturing subsector to 101.7 MJ/\$GDP for the Petroleum and Coal Product Manufacturing subsector. All seven selected subsectors experienced a decrease in energy intensity from 1995 to 2010, but significant decreases were shown for the Non-Metallic Mineral Product Manufacturing subsector (47.2 percent), the Paper Manufacturing subsector (27.0 percent) and the Primary Metal Manufacturing subsector (22.6 percent). For a full breakdown of energy intensity data for the seven subsectors, see Table A.7 in Appendix A.

Figure 4. Energy intensity of the seven selected subsectors, 1995–2010

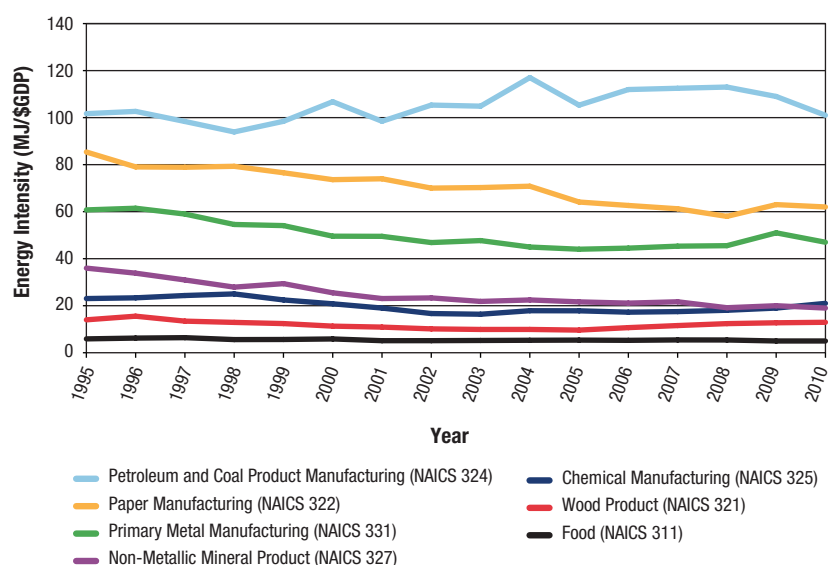


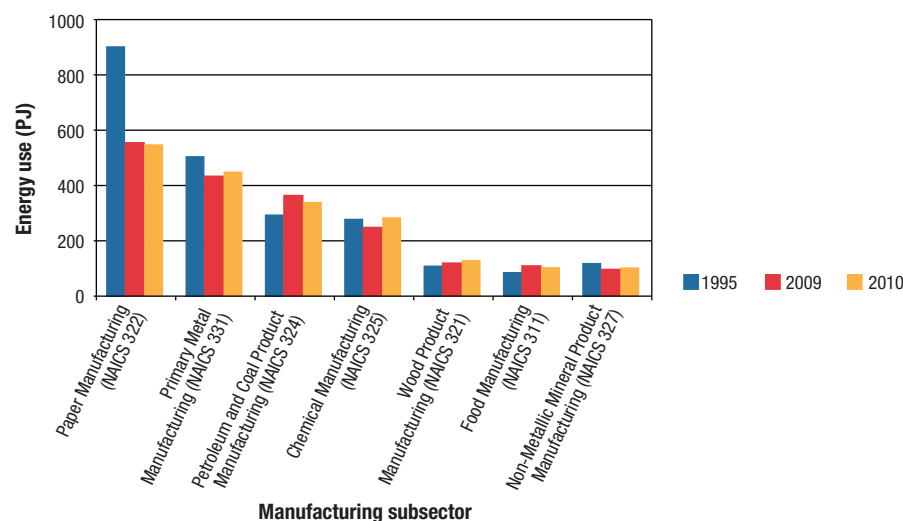
Figure 5 shows the energy use of the selected Manufacturing subsectors for 1995, 2009 and 2010. Some of the biggest changes in both levels and percentages were as follows (see Table A.5 in Appendix A):

- Energy consumption in the Paper Manufacturing subsector decreased 39.3 percent (354.5 PJ) from 1995 to 2010.
- The Petroleum and Coal Product Manufacturing subsector consumed 15.5 percent (45.5 PJ) more energy in 2010 as compared to 1995, although the 2010 level was down slightly (5.4 percent) from 2009.
- From 1995 to 2010, energy consumption in the Food Manufacturing subsector increased 20.7 percent, and similarly, that of the Wood Product Manufacturing subsector grew 18.5 percent.

From 1995 to 2010...

...energy consumption for the Paper Manufacturing subsector decreased substantially (39.3 percent).

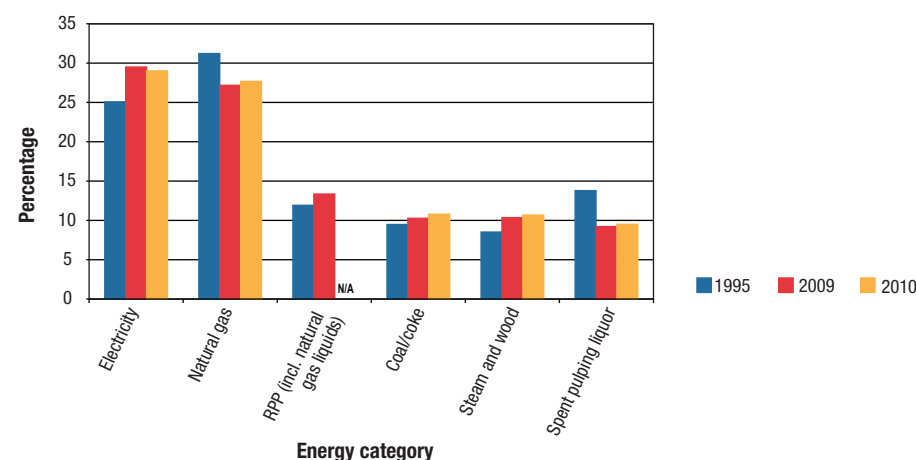
Figure 5. Energy consumption of the seven subsectors, 1995, 2009 and 2010



4.3 Energy consumption by energy category

From 1995 to 2010, the energy consumed by the Manufacturing sector shifted from some energy sources toward others. Figure 6 outlines the variances in the share of energy categories in 1995, 2009 and 2010 (refer to Tables A.8 and A.9 in Appendix A for trends from 1995 to 2010). The share of steam and wood, coal/coke and electricity increased, whereas the share of spent pulping liquor¹² and natural gas decreased. The share of refined petroleum products¹³ (including natural gas liquids) increased from 1995 to 2009 (2010 data are confidential and cannot be reported).

Figure 6. Share of energy consumption of the Manufacturing sector by energy category, 1995, 2009 and 2010



From 1995 to 2010...

...the share of energy consumption of steam and wood, coal/coke and electricity increased the most, whereas that of spent pulping liquor and natural gas decreased the most.

Note that, according to the ICE survey, spent pulping liquor is produced and used exclusively by the Paper Manufacturing subsector. This subsector has been in decline since 2004, as shown by the drop in the subsector's GDP, from \$12.0 billion in 2004 to

¹² See Appendix B, Glossary, for a definition

¹³ See Appendix B, Glossary, for a definition.

Since 2003...

...electricity has replaced natural gas as the most used energy source.

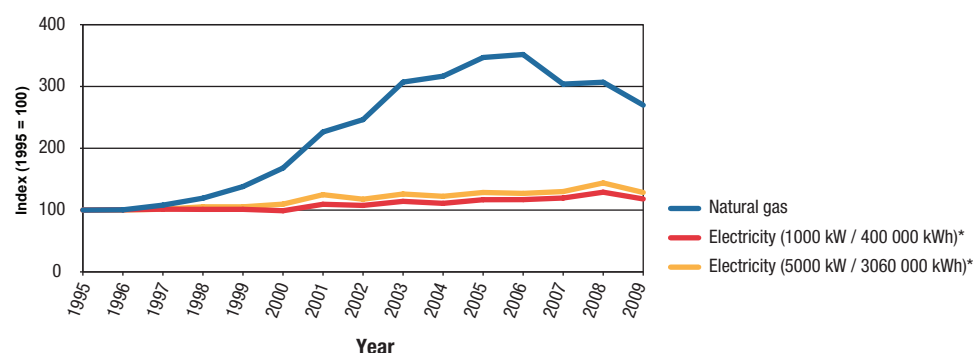
The rapid growth in the price of natural gas from 2003 to 2006 compared with that of electricity may help explain the shift away from natural gas use toward electricity use in the Manufacturing sector.

The structure of a sector, in terms of production, also contributes to the change in fuel mix.

\$8.8 billion in 2010 (or 26.7 percent) (see Table A.6 in Appendix A). This decline might explain, at least in part, the decreased use of spent pulping liquor from 2004 to 2008, although 2009 and 2010 saw a slight increase in use of this energy source (due to a similar increase in output by the subsector during that same period).

Electricity has replaced natural gas as the most used energy source since 2003. As shown in Figure 7, the rapid growth in the price of natural gas compared with that of electricity between 1996 and 2006 may help explain this energy source shift, which, in turn, influenced the Manufacturing sector's fuel mix (see Table A.10 in Appendix A). However, the gap between both of these energy sources narrowed over the last four years, with the price of natural gas dropping. For a breakdown of the share of energy consumption in the Manufacturing sector by energy source from 1995 to 2010, refer to Table A.8 in Appendix A of this report.

Figure 7. Indexed growth of industrial natural gas and electricity prices, 1995–2009



*kW (kilowatt) refers to electrical power load, whereas kWh (kilowatt hour) refers to electrical energy consumed, i.e. the amount of electrical power consumed over a period of time.

In addition to the price of fuels, the structure of a sector, in terms of production, contributes to the fuel mix. For instance, an increase in GDP of the Primary Production of Alumina and Aluminum industry (NAICS 331313), which is an electricity-intensive industry, can contribute to an increase in the use of electricity for the entire Manufacturing sector.

As a complement to Figure 6, Table 3 illustrates the energy use by energy category and energy source for the Manufacturing sector in 1995 and 2010 (see Table A.8 in Appendix A for a full breakdown). Overall energy consumption in the sector fell by over 14 percent over the period 1995 to 2010. The table outlines significant reductions in the consumption of most energy sources. Within the RPP energy category, there were significant changes to the fuel mix (i.e. heavy fuel oil and propane were down 68.3 percent and 42.9 percent respectively, while consumption of middle distillates was up 53.4 percent). Petroleum coke and coal also experienced a significant increase in use during the period, whereas both coke and coke oven gas decreased.

From 1995 to 2010...

...overall energy consumption in the sector fell by over 14 percent

...the largest decrease in absolute terms was the use of natural gas (186.6 PJ)

...the sector used 14.8 PJ more petroleum coke and coke from catalytic cracking catalyst in 2010 than it did in 1995.

Table 3. Manufacturing sector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	624.7	25.1	619.7	29.0	-0.8
Natural gas	Natural gas	777.8	31.2	591.2	27.7	-24.0
Coal/coke	Coal	41.3	1.7	50.5	2.4	22.2
	Coke	102.9	4.1	78.7	3.7	-23.5
	Coke oven gas	27.4	1.1	21.9	1.0	-20.0
	Petroleum coke and coke from catalytic cracking catalyst	64.6	2.6	79.4	3.7	22.9
	Total, coal/coke	236.2	9.5	230.5	10.8	-2.4
RPP** (incl. natural gas liquids)	Heavy fuel oil	139.8	5.6	44.4	2.1	-68.3
	Middle distillates	17.2	0.7	26.4	1.2	53.4
	Propane	12.3	0.5	7.0	0.3	-42.9
	Refinery fuel gas	127.6	5.1	X*	N/A	N/A
	Butane	–	–	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	296.9	11.9	X*	N/A	N/A
Spent pulping liquor	Spent pulping liquor	343.6	13.8	203.1	9.5	-40.9
Steam and wood	Steam and wood	212.3	8.5	228.1	10.7	7.4
Total		2491.5	100.0	2135.9	100.0	-14.3

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

Between 2009 and 2010, total energy consumption in the sector rose slightly (3.1 percent), whereas output increased by 7.0 percent. As outlined in Table 4, there were increases in energy consumption of all energy sources from 2009 to 2010, with the exception of heavy fuel oil, which was the only energy source to decrease (22.6 percent).

From 2009 to 2010...

...total energy consumption in the sector rose slightly (3.1 percent), whereas output increased by 7.0 percent.

...heavy fuel oil was the only energy source to decrease in use (22.6 percent)

Table 4. Manufacturing sector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	611.3	29.5	619.7	29.0	1.4
Natural gas	Natural gas	563.1	27.2	591.2	27.7	5.0
Coal/coke	Coal	42.4	2.0	50.5	2.4	18.9
	Coke	74.4	3.6	78.7	3.7	5.7
	Coke oven gas	19.9	1.0	21.9	1.0	10.2
	Petroleum coke and coke from catalytic cracking catalyst	76.0	3.7	79.4	3.7	4.5
	Total, coal/coke	212.8	10.3	230.5	10.8	8.3
RPP** (incl. natural gas liquids)	Heavy fuel oil	57.4	2.8	44.4	2.1	-22.6
	Middle distillates	24.5	1.2	26.4	1.2	7.8
	Propane	6.9	0.3	7.0	0.3	2.2
	Refinery fuel gas	188.0	9.1	X*	N/A	N/A
	Butane	2.4	0.1	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	276.7	13.4	X*	N/A	N/A
Spent pulping liquor	Spent pulping liquor	191.1	9.2	203.1	9.5	6.3
Steam and wood	Steam and wood	214.6	10.4	228.1	10.7	6.3
Total		2072.0	100.0	2135.9	100.0	3.1

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

5 Selected Manufacturing subsectors

Although the Manufacturing sector has 21 subsectors,¹⁴ 91.0 percent of all energy consumption in 2010 was by only seven subsectors, as shown in Figure 8. These subsectors (in order of their share of energy consumption) are

- Paper Manufacturing (NAICS 322)
- Primary Metal Manufacturing (NAICS 331)
- Petroleum and Coal Product Manufacturing (NAICS 324)
- Chemical Manufacturing (NAICS 325)
- Wood Product Manufacturing (NAICS 321)
- Food Manufacturing (NAICS 311)
- Non-Metallic Mineral Product Manufacturing (NAICS 327)

This section examines these seven subsectors in greater detail.

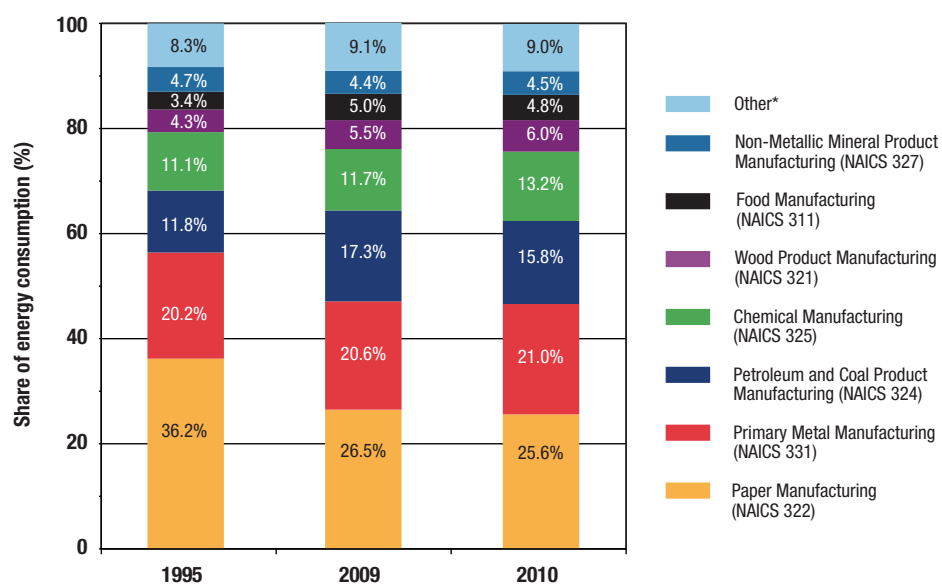
As demonstrated in Figure 8 (and Table A.4 in Appendix A), the share of energy consumption of the Paper Manufacturing subsector decreased substantially from 1995 to 2009 (9.7 percentage points), then remained steady in 2010. The Petroleum and Coal Manufacturing subsector experienced an increase in its share of energy consumption from 1995 to 2009 (5.5 percentage points) but this decreased slightly in 2010. The share of the other selected subsectors remained relatively stable from 1995 to 2010.

From 1995 to 2009...

...the share of energy consumption of the Paper Manufacturing subsector decreased substantially, then remained steady in 2010

...the share of energy consumption of the Petroleum and Coal Manufacturing subsector increased considerably, but decreased slightly in 2010.

Figure 8. Share of the Manufacturing sector's energy consumption by subsector, 1995, 2009 and 2010



*Other includes NAICS 312, 313, 314, 315, 316, 323, 326, 332, 333, 334, 335, 336, 337 and 339.

¹⁴ For a list of the 21 subsectors, see Appendix C, North American Industry Classification System.

In 2010...

...the Paper Manufacturing subsector consumed 25.6 percent (down from 36.2 percent in 1995) of the Manufacturing sector's energy consumption – making it the largest energy-consuming manufacturing subsector in Canada.

Energy intensity for the Paper Manufacturing sector...

...decreased 27.0 percent from 1995 to 2010, due to a 39.3 percent decrease in energy consumption and 16.9 percent decrease in output

...Paper Manufacturing was the only subsector of the seven largest consumers of energy within the sector that had a decrease in GDP from 1995 to 2010.

5.1 Paper Manufacturing subsector (NAICS 322)

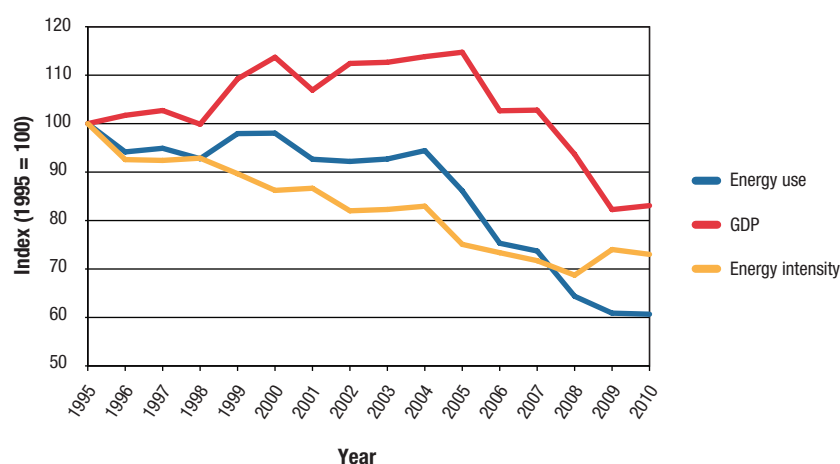
Establishments in the Paper Manufacturing subsector produce pulp, paper and paper products. The 2010 ICE survey estimated that this subsector consumed 546.6 petajoules (PJ) of energy, corresponding to nearly 26 percent of the Manufacturing sector's energy consumption – making it the largest energy-consuming manufacturing subsector in Canada.

5.1.1 Paper Manufacturing subsector's energy consumption, output and energy intensity trends

Of the seven largest consumers of energy within the Manufacturing sector, Paper Manufacturing is the only subsector that had a decrease in gross domestic product (GDP) between 1995 and 2010 (16.9 percent, falling from \$10.6 billion in 1995 to \$8.8 billion in 2010). At the same time, its energy consumption decreased 39.3 percent, from 901.1 PJ to 546.6 PJ. Consequently, the subsector's associated energy intensity diminished 27.0 percent, from 85.4 megajoules per dollar of GDP (MJ/\$GDP) to 62.4 MJ/\$GDP, which is a 1.8 percent average annual decline over this period.

Figure 9 illustrates the indexed growth of energy use, GDP and energy intensity from 1995 to 2010 for this subsector (see also Table A.12 in Appendix A). When GDP fell 17.7 percent between 2004 and 2008, energy use declined 31.8 percent. The increasing gap between the two indicators resulted in a decrease of energy intensity over this time. It is possible that this subsector's output and energy intensity decreased from 2004 to 2008 by closing their most energy-intensive operations first. However, between 2008 and 2009, GDP fell substantially (12.2 percent), while energy use decreased only by 5.4 percent. This resulted in an increase of energy intensity of 7.7 percent in 2009, as it too was faced with the impact of the recession. Between 2009 and 2010, output increased slightly for the first time since 2006–2007, while energy use decreased slightly, causing energy intensity to also decrease, as the economy started to improve.

Figure 9. Indexed growth of energy use, GDP and energy intensity for the Paper Manufacturing subsector, 1995–2010



In 1995, the Paper Manufacturing subsector was consuming 397.3 PJ more than the second most energy-consuming subsector. In 2010, this gap was reduced to only 98.4 PJ, due in large part to market conditions for Canadian paper products, as indicated by its

While capacity utilization for the entire sector decreased by 12.0 percentage points from 2007 to 2009, it decreased by only 5.0 percentage points for the Paper Manufacturing subsector...

This subsector coped better than the rest of the Manufacturing sector with the recent economic downturn...

Both the sector and subsector saw a resurgence in capacity utilization in 2010...

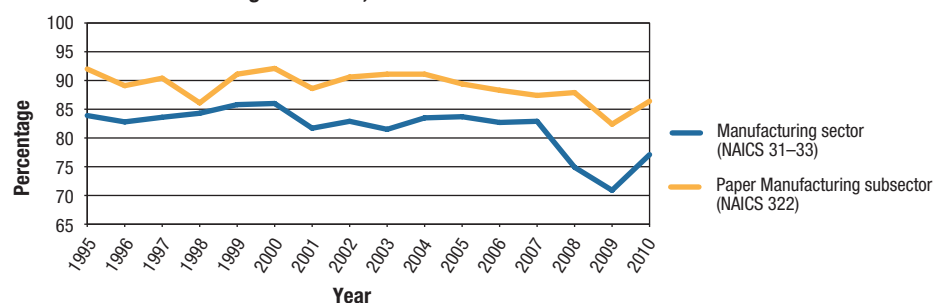
From 1995 to 2010...

...three of the four industries in the Paper Manufacturing subsector experienced substantial decreases in energy consumption.

decline in GDP. A full breakdown of the seven subsectors' energy consumption, GDP and energy intensity is provided in Tables A.5, A.6 and A.7 in Appendix A.

As shown in Figure 10, the drop in energy consumption in the Paper Manufacturing subsector from 2004 to 2008 cannot be entirely associated with capacity utilization. In fact, this subsector coped better than the rest of the Manufacturing sector with the recent economic downturn. While capacity utilization for the entire sector decreased 12.0 percentage points from 2007 to 2009, it decreased by only 5.0 percentage points for the Paper Manufacturing subsector. Both the sector and subsector saw a resurgence in capacity utilization in 2010. For a breakdown of capacity utilization rates for the sector and selected subsectors, refer to Table A.11 in Appendix A.

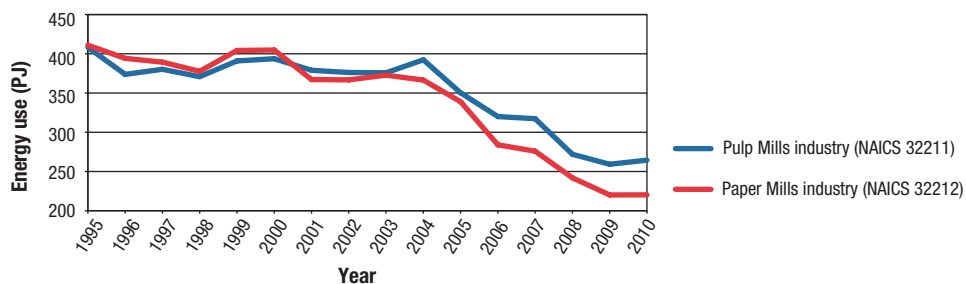
Figure 10. Comparison of capacity utilization rates for the Manufacturing sector and Paper Manufacturing subsector, 1995–2010



5.1.2 Paper Manufacturing subsector's energy consumption trends by industry

Figures 11a and 11b illustrate the energy used by the industries that make up the Paper Manufacturing subsector for the period 1995–2010. Three of the four industries experienced substantial decreases in energy consumption during the period. The only industry that increased its energy consumption (47.7 percent from 1995 to 2008, then another 50.0 percent from 2008 to 2010) was the Converted Paper Product Manufacturing industry (NAICS 3222), (even though its output decreased slightly [5.7 percent from 1995 to 2010]), mostly due to a diversification of products and services over the past few years. However, this industry accounted for only 4.5 percent of the energy use of the Paper Manufacturing subsector in 2010. For a detailed breakdown of energy consumption and GDP of the four industries that make up the Paper Manufacturing subsector, refer to Tables A.13 and A.14 in Appendix A.

Figure 11a. Energy consumption of the Paper Manufacturing industries, 1995–2010

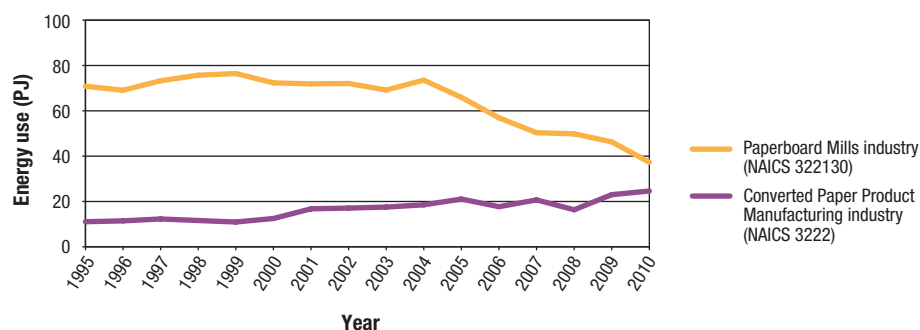


From 1995 to 2010...

...the Paper Manufacturing subsector used 354.5 less PJ in 2010 compared to 1995

...the largest drop was in the use of spent pulping liquor (the most commonly used energy source in this subsector).

Figure 11b. Energy consumption of the Paper Manufacturing industries, 1995–2010



5.1.3 Paper Manufacturing subsector's energy consumption by energy source

Table 5 lists the energy consumption by energy source for the Paper Manufacturing subsector in 1995 and 2010. Energy consumption for this subsector decreased by 39.3 percent during this period.

Table 5. Paper Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	193.7	21.5	143.1	26.2	-26.1
Natural gas	Natural gas	156.5	17.4	76.9	14.1	-50.8
Coal/coke	Coal	2.4	0.3	0.0	0.0	-100.0
RPP* (incl. natural gas liquids)	Heavy fuel oil	63.9	7.1	10.6	1.9	-83.4
	Middle distillates	3.2	0.4	1.3	0.2	-61.0
	Propane	1.3	0.1	0.4	0.1	-73.6
	Total, RPP (incl. natural gas liquids)	68.5	7.6	12.2	2.2	-82.1
Spent pulping liquor	Spent pulping liquor	343.6	38.1	203.1	37.1	-40.9
Steam and wood	Steam	9.1	1.0	13.1	2.4	43.9
	Wood	127.4	14.1	98.2	18.0	-22.9
	Total, steam and wood	136.5	15.1	111.3	20.4	-18.5
Total		901.1	100.0	546.6	100.0	-39.3

Note: Due to rounding, the numbers in the table may not add up.

*RPP = refined petroleum products

According to ICE survey estimates, Paper Manufacturing is the only subsector that produces and consumes spent pulping liquor. The demand for this type of energy, which is the most commonly used energy source in the subsector (37.1 percent, or 203.1 PJ, in 2010), decreased 40.9 percent (140.5 PJ) between 1995 and 2010. Since 2001, natural gas moved from the third most used energy source to fourth, after spent pulping liquor, electricity and wood. Natural gas consumption decreased 50.9 percent or 79.6 PJ from 1995 to 2010. The use of heavy fuel oil, electricity and wood also decreased considerably from 1995 to 2010 (83.4 percent, 26.1 percent and 22.9 percent respectively). Although steam remains one of the least used energy sources by the Paper Manufacturing subsector,

From 2009 to 2010...

...the use of spent pulping liquor increased by 6.3 percent.

it was the only energy source to increase in use from 1995 to 2010 (43.9 percent). The increasing use of steam, combined with the significant drop in the use of heavy fuel oil and the fact that coal was no longer being used, contributed toward making the Paper Manufacturing subsector less greenhouse gas intensive.

Table A.15 in Appendix A provides a complete breakdown of the energy sources used by this subsector from 1995 to 2010.

Table 6. Paper Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	146.8	26.8	143.1	26.2	-2.5
Natural gas	Natural gas	78.9	14.4	76.9	14.1	-2.4
Coal/coke	Coal	X*	N/A	0.0	0.0	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	15.0	2.7	10.6	1.9	-29.3
	Middle distillates	1.3	0.2	1.3	0.2	-6.2
	Propane	X*	N/A	0.4	0.1	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	12.2	2.2	N/A
Spent pulping liquor	Spent pulping liquor	191.1	34.8	203.1	37.1	6.3
Steam and wood	Steam	12.2	2.2	13.1	2.4	7.2
	Wood	102.5	18.7	98.2	18.0	-4.2
	Total, steam and wood	114.7	20.9	111.3	20.4	-3.0
Total		548.7	100.0	546.6	100.0	-0.4

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

Most of the trends observed with respect to energy sources used by the Paper Manufacturing subsector from 1995 to 2010 also applied for the period 2009 to 2010, with the exception of spent pulping liquor, which increased by 6.3 percent.

5.2 Primary Metal Manufacturing subsector (NAICS 331)

The Primary Metal Manufacturing subsector includes establishments that perform smelting and refining of ferrous metals (those that contain iron, including iron-containing alloys such as steel) and non-ferrous metals (those that do not contain iron, such as aluminum and copper). Smelting refers to the “heat treatment of an ore to separate the metallic portion.” Refining is “a separation process whereby undesirable components are removed to give a concentrated and purified product.”¹⁵

The 2010 ICE survey estimates that the Primary Metal Manufacturing subsector consumed 448.2 PJ of energy, which accounted for 21.0 percent of the Manufacturing sector's energy consumption, and was the second most energy-consuming subsector in the Manufacturing sector.

¹⁵ N.I. Sax and R.J. Lewis, Hawley's Condensed Chemical Dictionary, Tenth Edition (ISBN 0-442-28097-1).

In 2010...

...the Primary Metal Manufacturing subsector consumed 21.0 percent of the Manufacturing sector's energy consumption – making it the second most energy-consuming manufacturing subsector in Canada.

Energy intensity for the Primary Metal Manufacturing sector...

...was 22.4 percent lower in 2010 compared to 1995, even though output grew by 14.7 percent over the same period.

From 2008 to 2009...

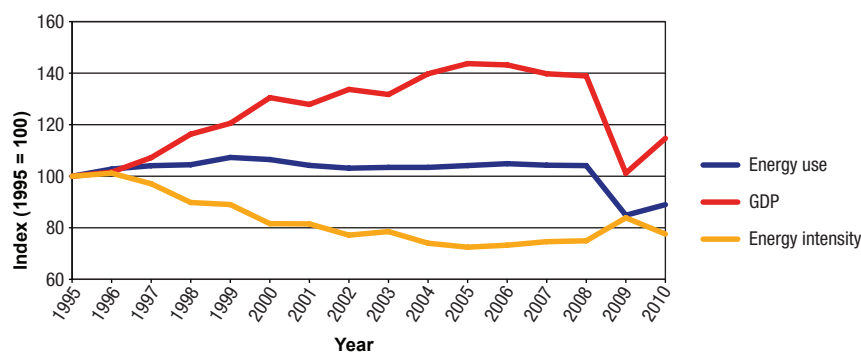
...capacity utilization of the Primary Metal Manufacturing subsector (and in particular the Iron and Steel industry) decreased significantly (12.6 percentage points) compared with a 4.0 percentage point decrease for the overall sector

...the continuing recession in the United States and the impact of their temporary import restriction on foreign steel were felt by this subsector in 2009.

5.2.1 Primary Metal Manufacturing subsector's energy consumption output and energy intensity trends

As was the case with the Paper Manufacturing subsector, the energy intensity of the Primary Metal Manufacturing subsector declined steadily from 1995 to 2008 (see Table A.16 in Appendix A). This decline was due to a 38.9 percent increase in output over this period combined with relatively stable energy use (only 4.1 percent growth). Between 1995 and 2008, this subsector saw its energy intensity decrease 25.0 percent, from 60.7 MJ/\$GDP to 45.5 MJ/\$GDP, or an average annual decrease of 1.9 percent. However, between 2008 and 2009, both GDP and energy use fell substantially (27.1 percent and 18.4 percent, respectively). This resulted in an increase of energy intensity of almost 12 percent in 2009.¹⁶ Figure 12 illustrates this changing trend and shows that in 2010, both GDP and energy use grew (by 13.3 percent and 4.8 percent, respectively) over the previous year, causing energy intensity to fall by almost 8 percent from the previous year.

Figure 12. Indexed growth of energy use, GDP and energy intensity for the Primary Metal Manufacturing subsector, 1995–2010



As demonstrated in Figure 13, between 2008 and 2009, capacity utilization of the Primary Metal Manufacturing subsector (and in particular the Iron and Steel industry) decreased significantly (12.6 percentage points) compared with a 4.0 percentage point decrease for the overall sector. The continuing recession in the United States and the impact of the temporary import restriction on foreign steel¹⁷ were felt by this subsector in 2009. In 2010, capacity utilization grew for both the Manufacturing sector as a whole and this subsector by 6.2 percentage points and 5.2 percentage points, respectively (see Table A.11 in Appendix A).

¹⁶ The decrease in output experienced by this subsector between 2008 and 2009 is discussed further in this section.

¹⁷ The provisions of the *American Reinvestment and Recovery Act of 2009* (the ARRA) explicitly limited foreign companies' access to the estimated US\$275 billion in procurement funds contained in the US\$787-billion stimulus package. As a result, ARRA-financed procurement at the state and local levels for iron, steel and manufactured products was effectively closed to Canadian bidders. House of Commons Canada, *Canada-United States Agreement on Government Procurement Report of the Standing Committee on International Trade*, May 2010, www.buildingtrades.ca/Files/Documents/403_CIIT_Rpt01-e.aspx.

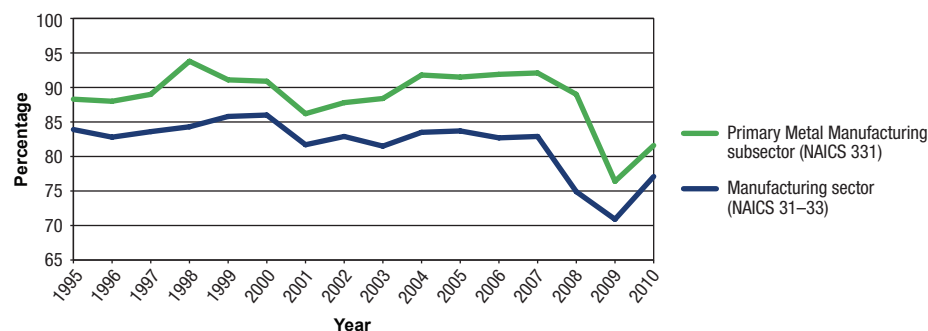
In 2010...

...capacity utilization grew for both the Manufacturing sector as a whole, and this subsector.

From 1997 to 2010...

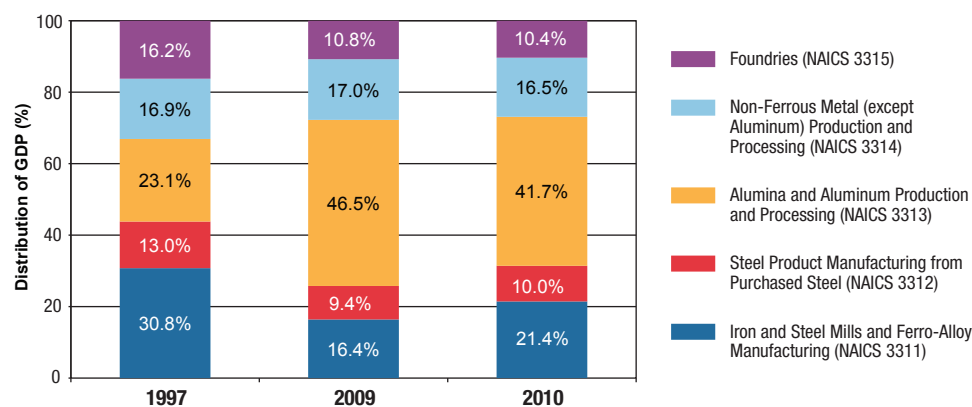
...the GDP of the Alumina and Aluminum Production and Processing industry grew 18.6 percentage points, making it the largest industry in the Primary Metal Manufacturing subsector (in terms of output) in 2010, surpassing the Iron and Steel Mills and Ferro-Alloy Manufacturing industry's share by 20.3 percentage points.

Figure 13. Comparison of capacity utilization rates for the Manufacturing sector and Primary Metal Manufacturing subsector, 1995–2010



Although the Primary Metal Manufacturing subsector experienced the largest decrease in output among the seven subsectors from 2008 to 2009 (see Table A.6 in Appendix A), it experienced substantial growth in 2010 (13.1 percent). Figure 14 illustrates the share of GDP among the Primary Metal Manufacturing industries for 1997,¹⁸ 2009 and 2010. As this figure shows, the subsector experienced some structural changes over the years. The largest decrease in the share of output was experienced by the Iron and Steel Mills and Ferro-Alloy Manufacturing (NAICS 3311) industry, (14.4 percentage points from 1997 to 2009). However, this industry's GDP grew by 5.0 percentage points the following year.¹⁹ In contrast, the Alumina and Aluminum Production and Processing (NAICS 3313) industry's share of the subsector's GDP increased 23.4 percentage points from 1997 to 2009²⁰ but subsequently decreased 4.8 percentage points in 2010. For further breakdown of the distribution of GDP for this subsector, refer to Tables A.17 and A.18 in Appendix A.

Figure 14. Distribution of GDP* of the Primary Metal Manufacturing subsector by industry, 1997, 2009 and 2010



* GDP at basic price in constant 2002 dollars; 1997 share is based on the sum of the subindustries, which is slightly different than the sector estimate.

¹⁸ The data for 1995 and 1996 data were not available for all industries.

¹⁹ "This increase was as a result of the Canada-U.S. Agreement on Government Procurement, which provided the opportunity for U.S. subfederal governments and contractors to continue to work with Canadian suppliers or renew those relationships". Foreign Affairs and International Trade Canada, *Information on Canada - U.S. Agreement on Government Procurement*,

www.international.gc.ca/trade-agreements-accords-commerciaux/fo/information_reseignements.aspx

²⁰ This was due to an almost two-fold increase in the sales of manufactured goods of the Primary Production of Alumina and Aluminum industry (NAICS 331313) between 1995 and 2009.

From 1995 to 2010...

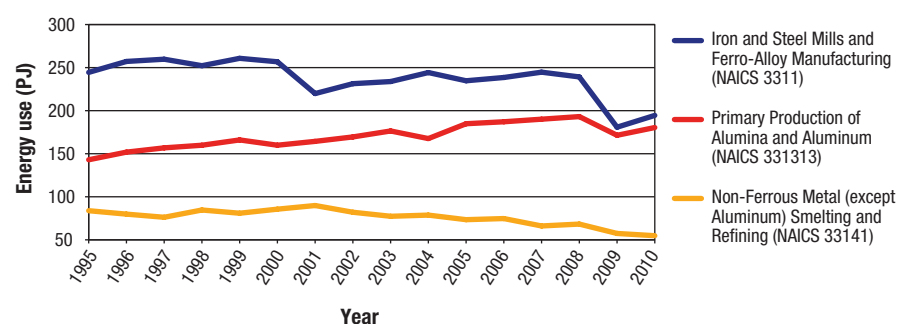
...energy consumption of the Primary Production of Alumina and Aluminum industry has been increasing, whereas that of the other two most energy-consuming industries has been decreasing.

5.2.2 Primary Metal Manufacturing subsector's energy consumption trends by industry

Figure 15 illustrates energy use for the three largest energy-consuming industries in the Primary Metal Manufacturing subsector.²¹ These three industries accounted for 95.9 percent of the subsector's energy use in 2010.

Even though energy use in the subsector remained relatively constant from 1995 to 2008 (see Table A.3 in Appendix A), then decreased substantially between 2008 and 2009 (18.5 percent), and finally increased again in 2010 (4.8 percent), this trend did not hold true for all industries. Energy consumption of the Primary Production of Alumina and Aluminum industry (NAICS 331313) increased 35.0 percent between 1995 and 2008, then decreased 11.2 percent between 2008 and 2009, and increased once again (5.3 percent) between 2009 and 2010. The Iron and Steel Mills and Ferro-Alloy Manufacturing industry (NAICS 3311) and the Non-Ferrous Metal (except Aluminum) Smelting and Refining industry (NAICS 33141) partially offset the aforementioned increase with 2.2 percent and 18.5 percent reductions in their respective energy consumption for the period 1995 to 2008. These two industries experienced further 24.4 percent²² and 16.0 percent reductions in their respective energy consumption from 2008 to 2009, followed by respective increases and decreases of 7.6 percent and 4.5 percent in 2010. Table A.19 in Appendix A demonstrates the energy consumption trends of the subsector's industries from 1995 to 2010.

Figure 15. Energy consumption of the selected Primary Metal Manufacturing industries, 1995–2010



5.2.3 Primary Metal Manufacturing subsector's energy consumption by energy source

Table 7 shows the energy consumption by energy source for the Primary Metal Manufacturing subsector in 1995 and 2010. Considering the substantial increase in energy use in the Primary Production of Alumina and Aluminum industry between 1995 and 2010 (26.2 percent), it not surprising that electricity consumption continued to grow in this subsector, as this industry is known to be electricity-intensive.²³ Offsetting this

²¹ Due to data limitations for some industries, five- and six-digit NAICS code details are presented.

²² The Iron and Steel Mills industry experienced a significant decrease (48.5 percent) in GDP from 2008 to 2009, largely due to the U.S. Congress enacting a statute requiring recipients of stimulus money to (temporarily) buy American iron and steel only. Indeed, exports to the United States (the largest market for these products) by this industry decreased 46.7 percent between 2008 and 2009. However, exports to the United States increased by 50.8 percent from 2009 to 2010. (Source: Industry Canada, Trade Data Online (TDO), ic.gc.ca/tdo).

²³ John Nyboer and Kristin Lutes, *A Review of Energy Consumption and Related Data – Canadian Aluminum Industries, 1990 to 2009*, p.2. Canadian Industrial Energy End-Use Data and Analysis Centre, 2011.

From 1995 to 2010...

...even though the Primary Metal Manufacturing subsector consumed 11.0 percent less energy, it used 7.5 more PJ of electricity.

increase in electricity consumption was the combined decrease in the use of all other non-confidential energy sources (with the exception of coal and middle distillates).

Table 7. Primary Metal Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995-2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	214.4	42.6	221.9	49.5	3.5
Natural gas	Natural gas	128.4	25.5	89.0	19.8	-30.7
Coal/coke	Coal	9.9	2.0	19.5	4.3	95.9
	Coke from coal	102.2	20.3	X*	N/A	N/A
	Coke oven gas	27.4	5.4	21.9	4.9	-20.0
	Petroleum coke	2.2	0.4	X*	N/A	N/A
	Total, coal/coke	141.7	28.1	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	15.4	3.0	6.0	1.3	-61.2
	Middle distillates	2.4	0.5	2.8	0.6	17.5
	Propane	1.1	0.2	1.0	0.2	-6.7
	Total, RPP (incl. natural gas liquids)	18.8	3.7	9.7	2.2	-48.4
Steam and wood	Steam and wood	0.4	0.1	X*	N/A	N/A
Total		503.8	100.0	448.2	100.0	-11.0

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

For a complete breakdown of the energy sources used by this subsector from 1995 to 2010, refer to Table A.20 in Appendix A.

Although natural gas consumption decreased overall for this subsector between 1995 and 2010, it increased slightly between 2009 and 2010, as outlined in Table 8. The significant increase in the use of coal between 1995 and 2010 (95.9 percent) was evidenced mostly from 2009 to 2010, when this energy source's consumption increased from 10.7 PJ to 19.5 PJ (82.5 percent).

From 2009 to 2010...

...there was a significant increase in the use of coal (82.5 percent), coinciding with the increase in output of the Iron and Steel Mills industry.

In 2010...

...the Petroleum and Coal Product Manufacturing subsector consumed 15.8 percent of the Manufacturing sector's energy consumption

...this was the third among the most energy-consuming manufacturing subsectors in Canada.

Table 8. Primary Metal Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	215.5	50.4	221.9	49.5	3.0
Natural gas	Natural gas	87.8	20.5	89.0	19.8	1.3
Coal/coke	Coal	10.7	2.5	19.5	4.3	82.5
	Coke from coal	X*	N/A	X*	N/A	N/A
	Coke oven gas	19.9	4.7	21.9	4.9	10.2
	Total, coal/coke	X*	N/A	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	8.6	2.0	6.0	1.3	-30.7
	Middle distillates	2.7	0.6	2.8	0.6	1.8
	Propane	0.9	0.2	1.0	0.2	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	9.7	2.2	N/A
Steam and wood	Steam and wood	X*	N/A	X*	N/A	N/A
Total		427.6	100.0	448.2	100.0	4.8

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

5.3 Petroleum and Coal Product Manufacturing subsector (NAICS 324)

Establishments in the Petroleum and Coal Product Manufacturing subsector transform crude petroleum and coal into usable products. Petroleum Refineries (NAICS 32411) represent the main industry of the subsector in terms of energy use. The petroleum refining process separates various hydrocarbons contained in crude oil to produce many products, such as gasoline, diesel fuel oil, light and heavy fuel oils, and asphalt.

The 2010 ICE survey estimates that the Petroleum and Coal Product Manufacturing subsector consumed 338.5 PJ of energy in 2010, which was 15.8 percent of the Manufacturing sector's energy consumption. This ranked it third among the most energy-consuming subsectors of Canada's Manufacturing sector.

5.3.1 Petroleum and Coal Product Manufacturing subsector's energy consumption, output and energy intensity trends

Figure 16 illustrates the indexed growth of energy consumption, GDP and energy intensity for the Petroleum and Coal Product Manufacturing subsector from 1995 to 2010 (see also Table A.21 in Appendix A). From 1995 to 1998, both output and energy use increased in the subsector, the latter at a slower pace, causing energy intensity to fall. Between 1998 and 2007, output remained fairly constant while energy use rose 22.0 percent. The combination of these two factors yielded a 19.7 percent increase in energy intensity in that period. This increase may partly be attributable to the refining of more heavy crude during that period, as well as fluctuations in the price of oil. Finally, between 2007 and 2010, while energy use decreased substantially (11.4 percent), GDP remained constant, causing energy intensity to decrease (10.2 percent).

Energy intensity for the Petroleum and Coal Product Manufacturing subsector...

...was virtually the same in 2010 as it was in 1995, despite significant fluctuations over the 1995–2010 period. This is as a result of similar increases in both output and energy use over that period.

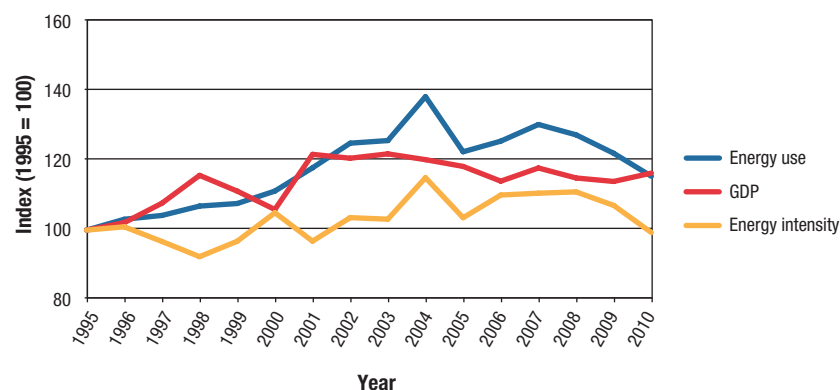
From 2008 to 2009...

...capacity utilization for the Petroleum and Coal Product Manufacturing subsector increased by 3.1 percentage points, while that for the sector as a whole decreased by 4.0 percentage points.

In 2010...

...the subsector's capacity utilization remained constant while that for the sector as a whole increased by 8.7 percent.

Figure 16. Indexed growth of energy use, GDP and energy intensity for the Petroleum and Coal Product Manufacturing subsector, 1995–2010

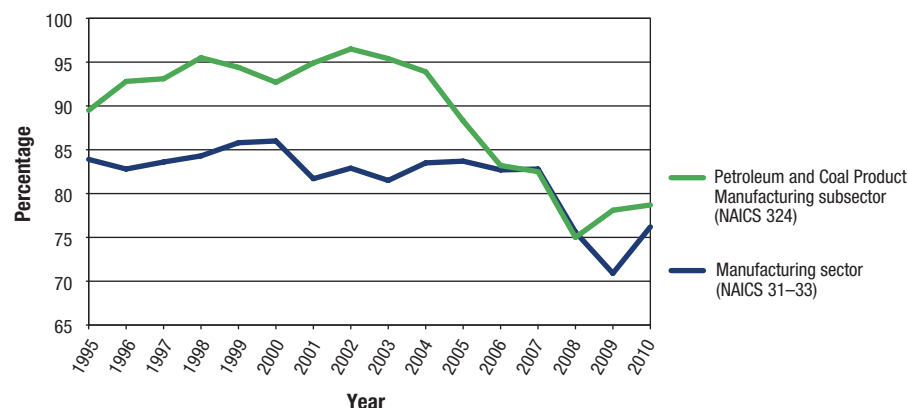


Overall, in 2010, Canada's Petroleum and Coal Product Manufacturing subsector used 15.5 percent more energy and produced 16.4 percent more output than it did in 1995 (see Table A.21 in Appendix A).

Due to data limitations, it is not possible to accurately calculate the energy intensity of the industries that compose this subsector. However, because the Petroleum Refineries industry represented 93.4 percent of the subsector's energy consumption, it can be inferred that this industry made a significant contribution to the 7.3 percent decrease in energy intensity of the subsector between 2009 and 2010.

As demonstrated in Figure 17 (and Table A.11 in Appendix A), capacity utilization of the Petroleum and Coal Product Manufacturing subsector was significantly higher than that of the sector as a whole from 1995 to 2004, after which time the rate for the subsector began to decrease and be more consistent with that of the sector. From 2008 to 2009, capacity utilization for the subsector increased by 3.1 percentage points, compared with a 4.0 percentage point decrease for the overall sector. In 2010, capacity utilization remained steady for this subsector, while the Manufacturing sector as a whole regained its loss from the previous year.

Figure 17. Comparison of capacity utilization rates for the Manufacturing sector and Petroleum and Coal Product Manufacturing subsector, 1995–2010



In 2010...

...the Petroleum Refineries industry represented 93.4 percent of the subsector's energy consumption.

From 1995 to 2010...

...the most significant increase in energy use (31.4 percent) occurred in refinery fuel gas, the most commonly used energy source for the Petroleum and Coal Product Manufacturing subsector.

5.3.2 Petroleum and Coal Product Manufacturing subsector's energy consumption trends by industry

The ICE survey collects information for only the Petroleum Refineries industry in the Petroleum and Coal Product Manufacturing subsector. As previously mentioned, this industry accounted for about 93.4 percent of all energy used to process petroleum and coal.

5.3.3 Petroleum and Coal Product Manufacturing subsector's energy consumption by energy source

Table 9 shows the energy consumption by energy source for the Petroleum and Coal Product Manufacturing subsector in 1995 and 2010. The only non-confidential energy sources that decreased from 1995 to 2010 were heavy fuel oil and coal (coal is no longer being used), although these sources were not among the most used in the subsector. All other energy sources increased over the period. The most significant increase occurred in refinery fuel gas – the most commonly used energy source in the subsector – which increased 31.4 percent (40.1 PJ) since 1995.

Table 9. Petroleum and Coal Product Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995-2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	17.3	5.9	24.9	7.3	43.5
Natural gas	Natural gas	51.0	17.4	60.8	18.0	19.2
Coal/coke	Coal	0.9	0.3	0.0	0.0	-100.0
	Petroleum coke	48.4	16.5	53.9	15.9	11.4
	Total, coal/coke	49.3	16.8	53.9	15.9	9.4
RPP** (incl. natural gas liquids)	Refinery fuel gas	127.6	43.6	167.7	49.5	31.4
	Heavy fuel oil	41.7	14.3	15.4	4.6	-63.0
	Propane	4.9	1.7	X*	N/A	N/A
	Middle distillates	0.4	0.1	10.1	3.0	2408.9
	Total, RPP (incl. natural gas liquids)	174.7	59.6	X*	N/A	N/A
Steam and wood	Steam and wood	0.6	0.2	X*	N/A	N/A
Total		293.0	100.0	338.5	100.0	15.5

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

Refer to Table A.22 in Appendix A for the full breakdown of energy sources used by this subsector from 1995 to 2010.

Although there was a significant increase in use of refinery fuel gas from 1995 to 2010 in this subsector, Table 10 shows that its consumption decreased from 2009 to 2010 (10.8 percent). Both this decrease and that in the use of heavy fuel oil (34.3 percent) contributed to the overall decrease in energy consumption in the Petroleum and Coal Product Manufacturing subsector in 2010.

From 2009 to 2010...

...both the decrease in refinery fuel gas (10.8 percent) and heavy fuel oil (34.3 percent) contributed to the overall decrease in energy consumption in the Petroleum and Coal Product Manufacturing subsector.

In 2010...

...the Chemical Manufacturing subsector consumed 282.6 PJ of energy or 13.2 percent of the Manufacturing sector's energy consumption

Energy intensity for the Chemical Manufacturing sector has been climbing since 2006.

Table 10. Petroleum and Coal Product Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	23.5	6.6	24.9	7.3	5.7
Natural gas	Natural gas	55.5	15.5	60.8	18.0	9.6
Coal/coke	Coal	0.0	0.0	0.0	0.0	0.0
	Petroleum coke	50.7	14.2	53.9	15.9	6.3
	Total, coal/coke	50.7	14.2	53.9	15.9	6.3
RPP** (incl. natural gas liquids)	Refinery fuel gas	188.0	52.5	167.7	49.5	-10.8
	Heavy fuel oil	23.5	6.6	15.4	4.6	-34.3
	Propane	X*	N/A	X*	N/A	N/A
	Middle distillates	10.2	2.9	10.1	3.0	-0.9
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam and wood	Steam and wood	X*	N/A	X*	N/A	N/A
Total		357.8	100.0	338.5	100.0	-5.4

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

5.4 Chemical Manufacturing subsector (NAICS 325)

Establishments in the Chemical Manufacturing subsector (NAICS 325) manufacture chemicals and chemical products from organic and inorganic raw materials.²⁴ The 2010 ICE survey estimated that the Chemical Manufacturing subsector consumed 282.6 PJ of energy in 2010, corresponding to 13.2 percent of the Manufacturing sector's energy consumption.

5.4.1 Chemical Manufacturing subsector's energy consumption, output and energy intensity trends

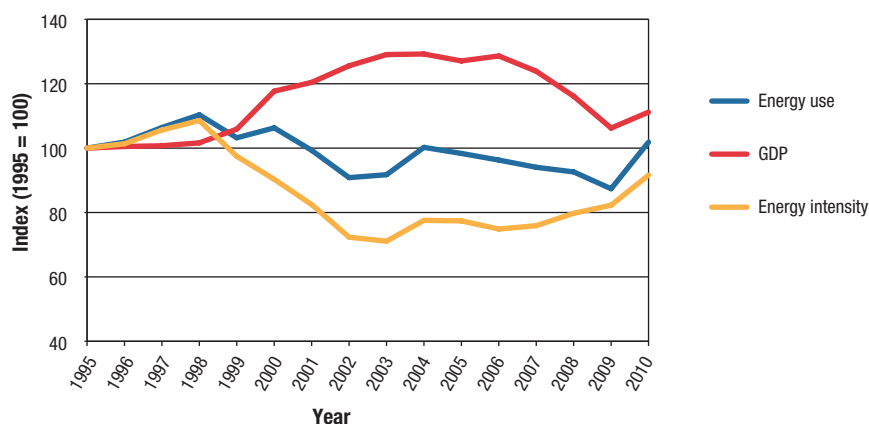
Figure 18 and Table A.23 in Appendix A illustrate the indexed growth of energy consumption, GDP and energy intensity from 1995 to 2010 for the Chemical Manufacturing subsector. From 1998 to 2003, output in the subsector grew rapidly while energy consumption declined. These two factors yielded a significant decrease in energy intensity over the period (34.5 percent). From 2004 to 2006, growth in GDP and energy use was relatively flat. From 2007 to 2009, both GDP and energy use decreased (14.3 percent and 7.0 percent respectively), causing energy intensity to rise by 8.4 percent. In 2010, both GDP and energy use increased, although the latter at a faster rate (4.7 percent and 16.6 percent respectively) and this caused energy intensity to increase once again (11.3 percent).

²⁴For a detailed description of the 18 industries that make up this subsector, refer to *North American Industry Classification (NAICS) 2007*, section NAICS 325, Statistics Canada, at www.statcan.gc.ca/pub/12-501-x/12-501-x2007001-eng.pdf.

From 2007 to 2010...

...capacity utilization for the Chemical Manufacturing subsector and the sector as a whole followed a similar pattern.

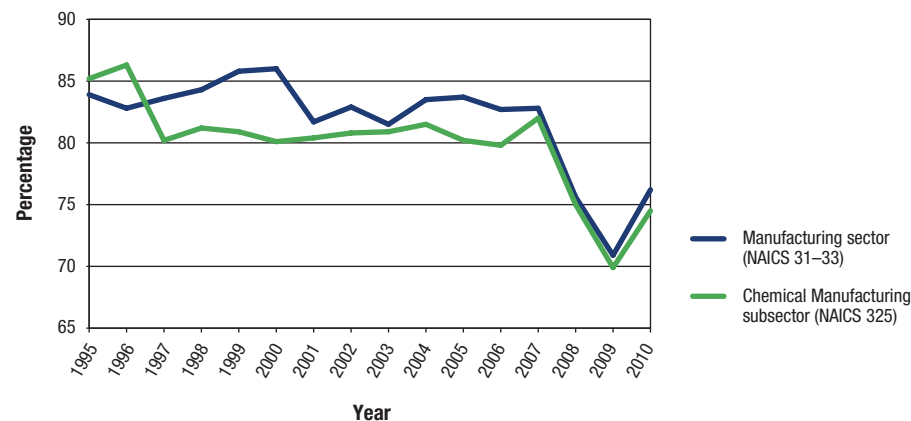
Figure 18. Indexed growth of energy use, GDP and energy intensity for the Chemical Manufacturing subsector, 1995–2010



Over the 15-year period from 1995 to 2010, Canada's Chemical Manufacturing subsector increased its output by 11.2 percent as well as its energy consumption by 1.9 percent. This resulted in an 8.4 percent decrease in energy intensity (an average annual decrease of 0.56 percent), from 23.0 MJ/\$GDP to 21.1 MJ/\$GDP.

As demonstrated in Figure 19 (and Table A.11 in Appendix A), between 2007 and 2010, capacity utilization for the Chemical Manufacturing subsector followed a very similar pattern to that of the overall sector. Both rates decreased substantially from 2007 and 2009, and then followed a similar increase the following year.

Figure 19. Comparison of capacity utilization rates for the Manufacturing sector and Chemical Manufacturing subsector, 1995–2010



From 1995 to 2010...

...energy consumption of the six largest industries in the Chemical Manufacturing subsector fluctuated significantly

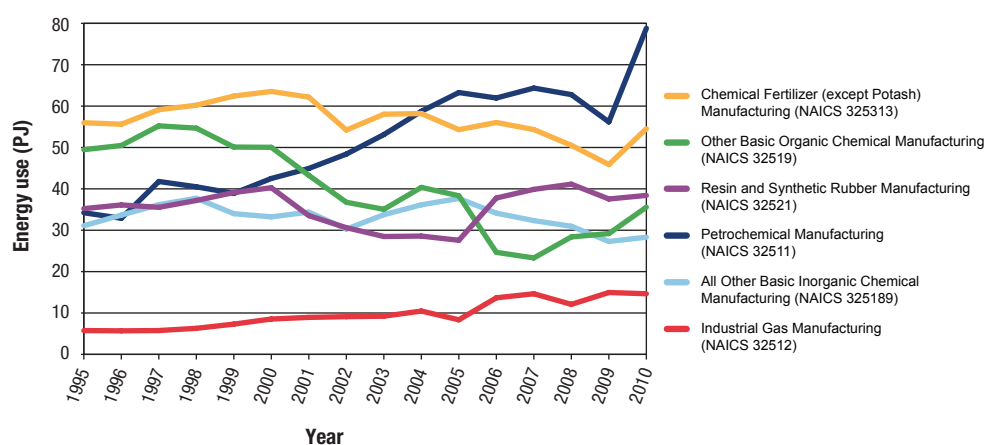
...the largest changes in energy consumption occurred in Industrial Gas Manufacturing, with a 154.3 percent increase, and Petrochemical Manufacturing, with a 130.3 percent increase.

5.4.2 Chemical Manufacturing subsector's energy consumption trends by industry

Figure 20 and Table A.24 in Appendix A illustrate the six industries for which energy consumption data are available for the entire study period. In 2010, these industries accounted for 88.6 percent of the Chemical Manufacturing subsector's energy use.

Substantial fluctuations within the Chemical Manufacturing subsector and the lack of output data make it difficult to properly analyze energy consumption trends among the industries. That being said, it is evident nevertheless that between 1995 and 2010, the largest changes in energy consumption occurred in Industrial Gas Manufacturing, with a 154.3 percent increase, and Petrochemical Manufacturing, with a 130.3 percent increase. In absolute terms, the Petrochemical Manufacturing industry increased its energy consumption the most (44.6 PJ), half of which occurred from 2009 to 2010. In 1995, the Chemical Fertilizer Manufacturing industry was one of the largest consumers of energy, but in 2004, the Petrochemical Manufacturing industry took over as the largest energy consumer. Many factors, such as increased energy efficiency and decreased production, can influence yearly variation in energy consumption.

Figure 20. Energy consumption of selected Chemical Manufacturing industries, 1995–2010



5.4.3 Chemical Manufacturing subsector's energy consumption by energy source

Table 11 shows the energy consumption by energy source for the Chemical Manufacturing subsector in 1995 and 2010. Natural gas consumption, which is the most widely used energy source in the Chemical Manufacturing subsector, decreased slightly (2.4 percent) between 1995 and 2010. Electricity consumption (the second largest energy source used in this subsector) also decreased from 1995 to 2010 (6.8 percent). Unfortunately, it is not possible to analyze the trend in energy consumption for the coal/coke, refined petroleum products, steam and wood categories because of the unavailability of data for 2009 and 2010.

From 1995 to 2010...

...natural gas consumption, which is the most widely used energy source in the Chemical Manufacturing subsector, decreased slightly (2.4 percent)

...electricity consumption (the second largest energy source used in this subsector) also decreased (6.8 percent).

Table 11. Chemical Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995-2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	71.6	25.8	66.8	23.6	-6.8
Natural gas	Natural gas	177.4	63.9	173.1	61.2	-2.4
Coal/coke	Coal	0.0	0.0	X*	N/A	N/A
	Petroleum coke and coke from catalytic cracking	0.7	0.3	X*	N/A	N/A
	Total, coal/coke	0.7	0.3	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	5.0	1.8	X*	N/A	N/A
	Middle distillates	1.2	0.4	X*	N/A	N/A
	Propane	0.3	0.1	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	6.5	2.3	X*	N/A	N/A
Steam	Steam	21.3	7.7	X*	N/A	N/A
Wood	Wood	0.0	0.0	0.0	0.0	N/A
Total		277.5	100.0	282.6	100.0	1.9

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

Table A.25 in Appendix A provides a full breakdown of energy sources used by this subsector from 1995 to 2010.

Between 2009 and 2010, the Chemical Manufacturing subsector increased its energy consumption by 16.6 percent. As outlined in Table 12, consumption of both natural gas and electricity grew during this period (13.2 percent and 2.2 percent, respectively).

From 2009 to 2010...

...the Chemical Manufacturing subsector increased its energy consumption by 16.6 percent

...natural gas use was up 13.2 percent.

In 2010...

...the Wood Product Manufacturing subsector was the fifth largest energy consuming Manufacturing subsector in Canada, consuming 128.2 PJ of energy.

Table 12. Chemical Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	65.3	26.9	66.8	23.6	2.2
Natural gas	Natural gas	152.9	63.1	173.1	61.2	13.2
Coal/coke	Coal	X*	N/A	X*	N/A	N/A
	Petroleum coke and coke from catalytic cracking	X*	N/A	X*	N/A	N/A
	Total, coal/coke	X*	N/A	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	X*	N/A	X*	N/A	N/A
	Middle distillates	X*	N/A	X*	N/A	N/A
	Propane	X*	N/A	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam	Steam	22.0	9.1	X*	N/A	N/A
Wood	Wood	0.4	0.2	0.0	0.0	-98.5
Total		242.5	100.0	282.6	100.0	16.6

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

5.5 Wood Product Manufacturing subsector (NAICS 321)

Establishments in the Wood Product Manufacturing subsector produce products from wood. These establishments are engaged in activities such as sawing logs and making products that improve the natural characteristics of woods (veneers, plywood etc.). The 2010 ICE survey estimated that this subsector was the fifth largest energy consuming Manufacturing subsector in Canada, consuming 128.2 PJ of energy, corresponding to 6.0 percent of the sector's energy consumption.

5.5.1 Wood Product Manufacturing subsector's energy consumption, output and energy intensity trends

Figure 21 illustrates the indexed growth of energy consumption, GDP and energy intensity from 1995 to 2010 for the Wood Product Manufacturing subsector (refer also to Table A.26 in Appendix A). Two distinct trends in energy use and GDP are observed for this subsector, one from 1995 to 2005 and the other from 2006 to 2009.

From 1995 to 2005, GDP grew by 73.6 percent (from \$7.7 to \$13.4 billion), while energy use increased 19.4 percent (from 108.2 PJ to 129.2 PJ). This resulted in a decrease in energy intensity of 31.2 percent (from 14.0 MJ/\$GDP to 9.6 MJ/\$GDP). Between 2006 and 2009, the opposite situation happened: GDP fell 32.9 percent (from \$13.3 to \$8.9 billion), while energy use declined 19.8 percent (from 141.8 PJ to 113.5 PJ), causing energy intensity to increase by 19.3 percent (from 10.7 MJ/\$GDP to 12.7 MJ/\$GDP). This is the opposite of what has been observed in the Paper Manufacturing subsector (see Section 5.1). One explanation may be that despite decreasing production, few wood products plants have closed, thereby reducing the establishments' scale effects (for a description of scale effect, see Chapter 3). Finally, between 2009 and 2010, both output

Energy intensity for the Wood Product Manufacturing sector...

...decreased steadily from 1995 to 2005, as output grew at a significantly faster rate than energy consumption

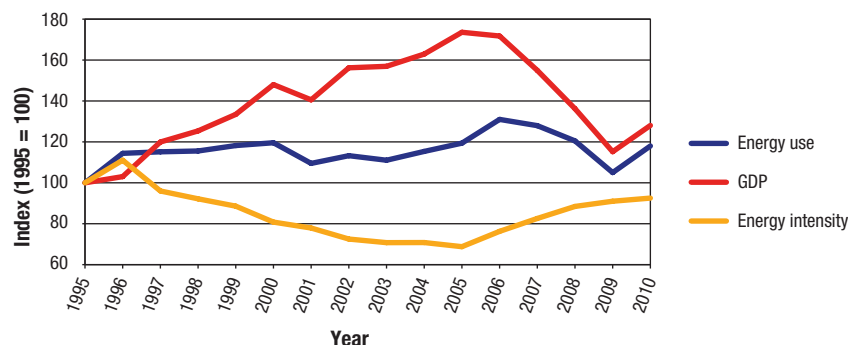
...increased substantially from 2006 to 2009, as output fell more than energy consumption, and is approaching the 1995 value.

From 2001 to 2004...

...capacity utilization grew substantially faster for the Wood Product Manufacturing subsector than for the sector as a whole. However, from 2004 to 2009, it decreased at a much quicker rate. Finally, in 2010, the subsector's capacity utilization grew at a faster rate once again.

and energy use grew at similarly significant rates such that energy intensity was relatively unaffected.

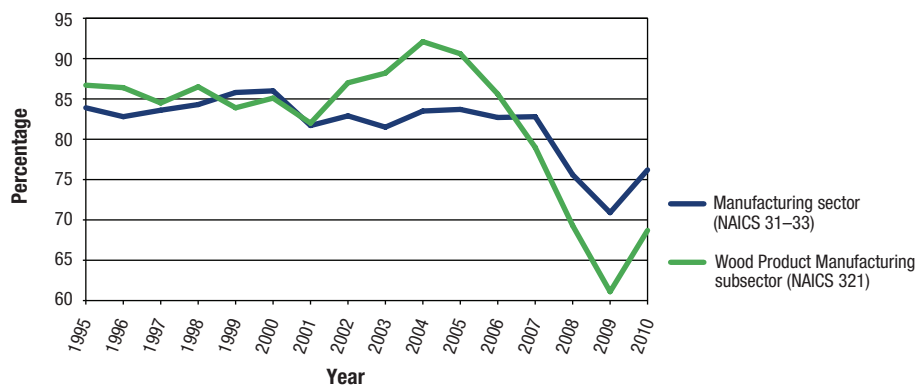
Figure 21. Indexed growth of energy use, GDP and energy intensity for the Wood Manufacturing subsector, 1995–2010



Overall, from 1995 to 2010, the Wood Product Manufacturing subsector's output increased 28.0 percent (from \$7.7 billion to \$9.9 billion), while energy consumption increased 18.0 percent (from 108.2 PJ to 128.2 PJ). Consequently, the associated energy intensity decreased by 7.5 percent (from 14.0 MJ/\$GDP to 13.0 MJ/\$GDP).

As demonstrated in Figure 22 (and Table A.11 in Appendix A), in 2001, capacity utilization of the Wood Product Manufacturing subsector grew, then peaked in 2004, unlike that of the overall sector. However, from 2004 to 2009, the capacity utilization of the subsector decreased significantly (31.0 percentage points) compared with a 12.6 percentage point decrease for the overall sector. Finally, in 2010, capacity utilization grew at a slightly faster rate for this subsector (7.6 percentage points) than the sector as a whole (6.2 percentage points).

Figure 22. Comparison of capacity utilization rates for the Manufacturing sector and Wood Product Manufacturing subsector, 1995–2010



From 1995 to 2010...

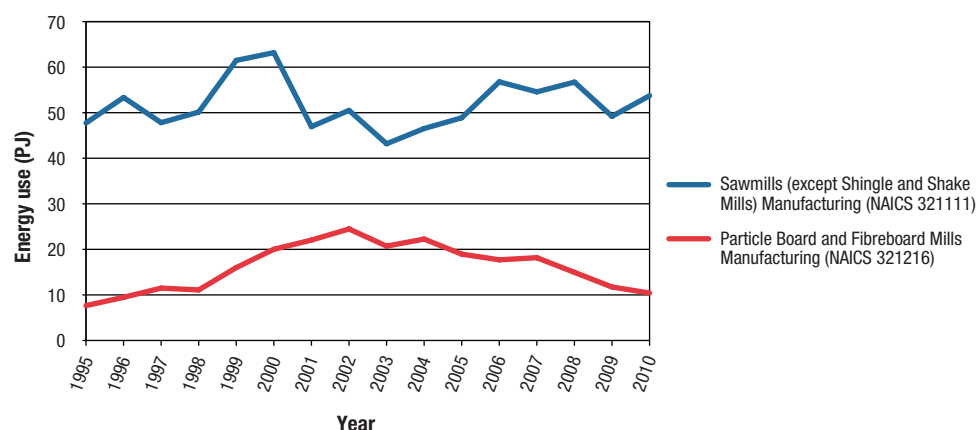
...energy consumption of the two Wood Product Manufacturing industries for which data are available, underwent an increase (12.6 percent and 35.1 percent).

5.5.2 Wood Product Manufacturing subsector's energy consumption trends by industry

The ICE survey collects energy consumption data for only two Wood Product industries: Sawmills (except Shingle and Shake Mills) (NAICS 321111) and Particle Board and Fibreboard Mills (NAICS 321216). These two industries accounted for 50.0 percent of the energy use of the Wood Product Manufacturing subsector in 2010.

Figure 23 illustrates the variations in energy consumption in both industries (see also Table A.27 in Appendix A). Both Sawmills (except Shingle and Shake Mills) and Particle Board and Fibreboard Mills experienced an increase in energy use from 1995 to 2010 (12.6 percent and 35.1 percent, respectively). These variations appear to be caused by changes in production, but unfortunately, supporting output data are not available for these industries. However, as outlined in Table A.26 in Appendix A, GDP for the subsector increased in 2000 (similar to that of the Sawmills industry) and again in 2002 (as also experienced by the Particle Board and Fibreboard Mills industry).

Figure 23. Energy consumption of selected Wood Product Manufacturing industries, 1995–2010



5.5.3 Wood Product Manufacturing subsector's energy consumption trends by energy source

Table 13 lists the energy consumption by energy source for the Wood Product Manufacturing subsector in 1995 and 2010. Energy consumption for this subsector increased by 18.5 percent during this period.

The Wood Product Manufacturing subsector uses wood the most intensively as a fuel source in the Manufacturing sector...

From 1995 to 2010...

...the use of wood and electricity increased substantially (49.8 percent and 38.1 percent, respectively).

From 2009 to 2010...

...the Wood Product Manufacturing subsector increased its energy consumption by 13.0 percent.

Table 13. Wood Product Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	21.0	19.4	29.0	22.6	38.1
Natural gas	Natural gas	29.5	27.2	15.7	12.3	-46.7
RPP** (incl. natural gas liquids)	Heavy fuel oil	1.5	1.4	X*	N/A	N/A
	Middle distillates	4.7	4.4	4.8	3.7	1.4
	Propane	0.8	0.7	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	7.1	6.5	X*	N/A	N/A
Steam and wood	Steam	0.04	0.0	1.0	0.8	2699.1
	Wood	50.7	46.8	75.9	59.2	49.8
	Total, steam and wood	50.7	46.9	76.9	60.0	51.7
Total		108.2	100.0	128.2	100.0	18.5

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

This subsector's energy mix changed from 1995 to 2010. The use of wood increased from 50.7 PJ in 1995 to 75.9 PJ in 2010, while natural gas consumption decreased from 29.5 PJ in 1995 to 15.7 PJ in 2010. The use of electricity also increased over the period, but at a slower pace, as outlined in Table A.28 in Appendix A, which provides a full breakdown of energy sources used by this subsector from 1995 to 2010.

Between 2009 and 2010, the Wood Product Manufacturing subsector increased its energy consumption by 13.0 percent. As outlined in Table 14, use of all energy sources grew during this period.

Table 14. Wood Product Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	25.9	22.8	29.0	22.6	11.8
Natural gas	Natural gas	15.6	13.8	15.7	12.3	0.6
RPP** (incl. natural gas liquids)	Heavy fuel oil	1.3	1.2	X*	N/A	N/A
	Middle distillates	4.0	3.5	4.8	3.7	19.9
	Propane	X*	N/A	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam and wood	Steam	X*	N/A	1.0	0.8	N/A
	Wood	64.5	56.9	75.9	59.2	17.7
	Total, steam and wood	X*	N/A	76.9	60.0	N/A
Total		113.5	100.0	128.2	100.0	13.0

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

In 2010...

...the Food Manufacturing subsector consumed 102.4 PJ of energy (4.8 percent of the Manufacturing sector's energy consumption).

Energy intensity for the Food Manufacturing sector...

...has been relatively stable since 2001, experiencing a slight decrease from 2009 to 2010 (3.2 percent).

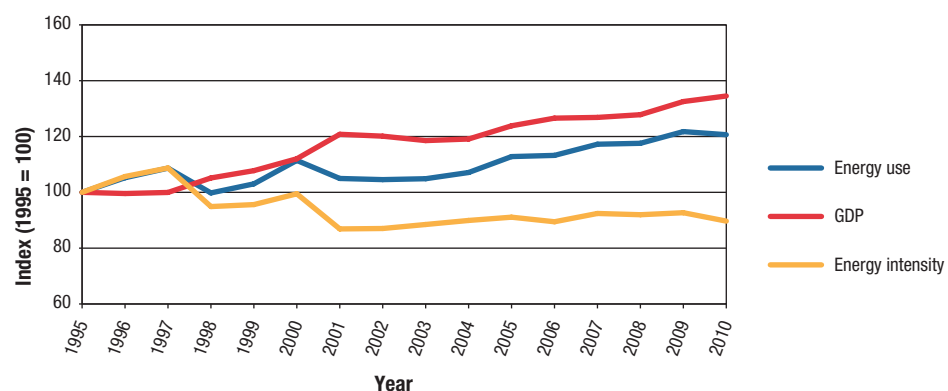
5.6 Food Manufacturing subsector (NAICS 311)

Establishments in the Food Manufacturing subsector are primarily engaged in producing food for human or animal consumption. The 2010 ICE survey estimated that this subsector consumed 102.4 PJ of energy, corresponding to 4.8 percent of the Manufacturing sector's energy consumption.

5.6.1 Food Manufacturing subsector energy consumption, output and energy intensity trends

Figure 24 illustrates the indexed growth of energy consumption, GDP and energy intensity from 1995 to 2010 for the Food Manufacturing subsector (see also Table A.29 in Appendix A). With the exception of two plateaus, one from 1995 to 1997 and one from 2001 to 2005, GDP in the Food Manufacturing subsector increased more or less constantly over the 15 years. Energy use, after spiking in 1997 and again in 2000, started increasing steadily in 2001, at a slightly faster pace than that of GDP. Energy use decreased slightly from 2009 to 2010 (0.9 percent) even though GDP grew (1.5 percent). Energy intensity decreased between 1995 and 2001 with notable spikes in 1997 and 2000, which correspond to the aforementioned spikes in energy consumption. Since 2001, energy intensity in this subsector has been relatively stable, experiencing a slight decrease from 2009 to 2010 (3.2 percent).

Figure 24. Indexed growth of energy use, GDP and energy intensity for the Food Manufacturing subsector, 1995–2010



Over the 1995 to 2010 period, the Food Manufacturing subsector's output increased 34.5 percent, from \$14.4 to \$19.4 billion, while its energy consumption increased 20.7 percent, from 84.9 to 102.4 PJ. Consequently, its associated energy intensity diminished by 10.3 percent, from 5.9 MJ/\$GDP to 5.3 MJ/\$GDP.

As demonstrated in Figure 25 (and Table A.11 in Appendix A), capacity utilization of the Food Manufacturing subsector remained relatively stable from 1995 to 2010, compared with that of the overall sector. It is not surprising that this subsector was less affected by the effects of the recession, due to the nature of the Food industry and the fact that it is less prone to cyclical variations in the economy. Unlike the Manufacturing sector, which experienced a 12.0 percentage point decrease between 2007 and 2009, the Food Manufacturing subsector's capacity utilization rate decreased only slightly from 2007 to 2008 (2.4 percentage points), then rebounded in 2009.

From 1995 to 2010...

...capacity utilization of the Food Manufacturing subsector remained relatively stable, compared with that of the overall sector.

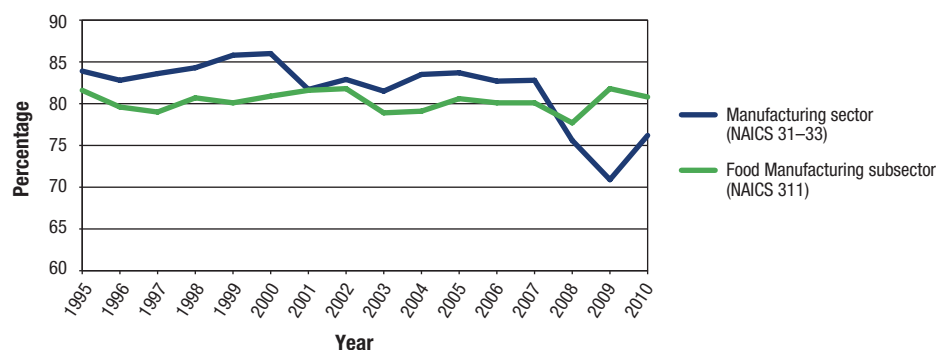
From 1995 to 2010...

...energy consumption in the Meat Product Manufacturing industry grew the fastest among the four industries studied.

From 1995 to 2010...

...the Dairy Product Manufacturing industry was the only Food industry to experience a decrease in energy intensity.

Figure 25. Comparison of capacity utilization rates for the Manufacturing sector and Food Manufacturing subsector, 1995–2010

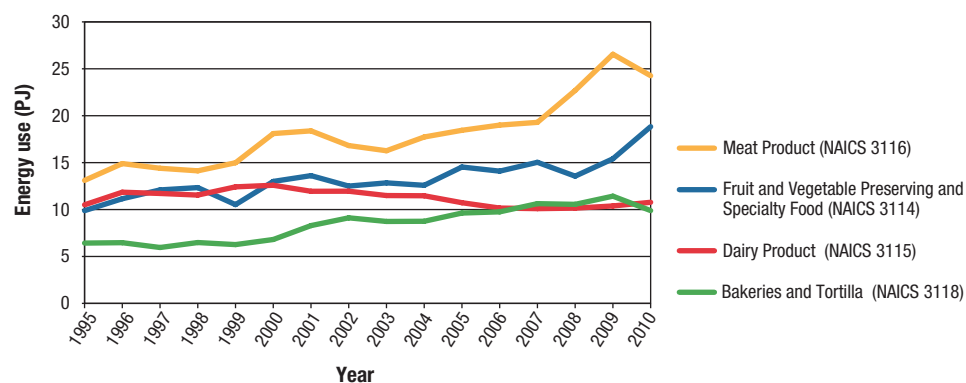


5.6.2 Food Manufacturing subsector energy consumption trends by industry

Figure 26 illustrates the growth in energy use by selected Food Manufacturing industries. The four industries presented accounted for 62.2 percent of the energy consumption of the Food Manufacturing subsector in 2010.

A portion of the fluctuation in the industries' energy consumption can be explained by variations in output as measured by GDP. For example, the Meat Product Manufacturing (NAICS 3116) industry's GDP and energy use increased significantly from 1995 to 2008 (64.6 percent and 73.3 percent respectively). Both increased again from 2008 to 2009, but energy consumption grew at a faster rate. Finally, in 2010, GDP increased and energy consumption decreased, both slightly, causing energy intensity to fall 10.5 percent.

Figure 26. Energy consumption of selected Food Manufacturing industries, 1995–2010



The Dairy Product Manufacturing industry (NAICS 3115) was the only Food Manufacturing industry with relatively stable energy consumption patterns from 1995 to 2010, while its GDP increased over that period by 11.0 percent. Because of this, it was also the only industry to experience a decrease in energy intensity over the study period. A full breakdown of energy consumption, GDP and energy intensity for these four Food Manufacturing industries is provided in Tables A.30, A.31 and A.32 in Appendix A.

From 1995 to 2010...

...natural gas, electricity and heavy fuel oil have made up over 91.7 percent of all energy used by the Food Manufacturing subsector

...electricity use increased by 50.7 percent, although natural gas remained the most commonly used energy source by this subsector.

5.6.3. Food Manufacturing subsector energy consumption by energy source

Table 15 lists the energy consumption by energy source for the Food Manufacturing subsector in 1995 and 2010. Energy consumption for this subsector increased by 20.6 percent during this period.

Table 15. Food Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	20.6	24.2	31.0	30.3	50.7
Natural gas	Natural gas	57.1	67.3	59.0	57.6	3.3
RPP** (incl. natural gas liquids)	Heavy fuel oil	4.4	5.2	3.9	3.8	-11.4
	Middle distillates	X*	N/A	2.0	2.0	N/A
	Propane	X*	N/A	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam and wood	Steam	1.0	1.2	X*	N/A	N/A
	Wood	X*	N/A	X*	N/A	N/A
	Total, steam and wood	X*	N/A	X*	N/A	N/A
Total		84.9	100.0	102.4	100.0	20.6

Note: Due to rounding, the numbers in the table may not add up

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

Since 1995, natural gas, electricity and heavy fuel oil have made up 91.7 percent of all energy used by the Food Manufacturing subsector. Natural gas is its most commonly used energy source, and it increased by 3.3 percent, from 57.1 PJ to 59.0 PJ from 1995 to 2010.

However, the increased use of electricity encapsulated most of the subsector's energy consumption increase since 2004. Over the entire period, electricity use increased by 50.7 percent from 20.6 PJ to 31.0 PJ. The use of heavy fuel oil decreased by 11.4 percent from 1995 to 2010 and accounted for 3.8 percent of the energy source share in 2010.

Table A.33 in Appendix A provides a full breakdown of energy sources used by this subsector from 1995 to 2010.

Table 16 demonstrates that overall energy consumption decreased slightly for this subsector from 2009 to 2010 (1.0 percent), which was evidenced mostly in the use of electricity.

From 2009 to 2010...

...overall energy consumption decreased slightly for the Food Manufacturing subsector (1.0 percent), which was evidenced mostly in the use of electricity.

In 2010...

...the Non-Metallic Mineral Product Manufacturing subsector consumed 96.2 PJ of energy or 4.5 percent of the Manufacturing sector's energy consumption.

Table 16. Food Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009–2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	34.5	33.4	31.0	30.3	-10.1
Natural gas	Natural gas	61.7	59.7	59.0	57.6	-4.4
RPP** (incl. natural gas liquids)	Heavy fuel oil	3.9	3.8	3.9	3.8	0.0
	Middle distillates	2.0	1.9	2.0	2.0	0.0
	Propane	X*	N/A	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam and wood	Steam	X*	N/A	X*	N/A	N/A
	Wood	X*	X*	X*	N/A	N/A
	Total, steam and wood	X*	N/A	X*	N/A	N/A
Total		103.4	100.0	102.4	100.0	-1.0

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

5.7 Non-Metallic Mineral Product Manufacturing (NAICS 327)

Rounding out the top seven energy-consuming Manufacturing subsectors is Non-Metallic Mineral Product Manufacturing. Establishments in this subsector “cut, grind, shape and finish granite, marble, limestone, slate and other stone; mix non-metallic minerals with chemicals and other additives; and heat non-metallic mineral preparations to make products, such as bricks, refractories, ceramic products, cement and glass.”²⁵

According to 2010 ICE survey estimates, the Non-Metallic Mineral Product Manufacturing subsector consumed 96.2 PJ of energy in 2010, which accounted for 4.5 percent of the sector's energy consumption.

5.7.1 Non-Metallic Mineral Product Manufacturing subsector's energy consumption, output and energy intensity trends

Figure 27 illustrates the indexed growth of energy consumption, GDP and energy intensity from 1995 to 2010 for Non-Metallic Mineral Product Manufacturing. Between 1995 and 2007, despite significant growth in output (81.6 percent), the subsector's energy use was relatively constant (9.4 percent increase), yielding a strong decrease in energy intensity (39.8 percent). From 2007 to 2010, energy intensity continued to decrease (10.5 percent) as both energy consumption and GDP decreased (25.2 percent and 16.5 percent respectively). For a complete breakdown of these trends, refer to Table A.34 in Appendix A.

²⁵ <http://stds.statcan.gc.ca/naics-scian/2007/cs-rc-eng.asp?criteria=327>

Energy intensity for the subsector...

...decreased significantly between 1995 and 2007 with strong growth in output and relatively constant energy use

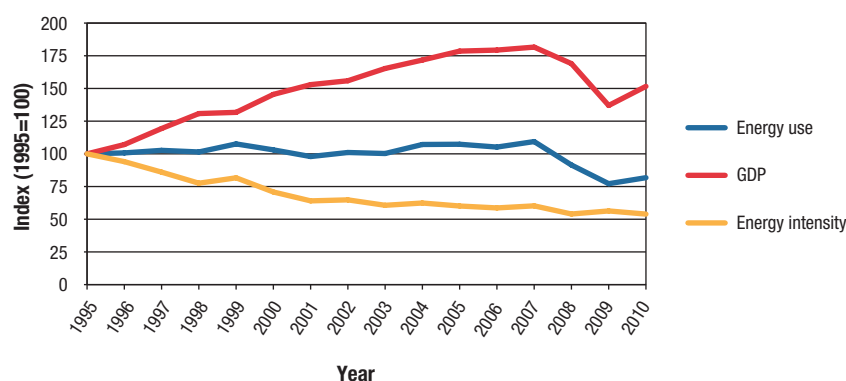
...continued to decrease from 2007 to 2010 as both energy consumption and GDP decreased.

From 2002 to 2010...

...capacity utilization of the subsector followed a very similar pattern to that of the sector, except in 2009, when it fell 12.4 percentage points from the previous year.

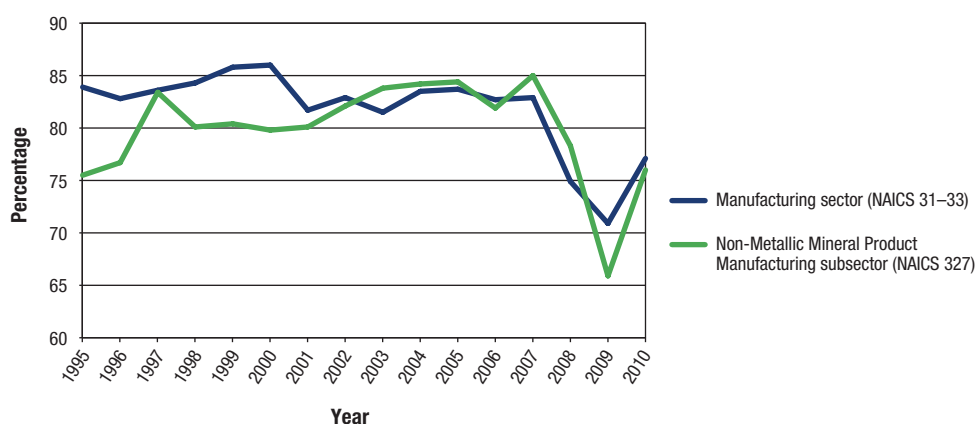
Both the sector and the subsector saw a resurgence in capacity utilization in 2010.

Figure 27. Indexed growth of energy use, GDP and energy intensity for the Non-Metallic Mineral Product Manufacturing subsector, 1995–2010



As demonstrated in Figure 28 (and Table A.11 in Appendix A), capacity utilization of the Non-Metallic Mineral Product Manufacturing subsector was somewhat lower than that of the overall sector from 1995 to 2002, with the exception of 1997. From 2002 to 2010, capacity utilization of the subsector followed a very similar pattern to that of the sector, except in 2009, when it fell 12.4 percentage points from the previous year (compared to 4.0 percentage points for the sector), then rebounded in 2010.

Figure 28. Comparison of capacity utilization rates for the Manufacturing sector and Non-Metallic Mineral Product Manufacturing subsector, 1995–2010



5.7.2 Non-Metallic Mineral Product Manufacturing subsector's energy consumption trends by industry

Figure 29 illustrates the three industries for which energy consumption data are available for the entire period. In 2010, they accounted for 70.3 percent of the subsector's energy consumption. From 1995 to 2010, all three industries saw their energy consumption decrease. The largest decrease in energy consumption occurred in Glass Manufacturing (NAICS 327214), where consumption declined from 14.3 to 4.0 PJ between 1995 and 2010, a 72.0 percent decrease.

Energy used by Cement Manufacturing (NAICS 32731) decreased by 10.7 percent from 1995 to 2010, which included a 20.0 percent increase between 1995 and 2006, followed by a 25.6 decrease from 2006 onward. These variations in energy consumption

In 2010...

...the three Non-Metallic Mineral Product Manufacturing industries studied accounted for 70.3 percent of the subsector's energy use

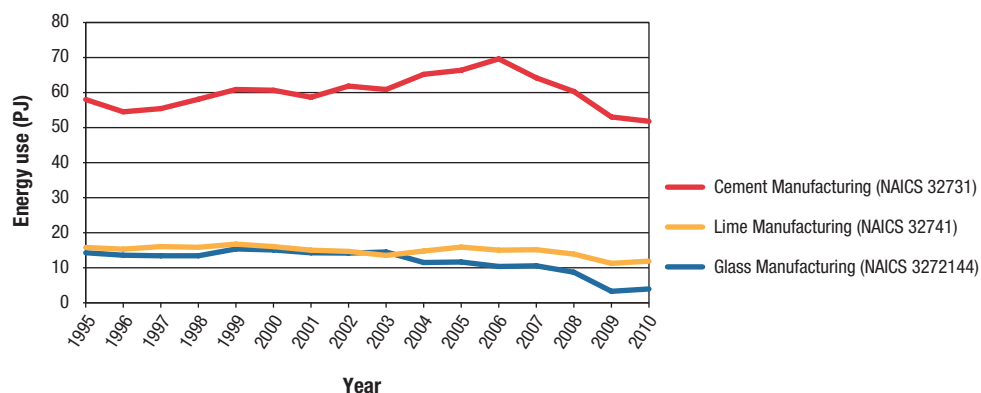
...the Cement industry alone accounted for 53.9 percent of the subsector's energy use.

From 1995 to 2010...

... all three industries saw their energy consumption decrease.

were caused, at least in part, by a 37.7 percent increase in GDP between 1997²⁶ and 2006 and a 25.5 percent decrease afterwards. Another reason for the recent decrease in energy consumption for this industry was the switch from wet kilns to more energy efficient dry kilns.²⁷ Cement Manufacturing represented 53.9 percent of the subsector's energy consumption in 2010, and therefore, significant decreases in energy consumption in that industry impacted the entire subsector.

Figure 29. Energy consumption of selected Non-Metallic Mineral Product Manufacturing industries, 1995–2010



For a breakdown of the industries' energy consumption and GDP,²⁸ refer to Tables A.35 and A.36 in Appendix A.

²⁶ GDP data for NAICS 32731 were not available for 1995 and 1996.

²⁷ John Nyboer and Sally Rudd, *A Review of Energy Consumption and Related Data – Canadian Cement Manufacturing Industry 1990 to 2009*, p. 1. Canadian Industrial Energy End-Use Data and Analysis Centre, 2011.

²⁸ GDP data for NAICS 32741 and 3272144 were not available for the study period.

From 1995 to 2010...

...the Non-Metallic Mineral Product Manufacturing subsector used considerably less natural gas (60.6 percent), which was partially offset by an increase in the use of coal, petroleum coke and coke oven gas

...the Lime Manufacturing industry doubled its use of coal from 1995 to 2010, from 2.85 PJ to 5.73 PJ.

5.7.3 Non-Metallic Mineral Product Manufacturing energy consumption by energy source

Table 17 shows the energy consumption by energy source for the Non-Metallic Mineral Product Manufacturing subsector in 1995 and 2010. Energy consumption for this subsector decreased by 18.2 percent during this period.

Table 17. Non-Metallic Mineral Product Manufacturing subsector's energy use by energy source, 1995 and 2010

Energy category	Energy source	1995 energy		2010 energy		Growth, 1995-2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	16.5	14.0	16.1	16.7	-2.4
Natural gas	Natural gas	54.5	46.3	21.5	22.3	-60.6
Coal/coke	Coal	27.3	23.2	30.4	31.6	11.4
	Coke from coal	0.5	0.4	X*	N/A	N/A
	Petroleum coke and coke oven gas	13.3	11.3	21.6	22.5	62.4
	Total, coal/coke	41.1	34.9	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	3.8	3.2	X*	N/A	N/A
	Middle distillates	1.2	1.0	2.3	2.4	N/A
	Propane	0.3	0.3	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	5.3	4.5	X*	N/A	N/A
Steam and wood	Steam	0.1	0.1	X*	N/A	N/A
	Wood	0.1	0.1	2.1	2.2	2000.0
	Total, steam and wood	0.2	0.2	X*	N/A	N/A
Total		117.6	100.0	96.2	100.0	-18.2

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

As with many subsectors that have been substituting natural gas for other energy sources, Non-Metallic Mineral Product Manufacturing also underwent a substantial decline in the use of natural gas (60.6 percent) from 1995 to 2010. This decline was partially offset by an increase in the use of coal as well as petroleum coke and coke oven gas, the two most-used energy sources in this subsector in 2010 (see Table A.36 in Appendix A). In particular, the Lime Manufacturing industry (NAICS 32741) doubled its use of coal from 1995 to 2010, from 2.85 PJ to 5.73 PJ, whereas its use of natural gas decreased from 8.06 PJ in 1995 to 1.01 PJ in 2010.

It is not possible to know the consumption rates for heavy fuel oil, propane, coke from coal and steam energy sources in 2010, due to data confidentiality. However, the total use of these four sources decreased over the period from 4.7 PJ in 1995 to 2.2 PJ in 2010.

From 2009 to 2010...

...overall energy consumption increased for this subsector (5.9 percent), which was evidenced mostly in the increased use of natural gas and electricity.

Table 18 demonstrates that overall energy consumption increased in this subsector from 2009 to 2010 (5.9 percent), which was evidenced mostly in the increased use of natural gas and electricity.

Table 18. Non-Metallic Mineral Product Manufacturing subsector's energy use by energy source, 2009 and 2010

Energy category	Energy source	2009 energy		2010 energy		Growth, 2009-2010
		(PJ)	(%)	(PJ)	(%)	(%)
Electricity	Electricity	15.0	16.5	16.1	16.7	7.3
Natural gas	Natural gas	18.7	20.6	21.5	22.3	15.0
Coal/coke	Coal	30.6	33.7	30.4	31.6	-0.7
	Coke from coal	X*	N/A	X*	N/A	N/A
	Petroleum coke and coke oven gas	21.8	24.0	21.6	22.5	-0.9
	Total, coal/coke	X*	N/A	X*	N/A	N/A
RPP** (incl. natural gas liquids)	Heavy fuel oil	1.1	1.2	X*	N/A	N/A
	Middle distillates	2.5	2.8	2.3	2.4	-8.0
	Propane	X*	N/A	X*	N/A	N/A
	Total, RPP (incl. natural gas liquids)	X*	N/A	X*	N/A	N/A
Steam and wood	Steam	X*	N/A	X*	N/A	N/A
	Wood	X*	N/A	2.1	2.2	N/A
	Total, steam and wood	X*	N/A	X*	N/A	N/A
Total		90.8	100.0	96.2	100.0	5.9

Note: Due to rounding, the numbers in the table may not add up.

*Undisclosed value for confidentiality reasons.

**RPP = refined petroleum products

6 Conclusion

After a difficult year in 2009, Canada's manufacturing sector began a comeback in 2010 with widespread growth and the reversal of many downward trends. The global economy also rebounded in 2010 with most major economies showing positive growth in gross domestic product (GDP). This followed one of the worst recessions in years.

According to Statistics Canada,²⁹ "Manufacturing sales increased 8.9 percent to \$529.8 billion in 2010 after a 17.8 percent decline in 2009. This was the largest single annual increase since 2000. The Manufacturing sector regained about 40 percent of the 2009 decline, which was the largest on record. Current dollar sales advanced in 19 of 21 industries, representing 95.4 percent of total Canadian Manufacturing."

As stated in the Canadian Manufacturing Online and the Canadian PLANT survey results,³⁰ a source of daily industry-focused news in Canada, "the last three years have not been easy for Canadian manufacturers. They've taken some hard knocks from waves of the perfect storm, whipped up by the high value of the dollar, chronic skills shortages, aggressive offshore competition, depressed markets, a disabled US economy, recurring rounds of Buy Americanism and potential global apocalypse. And yet, when they were asked about their prospects for 2012 and beyond, for the third consecutive year they expressed confidence and optimism. Indeed, PLANT's Business Outlook 2012 survey found manufacturers loosening the purse strings and investing in their plants."

In addition, according to the ISO,³¹ "individual organizations cannot control energy prices, government policies or the global economy, but they can improve the way they manage energy in the here and now. Improved energy performance can provide rapid benefits for an organization by maximizing the use of its energy sources and energy-related assets, thus reducing both energy cost and consumption. The organization will also make positive contributions toward reducing depletion of energy resources and mitigating worldwide effects of energy use, such as global warming."³²

This summary report examines energy consumption patterns for the Canadian Manufacturing sector from 1995 to 2010 and, in particular, those of the seven most energy-consuming subsectors, namely:

- Paper Manufacturing (NAICS 322)
- Primary Metal Manufacturing (NAICS 331)
- Petroleum and Coal Product Manufacturing (NAICS 324)
- Chemical Manufacturing (NAICS 325)
- Wood Product Manufacturing (NAICS 321)
- Food Manufacturing (NAICS 311) and
- Non-Metallic Mineral Product Manufacturing (NAICS 327)

According to the 2010 ICE survey, Canada's Manufacturing sector used 14.3 percent less energy and produced 11.0 percent more output in 2010 than it did in 1995. In 2010, the sector consumed 2136 PJ of energy (down from 2492 PJ in 1995), and its output increased to \$155.7 billion (up from \$140.3 billion in 1995). The largest decrease

²⁹ Statistics Canada, The Daily, June 2011, www.statcan.gc.ca/daily-quotidien/110620/dq110620b-eng.htm.

³⁰ Canadian PLANT, Insights and Strategies for Industry Leaders, www.granthornton.ca/resources/insights/reports/Canadian_manufacturing_outlook_survey_2011.pdf.

³¹ International Organization for Standardization. ISO 50001 provides organizations with a structured framework to manage energy such that it can increase energy efficiency, reduce costs and improve energy performance. It is a standard based on the common elements found in all of ISO's management systems standards, assuring a high level of compatibility with ISO 9001 (quality management) and ISO 14001 (environmental management). It integrates energy efficiency into management practices by making better use of existing energy-consuming processes.

³² International Standards for Business, Government and Society, 2011, www.iso.org/iso/pressrelease.htm?refid=Ref1434

in energy consumption among the subsectors from 1995 to 2010 occurred in the Paper Manufacturing subsector (39.3 percent). It was also the only subsector that experienced a decrease in GDP (16.9 percent) during that period.

As a result of decreased energy use and increased output from 1995 to 2010, the sector's overall energy intensity declined 23 percent, from 17.8 megajoules per dollar of GDP (MJ/\$GDP) to 13.7 MJ/\$GDP. All seven selected subsectors experienced a decrease in energy intensity over the period, but significant decreases were realized for the Non-Metallic Mineral Product Manufacturing subsector (47.2 percent), the Paper Manufacturing subsector (27.0 percent) and the Primary Metal Manufacturing subsector (23 percent).

The rate of capacity use in the Manufacturing sector has been on an upward trend since the second quarter of 2009, when it reached a record low of 69.4 percent. Among manufacturing industries, annual capacity use strengthened to 77.1 percent in 2010, from 70.9 percent in 2009 and 74.9 percent in 2008. Capacity use rose in 18 of the 21 major manufacturing industries in the first quarter of 2011.

Electricity has replaced natural gas as the most used energy source since 2003. The rapid growth in the price of natural gas compared with that of electricity between 1996 and 2006 may help explain this energy source shift, which, in turn, influenced the Manufacturing sector's fuel mix. However, the gap between both of these energy sources narrowed over the last four years, with the price of natural gas dropping. The use of both heavy fuel oil and spent pulping liquor decreased substantially from 1995 to 2010 (68.3 percent and 40.9 percent, respectively), both heavily used by the Paper Manufacturing subsector. A full breakdown of the energy consumption by energy source for the sector and seven selected subsectors can be found in Appendix A.

A

Detailed tables

Table A.1 Energy use, GDP and energy intensity for the Manufacturing sector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use (PJ)	2491.7	2492.6	2533.0	2513.3	2570.0	2597.0	2511.3	2511.3	2521.1	2614.7	2502.6	2406.0	2414.5	2287.2	2072.0	2135.9
GDP (Million \$2002)	140265	141798	151049	158595	171479	190628	181283	182736	181217	184773	188043	185353	181229	169059	145553	155746
Energy intensity (MJ/\$2002)	17.8	17.6	16.8	15.8	15.0	13.6	13.9	13.7	13.9	14.2	13.3	13.0	13.3	13.6	14.2	13.7

Table A.2 Indexed growth of energy use, GDP and energy intensity for the Manufacturing sector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	100.0	101.7	100.9	103.1	104.2	100.8	100.8	101.2	104.9	100.4	96.6	96.9	91.8	83.2	85.7
GDP	100.0	101.1	107.7	113.1	122.3	135.9	129.2	130.3	129.2	131.7	134.1	132.1	129.2	119.7	103.8	111.0
Energy intensity	100.0	99.0	94.4	89.2	84.4	76.7	78.0	77.4	78.3	79.7	74.9	73.1	75.0	76.7	80.1	77.2

Table A.3 Capacity utilization rates for the Manufacturing sector, 2006–2010

	2006				2007				2008				2009				2010			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	(%)				(%)				(%)				(%)				(%)			
Manufacturing (NAICS 31-33)	84.7	82.7	81.7	81.8	84.3	84.4	82.4	80.5	76.0	73.3	76.0	74.1	69.4	69.4	71.8	73.1	74.9	76.8	76.8	79.9

Table A.4 Share of energy consumption in the Manufacturing sector, 1995–2010

Subsector	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(%)															
Paper Manufacturing (NAICS 322)	36.2	34.0	33.8	33.3	34.3	34.0	33.2	33.1	33.1	32.5	31.0	28.2	27.5	25.4	26.5	25.6
Primary Metal Manufacturing (NAICS 331)	20.2	20.8	20.7	20.9	21.0	20.7	20.9	20.7	20.7	19.9	21.0	22.0	21.8	22.9	20.6	21.0
Petroleum and Coal Product Manufacturing (NAICS 324)	11.8	12.1	12.1	12.5	12.3	12.5	13.8	14.6	14.6	15.5	14.3	15.3	15.8	16.3	17.3	15.8
Chemical Manufacturing (NAICS 325)	11.1	11.3	11.7	12.2	11.1	11.4	11.0	10.0	10.1	10.6	10.9	11.1	10.8	11.2	11.7	13.2
Wood Product (NAICS 321)	4.3	5.0	4.9	5.0	5.0	5.0	4.7	4.9	4.8	4.8	5.2	5.9	5.7	5.7	5.5	6.0
Food (NAICS 311)	3.4	3.6	3.6	3.4	3.4	3.6	3.5	3.5	3.5	3.5	3.8	4.0	4.1	4.4	5.0	4.8
Non-Metallic Mineral Product (NAICS 327)	4.7	4.8	4.8	4.7	4.9	4.7	4.6	4.7	4.7	4.8	5.0	5.1	5.3	4.7	4.4	4.5
Other Manufacturing subsectors	8.3	8.4	8.5	8.1	7.9	8.1	8.3	8.5	8.5	8.3	8.7	8.4	8.9	9.4	9.1	9.0

Due to rounding, numbers in the table may not add up to 100.

Table A.5 Energy consumption of the selected Manufacturing subsectors, 1995–2010

Subsector	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Paper Manufacturing (NAICS 322)	901.1	848.5	855.2	835.8	882.6	883.4	834.9	830.8	835.3	850.9	776.2	678.6	664.2	580.1	548.7	546.6
Primary Metal Manufacturing (NAICS 331)	503.8	517.8	524.4	526.3	540.5	536.4	525.0	519.6	521.1	521.1	524.7	528.4	525.3	524.6	427.6	448.2
Petroleum and Coal Product Manufacturing (NAICS 324)	293.0	302.1	305.3	313.2	315.4	325.9	345.5	366.2	368.4	405.5	359.0	368.0	382.0	373.3	357.8	338.5
Chemical Manufacturing (NAICS 325)	277.5	282.7	295.3	306.2	286.4	295.0	275.6	252.1	254.6	278.1	272.9	267.2	261.0	257.0	242.5	282.6
Wood Product (NAICS 321)	108.2	123.8	124.6	125.1	128.0	129.4	118.5	122.6	120.2	124.9	129.2	141.8	138.5	130.4	113.5	128.2
Food (NAICS 311)	84.9	89.3	92.3	84.7	87.5	94.6	89.1	88.8	89.0	90.9	95.8	96.1	99.5	99.8	103.4	102.4
Non-Metallic Mineral Product (NAICS 327)	117.6	118.5	120.8	119.3	126.5	121.2	115.2	118.8	117.9	126.0	126.3	123.7	128.7	107.6	90.8	96.2

Table A.6 GDP of the seven selected Manufacturing subsectors, 1995–2010

Subsector	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(GDP [billion - \$2002])															
Paper Manufacturing (NAICS 322)	10.6	10.7	10.8	10.5	11.5	12.0	11.3	11.9	11.9	12.0	12.1	10.8	10.8	9.9	8.7	8.8
Primary Metal Manufacturing (NAICS 331)	8.3	8.4	8.9	9.6	10.0	10.8	10.6	11.1	10.9	11.6	11.9	11.9	11.6	11.5	8.4	9.5
Petroleum and Coal Product Manufacturing (NAICS 324)	2.9	2.9	3.1	3.3	3.2	3.1	3.5	3.5	3.5	3.5	3.4	3.3	3.4	3.3	3.3	3.4
Chemical Manufacturing (NAICS 325)	12.0	12.1	12.1	12.2	12.8	14.2	14.5	15.1	15.5	15.6	15.3	15.5	14.9	14.0	12.8	13.4
Wood Product (NAICS 321)	7.7	8.0	9.3	9.7	10.3	11.4	10.9	12.1	12.1	12.6	13.4	13.3	12.0	10.5	8.9	9.9
Food (NAICS 311)	14.4	14.3	14.4	15.1	15.5	16.1	17.4	17.3	17.1	17.2	17.8	18.2	18.3	18.4	19.1	19.4
Non-Metallic Mineral Product (NAICS 327)	3.3	3.5	3.9	4.3	4.3	4.8	5.0	5.1	5.4	5.6	5.8	5.9	5.9	5.5	4.5	5.0

Table A.7 Energy intensity of the seven selected Manufacturing subsectors, 1995–2010

Subsector	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(MJ/\$GDP)															
Paper Manufacturing (NAICS 322)	85.4	79.0	78.9	79.3	76.6	73.6	74.0	70.0	70.3	70.8	64.1	62.6	61.2	58.5	63.2	62.3
Primary Metal Manufacturing (NAICS 331)	60.7	61.5	59.0	54.6	54.1	49.6	49.5	46.9	47.7	45.0	44.0	44.5	45.3	45.5	50.9	47.1
Petroleum and Coal Product Manufacturing (NAICS 324)	101.7	102.7	98.4	93.9	98.4	106.8	98.5	105.3	104.9	117.0	105.3	111.9	112.5	112.7	108.9	101.0
Chemical Manufacturing (NAICS 325)	23.0	23.4	24.3	25.0	22.5	20.8	19.0	16.7	16.4	17.9	17.8	17.2	17.5	18.1	19.0	21.1
Wood Product (NAICS 321)	14.0	15.5	13.4	12.9	12.4	11.3	10.9	10.1	9.9	9.9	9.6	10.7	11.6	12.4	12.7	13.0
Food (NAICS 311)	5.9	6.2	6.4	5.6	5.6	5.9	5.1	5.1	5.2	5.3	5.4	5.3	5.4	5.4	5.4	5.3
Non-Metallic Mineral Product (NAICS 327)	36.0	33.8	31.0	27.9	29.4	25.5	23.0	23.3	21.8	22.5	21.6	21.1	21.7	19.1	20.3	19.4

Table A.8 Energy consumption of the Manufacturing sector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Electricity	624.7	629.6	640.2	647.0	667.5	690.2	684.2	697.0	705.4	701.0	724.7	707.7	700.7	679.3	611.3	619.7
Natural gas	777.8	799.4	824.9	796.0	785.2	782.8	721.9	726.3	672.6	694.9	662.4	618.2	635.2	617.7	563.1	591.2
Spent pulping liquor	343.6	297.5	302.9	299.1	326.5	319.7	288.9	290.9	292.6	299.8	258.5	216.6	223.1	184.2	191.1	203.1
Wood	178.9	186.6	181.5	181.3	188.2	190.2	179.1	182.6	195.5	211.8	210.8	209.6	189.9	188.9	170.6	184.1
Petroleum coke and coke from catalytic cracking catalyst	64.6	63.6	62.4	67.0	68.6	68.4	75.6	84.1	88.4	95.0	82.0	84.8	84.3	78.5	76.0	79.4
Coke from coal	102.9	100.3	97.6	99.9	102.7	103.4	96.3	93.3	92.2	93.4	92.9	101.6	102.7	98.9	74.4	78.7
Coal	41.3	41.5	43.4	44.1	44.6	49.1	47.6	46.8	50.8	55.4	51.7	53.1	54.4	53.4	42.4	50.5
Heavy fuel oil	139.8	142.6	137.7	143.7	142.2	139.2	139.4	114.7	138.7	150.2	126.4	100.0	99.1	76.2	57.4	44.4
Steam	33.5	28.6	30.0	30.5	37.2	37.4	40.1	41.3	48.0	48.0	50.1	60.1	59.9	53.5	44.1	44.0
Middle distillates	17.2	21.1	21.8	21.4	21.1	24.9	22.7	19.8	18.2	19.9	19.7	17.7	18.2	24.4	24.5	26.4
Coke oven gas	27.4	30.8	30.9	26.5	26.9	27.1	27.0	26.8	28.0	28.3	29.5	29.3	24.7	25.9	19.9	21.9
Liquified petroleum gases (propane)	12.3	13.4	14.2	13.9	13.9	13.2	15.4	12.6	11.6	9.4	7.4	9.5	9.0	8.2	6.9	7.0
Butane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	X
Refinery fuel gas	127.6	137.7	145.6	142.8	145.3	151.4	173.0	175.1	179.0	207.6	186.4	197.7	213.3	198.1	188.0	X
Total	2491.7	2492.6	2533.0	2513.3	2570.0	2597.0	2511.3	2511.3	2521.1	2614.7	2502.6	2406.0	2414.5	2287.2	2072.0	2135.9

Due to rounding, numbers may not add up to the total shown.

The letter X indicates an undisclosed value for confidentiality reasons.

Table A.9 Share of energy consumption of the Manufacturing sector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(%)															
Electricity	25.1	25.3	25.3	25.7	26.0	26.6	27.2	27.8	28.0	26.8	29.0	29.4	29.0	29.7	29.5	29.0
Natural gas	31.2	32.1	32.6	31.7	30.6	30.1	28.7	28.9	26.7	26.6	26.5	25.7	26.3	27.0	27.2	27.7
Spent pulping liquor	13.8	11.9	12.0	11.9	12.7	12.3	11.5	11.6	11.6	11.5	10.3	9.0	9.2	8.1	9.2	9.5
Wood	7.2	7.5	7.2	7.2	7.3	7.3	7.1	7.3	7.8	8.1	8.4	8.7	7.9	8.3	8.2	8.6
Petroleum coke and coke from catalytic cracking catalyst	2.6	2.6	2.5	2.7	2.7	2.6	3.0	3.3	3.5	3.6	3.3	3.5	3.5	3.4	3.7	3.7
Coke from coal	4.1	4.0	3.9	4.0	4.0	4.0	3.8	3.7	3.7	3.6	3.7	4.2	4.3	4.3	3.6	3.7
Coal	1.7	1.7	1.7	1.8	1.7	1.9	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.0	2.4
Heavy fuel oil	5.6	5.7	5.4	5.7	5.5	5.4	5.5	4.6	5.5	5.7	5.1	4.2	4.1	3.3	2.8	2.1
Steam	1.3	1.1	1.2	1.2	1.4	1.4	1.6	1.6	1.9	1.8	2.0	2.5	2.5	2.3	2.1	2.1
Middle distillates	0.7	0.8	0.9	0.9	0.8	1.0	0.9	0.8	0.7	0.8	0.8	0.7	0.8	1.1	1.2	1.2
Coke oven gas	1.1	1.2	1.2	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.0	1.1	1.0	1.0
Liquified petroleum gases (propane)	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.4	0.3	0.4	0.4	0.4	0.3	0.3
Butane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	N/A
Refinery fuel gas	5.1	5.5	5.7	5.7	5.7	5.8	6.9	7.0	7.1	7.9	7.4	8.2	8.8	8.7	9.1	N/A

Due to rounding, numbers in the table may not add up to 100.

Table A.10 Industrial natural gas and electricity prices, 1995–2009

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Natural gas (cents/m ³)	10.7	10.7	11.5	12.8	14.8	18.0	24.2	26.3	32.8	33.9	37.1	37.6	32.5	32.8	28.9
Electricity (1000 kW/ 400 000 kWh) (cents/kWh)	6.9	7.0	7.0	7.0	7.0	6.9	7.6	7.5	7.9	7.7	8.1	8.1	8.3	8.9	8.2
Electricity (5000 kW/ 3 060 000 kWh) (cents/kWh)	4.9	4.9	4.9	5.1	5.1	5.3	6.1	5.7	6.1	5.9	6.2	6.2	6.3	7.0	6.2

Table A.11 Capacity utilization rates for the Manufacturing sector and selected Manufacturing subsectors, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sector/subsector	(%)															
Manufacturing sector (NAICS 31–33)	83.9	82.8	83.6	84.3	85.8	86.0	81.7	82.9	81.5	83.5	83.7	82.7	82.9	74.9	70.9	77.1
Paper Manufacturing (NAICS 322)	92.0	89.1	90.4	86.1	91.1	92.1	88.6	90.6	91.1	91.1	89.4	88.3	87.4	87.9	82.4	86.4
Primary Metal Manufacturing (NAICS 331)	88.3	88.0	89.0	93.8	91.1	90.9	86.2	87.8	88.4	91.8	91.5	91.9	92.1	89.0	76.4	81.6
Petroleum and Coal Product Manufacturing (NAICS 324)	89.5	92.8	93.1	95.5	94.4	92.7	94.9	96.5	95.4	93.9	88.3	83.2	82.5	75.0	78.1	78.7
Chemical Manufacturing (NAICS 325)	85.2	86.3	80.2	81.2	80.9	80.1	80.4	80.8	80.9	81.5	80.2	79.8	82.0	75.0	69.9	74.5
Wood Product (NAICS 321)	86.7	86.4	84.5	86.5	83.9	85.1	82.0	87.0	88.2	92.1	90.6	85.6	79.0	69.3	61.1	68.7
Food (NAICS 311)	81.6	79.6	79.0	80.7	80.1	80.9	81.6	81.8	78.9	79.1	80.6	80.1	80.1	77.7	81.8	80.8
Non-Metallic Mineral Product (NAICS 327)	75.5	76.7	83.4	80.1	80.4	79.8	80.1	82.1	83.8	84.2	84.4	81.9	85.0	78.3	65.9	76.0

Table A.12 Indexed growth of energy use, GDP and energy intensity for the Paper Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	94.2	94.9	92.8	97.9	98.0	92.7	92.2	92.7	94.4	86.1	75.3	73.7	64.4	60.9	60.7
GDP	100.0	101.7	102.7	99.9	109.2	113.7	106.9	112.4	112.7	113.8	114.7	102.7	102.8	93.7	82.3	83.1
Energy intensity	100.0	92.6	92.4	92.9	89.7	86.2	86.7	82.0	82.3	83.0	75.1	73.4	71.7	68.7	74.0	73.0

Table A.13 Energy consumption of the Paper Manufacturing industries, 1995–2010

Paper Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Pulp Mills industry (NAICS 32211)	408.1	373.8	380.3	370.9	390.9	393.7	379.0	376.2	375.8	392.3	350.3	320.0	317.3	271.9	259.2	264.5
Paper Mills industry (NAICS 32212)	411.0	394.2	389.4	377.7	404.3	404.8	367.2	366.8	372.8	366.5	338.9	284.0	275.9	241.9	220.1	220.2
Paperboard Mills industry (NAICS 322130)	70.9	69.1	73.3	75.7	76.5	72.4	71.9	72.1	69.2	73.5	65.9	56.9	50.4	49.9	46.3	37.3
Converted Paper Product Manufacturing industry (NAICS 3222)	11.1	11.5	12.3	11.6	10.9	12.5	16.8	17.1	17.5	18.5	21.1	17.7	20.7	16.4	23.0	24.6

Table A.14 GDP of the Paper Manufacturing industries, 1997–2010

Paper Manufacturing industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Billion \$2002)													
Pulp Mills industry (NAICS 32211)	1.55	1.56	1.85	1.91	1.76	1.80	1.71	1.85	1.81	1.68	1.74	1.54	1.31	1.43
Paper Mills industry (NAICS 32212)	5.06	4.72	5.19	5.68	5.00	5.39	5.47	5.56	5.82	5.03	5.17	4.57	3.76	3.71
Paperboard Mills industry (NAICS 322130)	1.01	0.94	1.14	1.06	1.01	0.93	0.86	0.84	0.82	0.78	0.76	0.79	0.64	0.68
Converted Paper Product Manufacturing industry (NAICS 3222)	3.24	3.38	3.36	3.22	3.55	3.75	3.85	3.77	3.67	3.34	3.17	3.02	2.98	2.96

Table A.15 Energy consumption of the Paper Manufacturing subsector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Spent pulping liquor	343.6	297.5	302.9	299.1	326.5	319.7	288.9	290.9	292.6	299.8	258.5	216.6	223.1	184.2	191.1	203.1
Electricity	193.7	195.9	197.8	202.4	210.1	220.5	222.6	223.5	221.5	220.4	216.6	195.1	188.8	168.9	146.8	143.1
Wood	127.4	122.9	120.4	119.9	124.5	126.9	128.6	132.6	138.8	151.6	149.3	133.4	117.6	114.1	102.5	98.2
Natural gas	156.5	152.7	152.9	139.7	142.6	134.3	111.1	116.2	98.0	93.5	81.5	75.4	75.4	71.8	78.9	76.9
Steam	9.1	10.2	11.8	10.3	14.7	15.4	15.5	14.7	15.5	14.2	16.1	19.7	20.3	18.2	12.2	13.1
Heavy fuel oil	63.9	62.5	62.5	58.3	58.5	60.1	62.6	48.6	64.0	63.5	50.2	34.6	35.0	19.6	15.0	10.6
Middle distillates	3.2	3.1	3.0	2.3	2.3	2.7	2.8	2.1	2.3	X	1.9	1.7	1.8	1.6	1.3	1.3
Liquefied petroleum gases (propane)	1.3	1.2	1.2	1.3	1.3	1.4	X	X	X	1.3	0.9	0.9	X	X	X	0.4
Petroleum coke and coke from catalytic cracking catalyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke from coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	2.4	2.4	2.8	2.6	1.9	2.4	X	X	X	X	1.2	1.2	X	X	X	0.0
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	901.1	848.5	855.2	835.8	882.6	883.4	834.9	830.8	835.3	850.9	776.2	678.6	664.2	580.1	548.7	546.6

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

Table A.16 Indexed growth of energy use, GDP and energy intensity for the Primary Metal Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	102.8	104.1	104.5	107.3	106.5	104.2	103.1	103.4	103.4	104.1	104.9	104.3	104.1	84.9	89.0
GDP	100.0	101.6	107.2	116.3	120.5	130.5	127.9	133.7	131.7	139.8	143.7	143.2	139.8	138.9	101.2	114.7
Energy intensity	100.0	101.2	97.1	89.8	89.0	81.6	81.5	77.1	78.5	74.0	72.5	73.2	74.6	75.0	83.9	77.6

Table A.17 Distribution of GDP of the Primary Metal Manufacturing subsector by industry, 1997–2010

Primary Metal Manufacturing industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(%)													
Iron and Steel Mills and Ferro-Alloy Manufacturing (NAICS 3311)	30.8	31.0	30.0	29.4	24.9	28.6	26.8	24.9	24.6	24.5	25.6	23.3	16.4	21.4
Steel Product Manufacturing from Purchased Steel (NAICS 3312)	13.0	11.4	11.4	10.4	10.5	9.8	10.7	10.4	10.3	10.1	10.0	13.2	9.4	10.0
Alumina and Aluminum Production and Processing (NAICS 3313)	23.1	25.0	25.5	29.0	30.5	30.6	30.0	32.5	34.2	36.0	37.0	37.3	46.5	41.7
Non-Ferrous Metal (except Aluminum) Production and Processing (NAICS 3314)	16.9	17.2	17.8	17.0	20.3	17.7	17.1	17.4	17.2	15.9	14.8	14.9	17.0	16.5
Foundries (NAICS 3315)	16.2	15.4	15.3	14.3	13.7	13.3	15.4	14.8	13.7	13.6	12.6	11.3	10.8	10.4

Due to rounding, numbers in the table may not add up to 100.

Table A.18 GDP of the Primary Metal Manufacturing subsector industries, 1997–2010

Primary Metal Manufacturing industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(GDP [billion - \$2002])													
Iron and Steel Mills and Ferro-Alloy Manufacturing (NAICS 3311)	2.7	3.0	3.0	3.2	2.6	3.2	2.9	2.9	2.9	2.9	3.0	2.7	1.4	2.0
Steel Product Manufacturing from Purchased Steel (NAICS 3312)	1.2	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.5	0.8	0.9
Alumina and Aluminum Production and Processing (NAICS 3313)	2.1	2.4	2.6	3.1	3.2	3.4	3.3	3.8	4.1	4.3	4.3	4.3	3.9	4.0
Non-Ferrous Metal (except Aluminum) Production and Processing (NAICS 3314)	1.5	1.7	1.8	1.8	2.2	2.0	1.9	2.0	2.1	1.9	1.7	1.7	1.4	1.6
Foundries (NAICS 3315)	1.4	1.5	1.5	1.5	1.4	1.5	1.7	1.7	1.6	1.6	1.5	1.3	0.9	1.0

Table A.19 Energy consumption of selected Primary Metal Manufacturing industries, 1995–2010

Primary Metal Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Iron and Steel Mills and Ferro-Alloy Manufacturing (NAICS 3311)	244.5	257.2	259.8	252.2	260.8	256.8	219.8	231.3	233.8	244.3	234.7	238.5	244.7	239.2	180.8	194.5
Primary Production of Alumina and Aluminum (NAICS 331313)	143.0	151.8	156.8	159.9	166.0	159.9	164.3	169.5	176.4	167.6	184.8	187.1	190.1	193.1	171.4	180.4
Non-Ferrous Metal (except Aluminum) Smelting and Refining (NAICS 33141)	83.8	79.9	76.2	84.6	80.9	85.6	89.9	82.0	77.3	78.7	73.4	74.7	66.1	68.3	57.4	54.8

Table A.20 Energy consumption of the Primary Metal Manufacturing subsector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Electricity	214.4	217.7	221.4	228.9	237.0	236.0	232.3	236.8	241.8	234.3	244.5	250.4	234.8	241.3	215.5	221.9
Natural gas	128.4	135.2	142.1	135.7	139.5	136.2	133.5	131.4	123.7	124.9	120.1	109.6	116.3	111.8	87.8	89.0
Coke oven gas	27.4	30.8	30.9	26.5	26.9	27.1	27.0	26.8	28.0	28.3	29.5	29.3	24.7	25.9	19.9	21.9
Coal	9.9	11.6	10.2	11.8	10.9	11.2	X	X	11.0	X	X	X	13.4	14.2	10.7	19.5
Heavy fuel oil	15.4	16.3	14.8	15.9	16.5	14.9	17.0	14.4	16.7	20.3	21.0	17.9	21.8	21.3	8.6	6.0
Middle distillates	2.4	2.5	2.6	2.3	2.5	2.9	2.9	2.4	3.3	3.2	3.1	3.1	3.4	3.2	2.7	2.8
Liquified petroleum gases (propane)	1.1	0.9	0.9	1.0	1.0	2.0	1.8	0.8	1.0	1.0	1.0	0.9	1.0	X	0.9	1.0
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	X	X	X	X	X	X	X
Steam	0.4	0.9	3.0	3.1	2.9	3.1	X	X	X	X	X	X	X	X	X	X
Petroleum coke and coke from catalytic cracking catalyst	2.2	2.1	1.6	1.8	1.6	1.2	1.8	1.6	X	2.0	1.6	2.0	X	X	X	X
Coke from coal	102.2	99.8	97.1	99.2	101.8	101.8	94.6	92.4	91.2	X	90.7	100.2	102.1	98.2	X	X
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	503.8	517.8	524.4	526.3	540.5	536.4	525.0	519.6	521.1	521.1	524.7	528.4	525.3	524.6	427.6	448.2

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

Table A.21 Indexed growth of energy use, GDP and energy intensity for the Petroleum and Coal Product Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	103.1	104.2	106.9	107.7	111.2	117.9	125.0	125.8	138.4	122.5	125.6	130.4	127.4	122.1	115.5
GDP	100.0	102.2	107.7	115.8	111.2	105.9	121.8	120.7	121.9	120.3	118.3	114.1	117.9	115.0	114.0	116.4
Energy intensity	100.0	101.0	96.7	92.4	96.8	105.0	96.8	103.6	103.1	115.1	103.6	110.1	110.6	111.0	107.1	99.3

Table A.22 Energy consumption of the Petroleum and Coal Product Manufacturing subsector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Refinery fuel gas	127.6	137.7	145.6	142.8	145.3	151.4	173.0	175.1	179.0	207.6	186.4	197.7	213.3	198.1	188.0	167.7
Natural gas	51.0	52.8	48.7	48.6	48.1	51.2	48.9	63.7	58.9	56.1	53.3	57.1	57.2	62.6	55.5	60.8
Petroleum coke and coke from catalytic cracking catalyst	48.4	46.7	48.5	51.5	51.8	53.4	59.2	64.6	67.8	X	55.8	54.0	55.9	51.0	50.7	53.9
Electricity	17.3	18.3	18.2	18.2	19.0	20.1	18.4	20.5	20.5	20.8	20.8	21.1	21.7	22.8	23.5	24.9
Heavy fuel oil	41.7	40.2	38.4	45.7	42.8	41.4	38.4	36.4	37.8	46.5	X	X	29.0	24.9	23.5	15.4
Middle distillates	0.4	0.7	1.0	1.2	3.1	4.7	3.2	1.4	X	0.7	0.7	0.5	0.9	X	10.2	10.1
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	0.9	1.0	1.0	0.8	0.6	1.0	X	X	X	X	X	X	X	X	0.0	0.0
Liquified petroleum gases (propane)	4.9	3.9	3.0	3.5	3.5	1.7	2.3	2.5	1.4	1.6	0.9	0.9	1.2	1.2	X	X
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Steam	0.6	0.8	1.0	0.8	1.1	0.9	X	X	X	X	X	X	X	X	X	X
Coke from coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	293.0	302.1	305.3	313.2	315.4	325.9	345.5	366.2	368.4	405.5	359.0	368.0	382.0	373.3	357.8	338.5

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

Table A.23 Indexed growth of energy use, GDP and energy intensity for the Chemical Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	101.9	106.4	110.3	103.2	106.3	99.3	90.8	91.7	100.2	98.4	96.3	94.0	92.6	87.4	101.9
GDP	100.0	100.5	100.7	101.6	105.9	117.7	120.4	125.6	129.1	129.2	127.1	128.6	123.9	116.1	106.2	111.2
Energy intensity	100.0	101.4	105.6	108.6	97.5	90.3	82.5	72.3	71.1	77.6	77.4	74.9	75.9	79.8	82.3	91.6

Table A.24 Energy consumption of selected Chemical Manufacturing industries, 1995–2010

Chemical Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Petrochemical Manufacturing (NAICS 32511)	34.22	32.89	41.78	40.50	38.91	42.51	44.93	48.40	53.11	58.74	63.28	61.96	64.36	62.78	56.18	78.81
Industrial Gas Manufacturing (NAICS 32512)	5.76	5.69	5.76	6.29	7.31	8.55	8.94	9.11	9.23	10.47	8.35	13.67	14.65	12.09	14.95	14.65
All Other Basic Inorganic Chemical Manufacturing (NAICS 325189)	31.09	33.66	36.18	37.72	34.00	33.23	34.38	30.27	33.75	36.15	37.67	34.12	32.32	30.96	27.29	28.31
Other Basic Organic Chemical Manufacturing (NAICS 32519)	49.47	50.48	55.22	54.67	50.10	50.04	43.25	36.76	35.06	40.35	38.34	24.66	23.30	28.38	29.19	35.57
Resin and Synthetic Rubber Manufacturing (NAICS 32521)	35.22	36.11	35.54	37.19	39.12	40.27	33.53	30.62	28.49	28.59	27.57	37.79	39.88	41.14	37.55	38.42
Chemical Fertilizer (except Potash) Manufacturing (NAICS 325313)	55.97	55.63	59.13	60.21	62.43	63.54	62.17	54.21	58.04	58.20	54.31	56.04	54.33	50.52	45.88	54.53

Table A.25 Energy consumption of the Chemical Manufacturing subsector by energy source, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy source	(PJ)															
Natural gas	177.4	186.8	198.8	201.1	185.3	190.6	172.7	154.8	144.4	164.3	161.3	152.3	149.9	154.5	152.9	173.1
Electricity	71.6	71.8	76.4	81.3	76.6	82.8	79.7	74.6	77.4	80.4	80.2	82.5	79.2	75.0	65.3	66.8
Steam	21.3	13.9	11.7	13.8	14.8	14.1	16.7	18.7	24.4	26.0	25.9	27.6	28.7	24.7	22.0	X
Heavy fuel oil	5.0	7.7	6.1	7.7	7.6	5.1	4.8	2.1	5.0	5.3	3.3	2.3	X	X	X	X
Middle distillates	1.2	1.5	0.7	0.6	0.4	0.8	0.9	0.5	0.6	0.5	0.7	0.8	0.4	X	X	X
Petroleum coke and coke from catalytic cracking catalyst	0.7	0.7	0.8	0.8	0.8	0.8	0.0	0.8	X	X	X	X	X	X	X	X
Liquified petroleum gases (propane)	0.3	0.2	0.8	1.0	1.0	0.9	0.9	0.6	1.4	0.4	0.2	0.2	X	0.2	X	X
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	X
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	X	X	X	X	X	X
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	X	X	X	X	X	X	0.4	0.0
Coke from coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	277.5	282.7	295.3	306.2	286.4	295.0	275.6	252.1	254.6	278.1	272.9	267.2	261.0	257.0	242.5	282.6

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

Table A.26 Indexed growth of energy use, GDP and energy intensity for the Wood Product Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	114.4	115.2	115.6	118.2	119.6	109.5	113.3	111.0	115.3	119.4	131.0	127.9	120.5	105.0	118.0
GDP	100.0	103.0	119.9	125.4	133.4	148.0	140.6	156.2	156.9	162.9	173.6	171.7	154.9	136.2	115.2	128.0
Energy intensity	100.0	111.0	96.0	92.2	88.6	80.8	77.9	72.5	70.7	70.8	68.8	76.3	82.6	88.5	91.0	92.5

Table A.27 Energy consumption of selected Wood Product Manufacturing industries, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Wood Manufacturing industry	(PJ)															
Sawmills (except Shingle and Shake Mills) Manufacturing (NAICS 321111)	47.7	53.3	47.8	50.1	61.5	63.2	46.9	50.5	43.2	46.5	48.9	56.8	54.6	56.7	49.2	53.7
Particle Board and Fibreboard Mills Manufacturing (NAICS 321216)	7.7	9.5	11.5	11.1	16.0	20.0	22.0	24.5	20.7	22.3	18.9	17.7	18.2	15.0	11.7	10.4

Table A.28 Energy consumption of the Wood Product Manufacturing subsector by energy source, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy source	(PJ)															
Wood	50.7	62.9	60.5	60.9	62.7	62.8	50.1	49.5	55.2	58.8	60.1	74.0	68.6	70.1	64.5	75.9
Electricity	21.0	21.2	21.6	21.1	24.3	24.2	27.1	32.4	28.2	27.9	31.2	27.9	29.9	29.4	25.9	29.0
Natural gas	29.5	30.7	32.8	32.5	30.9	30.9	31.2	33.3	29.7	30.4	29.9	25.7	28.7	21.8	15.6	15.7
Middle distillates	4.7	5.1	6.4	7.4	6.3	7.2	6.5	4.1	4.3	4.7	5.0	5.3	5.2	4.3	4.0	4.8
Steam	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.4	X	X	0.3	X	2.3	X	X	1.0
Heavy fuel oil	1.5	2.0	1.7	1.5	2.0	2.2	2.0	1.8	1.8	2.1	1.9	1.7	1.7	1.5	1.3	X
Liquified petroleum gases (propane)	0.8	1.8	1.4	1.6	1.7	1.8	1.2	1.1	X	X	0.8	X	2.1	X	X	X
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petroleum coke and coke from catalytic cracking catalyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke from coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	108.2	123.8	124.6	125.1	128.0	129.4	118.5	122.6	120.2	124.9	129.2	141.8	138.5	130.4	113.5	128.2

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

Table A.29 Indexed growth of energy use, GDP and energy intensity for the Food Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	105.2	108.7	99.8	103.0	111.4	105.0	104.6	104.9	107.1	112.8	113.2	117.2	117.6	121.8	120.7
GDP	100.0	99.6	100.0	105.2	107.8	112.0	120.8	120.1	118.5	119.1	123.8	126.6	126.8	127.8	132.5	134.5
Energy intensity	100.0	105.7	108.7	94.9	95.6	99.5	86.9	87.0	88.5	89.9	91.1	89.5	92.4	92.0	92.7	89.7

Table A.30 Energy consumption of selected Food Manufacturing industries, 1995–2010

Food Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Fruit and Vegetable Preserving and Specialty Food (NAICS 3114)	9.9	11.2	12.1	12.3	10.5	13.0	13.6	12.5	12.8	12.6	14.5	14.1	15.0	13.6	15.4	18.8
Dairy Product (NAICS 3115)	10.5	11.8	11.7	11.5	12.4	12.6	11.9	12.0	11.5	11.5	10.7	10.2	10.1	10.2	10.4	10.8
Meat Product (NAICS 3116)	13.1	14.9	14.4	14.1	15.0	18.1	18.4	16.8	16.3	17.7	18.4	19.0	19.3	22.7	26.6	24.3
Bakeries and Tortilla (NAICS 3118)	6.4	6.5	6.0	6.5	6.3	6.8	8.3	9.1	8.7	8.8	9.6	9.8	10.6	10.6	11.4	9.9

Table A.31 GDP of selected Food Manufacturing industries, 1995–2010

Food Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(GDP [billion - \$2002])															
Fruit and Vegetable Preserving and Specialty Food (NAICS 3114)	1.56	1.58	1.80	1.71	1.97	2.01	2.34	2.38	2.27	2.12	2.04	2.04	2.11	2.10	2.17	2.06
Dairy Product (NAICS 3115)	2.36	2.19	2.16	2.36	2.31	2.28	2.43	2.18	2.19	2.23	2.33	2.41	2.47	2.64	2.63	2.62
Meat Product (NAICS 3116)	2.68	2.69	2.82	2.97	3.02	3.58	3.77	3.58	3.54	3.71	4.26	4.36	4.32	4.41	4.54	4.77
Bakeries and Tortilla (NAICS 3118)	-	-	2.03	2.15	2.20	2.18	2.42	2.40	2.21	2.38	2.41	2.55	2.54	2.78	2.93	2.82

Table A.32 Energy intensity of selected Food Manufacturing industries, 1995–2010

Food Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(MJ/\$GDP)															
Fruit and Vegetable Preserving and Specialty Food (NAICS 3114)	6.34	7.06	6.70	7.22	5.33	6.45	5.82	5.25	5.66	5.93	7.11	6.90	7.13	6.45	7.11	9.15
Dairy Product (NAICS 3115)	4.45	5.42	5.42	4.89	5.37	5.52	4.91	5.48	5.25	5.15	4.60	4.22	4.08	3.85	3.95	4.12
Meat Product (NAICS 3116)	4.90	5.53	5.10	4.76	4.96	5.05	4.87	4.70	4.60	4.78	4.33	4.36	4.47	5.15	5.85	5.08
Bakeries and Tortilla (NAICS 3118)	-	-	2.94	3.02	2.85	3.12	3.42	3.80	3.96	3.67	3.99	3.82	4.18	3.80	3.91	3.50

Table A.33 Energy consumption of the Food Manufacturing subsector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Natural gas	57.1	58.1	60.9	57.6	59.8	63.1	60.4	57.5	59.3	60.9	61.8	60.9	60.6	59.7	61.7	59.0
Electricity	20.6	21.3	22.0	18.3	18.9	20.5	18.9	20.2	21.3	21.4	25.3	26.6	29.9	32.4	34.5	31.0
Heavy fuel oil	4.4	5.4	5.6	5.2	4.4	7.2	5.3	4.3	3.9	4.2	4.2	4.4	4.7	4.1	4.1	3.9
Middle distillates	X	2.4	X	X	X	X	2.1	4.0	1.7	2.0	2.0	2.0	2.0	1.9	1.5	2.0
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petroleum coke and coke from catalytic cracking catalyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	X	0.0	0.0	0.0
Liquified petroleum gases (propane)	X	0.3	X	X	X	X	X	X	X	X	0.5	0.4	X	X	X	X
Steam	1.0	1.8	1.0	1.0	1.7	1.7	1.8	2.0	2.2	1.8	X	X	X	X	X	X
Coke from coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood	X	0.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	84.9	89.3	92.3	84.7	87.5	94.6	89.1	88.8	89.0	90.9	95.8	96.1	99.5	99.8	103.4	102.4

Due to rounding, numbers may not add up to the total shown.

The letter X indicates an undisclosed value for confidentiality reasons.

Table A.34 Indexed growth of energy consumption, GDP and energy intensity for the Non-Metallic Mineral Product Manufacturing subsector, 1995–2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy use	100.0	100.7	102.7	101.4	107.6	103.0	97.9	101.0	100.2	107.2	107.3	105.2	109.4	91.5	77.2	81.8
GDP	100.0	107.1	119.4	130.8	131.7	145.5	152.9	155.9	165.3	171.7	178.6	179.4	181.6	169.0	137.0	151.6
Energy intensity	100.0	94.0	86.0	77.5	81.7	70.8	64.0	64.8	60.7	62.4	60.1	58.6	60.2	54.0	56.3	53.9

Table A.35 Energy consumption of selected Non-Metallic Mineral Product Manufacturing industries, 1995–2010

Non-Metallic Mineral Product Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Cement Manufacturing (NAICS 32731)	58.0	54.5	55.4	58.1	60.9	60.7	58.7	61.8	60.9	65.2	66.4	69.6	64.2	60.3	53.0	51.8
Lime Manufacturing (NAICS 32741)	15.8	15.3	16.1	15.8	16.7	16.0	15.0	14.7	13.5	14.8	15.9	15.0	15.2	13.9	11.3	11.9
Glass Manufacturing (NAICS 3272144)	14.3	13.6	13.4	13.4	15.4	15.1	14.3	14.2	14.5	11.5	11.7	10.4	10.6	8.7	3.3	4.0

Table A.36 GDP of selected Non-Metallic Mineral Product Manufacturing industries, 1995–2010

Non-Metallic Mineral Product Manufacturing industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(GDP [billion - \$2002])															
Cement Manufacturing (NAICS 32731)	-	-	0.77	0.73	0.72	0.76	0.81	0.79	0.81	0.91	1.05	1.06	1.03	0.91	0.74	0.79
Lime Manufacturing (NAICS 32741)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glass Manufacturing (NAICS 3272144)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A.37 Energy consumption of the Non-Metallic Mineral Product Manufacturing subsector by energy source, 1995–2010

Energy source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(PJ)															
Coal	27.3	25.6	28.5	28.3	30.5	33.5	33.2	34.1	36.4	X	38.3	38.5	37.4	36.1	30.6	30.4
Petroleum coke and coke from catalytic cracking catalyst	13.3	14.1	11.5	12.9	14.4	13.1	14.6	17.0	18.3	22.4	X	X	25.2	24.2	21.8	21.6
Natural gas	54.5	55.4	57.2	54.8	57.4	51.2	43.6	43.7	37.1	39.3	37.0	32.3	39.6	26.7	18.7	21.5
Electricity	16.5	15.9	15.7	14.4	15.2	15.5	14.9	15.8	16.8	16.4	16.7	17.7	20.1	15.5	15.0	16.1
Middle distillates	1.2	2.9	3.4	3.6	2.9	2.8	3.1	3.0	2.7	4.4	3.8	2.3	2.1	2.2	2.5	2.3
Wood	0.1	0.1	0.1	0.1	0.1	0.0	X	X	X	X	X	X	X	X	X	2.1
Refinery fuel gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy fuel oil	3.8	3.7	3.4	4.3	4.9	3.4	3.8	3.9	4.7	4.2	3.9	2.6	2.7	X	1.1	X
Coke oven gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Liquefied petroleum gases (propane)	0.3	0.3	0.4	0.3	0.3	0.2	0.3	0.6	0.6	0.5	0.5	X	X	X	X	X
Steam	0.1	0.1	0.1	0.1	0.1	0.1	X	X	X	X	X	0.0	X	X	X	X
Coke from coal	0.5	0.3	0.4	0.5	0.8	1.4	1.6	0.7	X	X	2.1	1.4	0.6	0.7	X	X
Spent pulping liquor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	117.6	118.5	120.8	119.3	126.5	121.2	115.2	118.8	117.9	126.0	126.3	123.7	128.7	107.6	90.8	96.2

Due to rounding, numbers may not add up to the total shown.
The letter X indicates an undisclosed value for confidentiality reasons.

B Glossary

Energy intensity

The amount of energy used per unit of activity. Examples of activity measures are households and floor space (residential sector), passenger-kilometres and tonne-kilometres (transportation sector), and physical units of production and constant dollar value of gross domestic product (industrial sector).

Energy source

Any substance that supplies heat or power (e.g. coal, coal coke, coke oven gas, coke from catalytic cracking catalyst, electricity, heavy fuel oil, middle distillates, natural gas, petroleum coke, propane, refinery fuel gas, spent pulping liquor, steam and wood).

Establishment

As a statistical unit, is defined as the most homogeneous unit of production for which the business maintains accounting records from which it is possible to assemble all the data elements required to compile the full structure of the gross value of production (total sales or shipments, and inventories), the cost of materials and services, and labour and capital used in production. Provided that the necessary accounts are available, the statistical structure replicates the operating structure of the business. In delineating the establishment, however, producing units may be grouped. An establishment comprises at least one location, but it can also be composed of many. Establishments may also be referred to as profit centres.

Gross domestic product (GDP)

The total value of goods and services produced within the border of a geographic area (Canada) during a given year. Also referred to as annual economic output or, more simply, output. To avoid counting the same output more than once, GDP includes only final goods and services – not those that are used to make another product. In this report, GDP figures are reported in constant 2002 dollars.

Industrial capacity utilization rate

The ratio of an industry's actual output to its estimated potential output. The measures of actual output used in the production of the rates of capacity use are the measures of real gross domestic product at factor cost, seasonally adjusted, by industry.

North American Industry Classification System (NAICS)

An industry classification system developed by the statistical agencies of Canada, Mexico and the United States. Created against the background of the North American Free Trade Agreement, it provides common definitions of the industrial structure of the three countries and a common statistical framework to facilitate the analysis of the three economies. NAICS is based on supply-side or production-oriented principles, to ensure that industrial data, classified to NAICS, are suitable for the analysis of production-related issues, such as industrial performance.

Petajoule

One petajoule equals 1×10^{15} joules. A joule is the international unit of a measure of energy – the energy produced by the power of one watt flowing for one second. There are 3.6 million joules in one kilowatt hour.

Refined petroleum products (RPP)

Refined petroleum products include but are not limited to gasoline, kerosene, distillates (including No. 2 fuel oil), liquefied petroleum gas, asphalt, lubricating oils, diesel fuels, and residual fuels.

Spent pulping liquor

A by-product of the paper making process containing carbohydrate and lignin decomposition products. Also known as black liquor.

C North American Industry Classification System

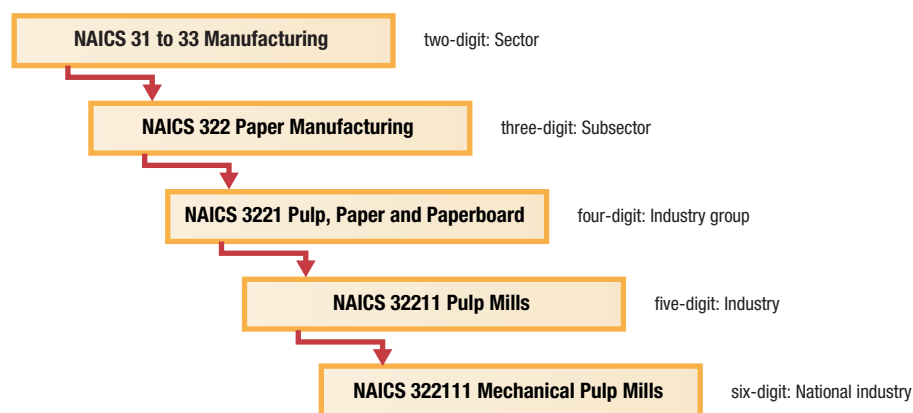
The North American Industrial Classification System (NAICS) is an industry classification that provides common definitions of the industrial structure of Canada, Mexico and the United States. Developed jointly by the statistical agencies of these three countries, NAICS was adopted in 1997 and revised in 2002 and 2007 (and recently in 2012) to increase comparability among the three countries and to add new industries.

The NAICS numbering system is a six-digit code:

- first two digits designate the sector
- third digit designates the subsector
- fourth digit designates the industry group
- fifth digit designates the industry
- sixth digit can indicate another level of detail (to include additional detail, a country can create national industries and indicate that in the sixth digit)

The following table shows an example of the designation of the NAICS codes.

Figure C.1 Example of NAICS code designation



NAICS Canada 2007 consists of 20 sectors, 102 subsectors, 324 industry groups, 718 industries and 928 national industries. Table C.1 lists the 20 sectors.

Table C.1 Sectors included in NAICS 2007

Sector	NAICS
Agriculture, Forestry, Fishing and Hunting	11
Mining, Quarrying, and Oil and Gas Extraction	21
Utilities	22
Construction	23
Manufacturing	31-33
Wholesale Trade	41
Retail Trade	44-45
Transportation and Warehousing	48-49
Information and Cultural Industries	51
Finance and Insurance	52
Real Estate and Rental and Leasing	53
Professional, Scientific and Technical Services	54
Management of Companies and Enterprises	55
Administrative and Support and Waste Management and Remediation Services	56
Educational Services	61
Health Care and Social Assistance	62
Arts, Entertainment and Recreation	71
Accommodation and Food Services	72
Other Services (except Public Administration)	81
Public Administration	91

The 7 three-digit NAICS codes (subsectors) analyzed in this summary report are as follows:

311 Food Manufacturing

This subsector comprises establishments primarily engaged in producing food for human or animal consumption.

Exclusion(s): Establishments primarily engaged in

- manufacturing beverages or tobacco (312, Beverage and Tobacco Product Manufacturing)

321 Wood Product Manufacturing

This subsector comprises establishments primarily engaged in manufacturing products from wood. There are three industry groups in this subsector, comprising establishments engaged in sawing logs into lumber and similar products, or preserving these products; making products that improve the natural characteristics of wood, by making veneers, plywood, reconstituted wood panel products or engineered wood assemblies; and making a diverse range of wood products, such as millwork.

Exclusion(s): Establishments primarily engaged in

- logging; and chipping logs in the field (113, Forestry and Logging)
- manufacturing wood pulp, paper and paper products (322, Paper Manufacturing)
- manufacturing wood kitchen cabinets and counters, and bathroom vanities (337, Furniture and Related Product Manufacturing)
- manufacturing wood signs and coffins (339, Miscellaneous Manufacturing)

322 Paper Manufacturing

This subsector comprises establishments primarily engaged in manufacturing pulp, paper and paper products. The manufacture of pulp involves separating the cellulose fibres from other impurities in wood, used paper or other fibre

sources. The manufacture of paper involves matting these fibres into a sheet. Converted paper products are produced from paper and other materials by various cutting and shaping techniques.

324 Petroleum and Coal Products Manufacturing

This subsector comprises establishments primarily engaged in transforming crude petroleum and coal into intermediate and end products. The dominant process is petroleum refining, which separates crude petroleum into components or fractions through such techniques as cracking and distillation.

Exclusion(s): Establishments primarily engaged in manufacturing chemicals and chemical preparations from refined petroleum and coal products (325, Chemical Manufacturing)

325 Chemical Manufacturing

This subsector comprises establishments primarily engaged in manufacturing chemicals and chemical preparations, from organic and inorganic raw materials.

Exclusion(s): Establishments primarily engaged in

- field processing of crude petroleum and natural gas (211, Oil and Gas Extraction)
- beneficiating mineral ores (212, Mining and Quarrying [except Oil and Gas])
- processing crude petroleum and coal (324, Petroleum and Coal Products Manufacturing)
- smelting and refining ores and concentrates (331, Primary Metal Manufacturing)

327 Non-Metallic Mineral Product Manufacturing

This subsector comprises establishments primarily engaged in manufacturing non-metallic mineral products. These establishments cut, grind, shape and finish granite, marble, limestone, slate and other stone; mix non-metallic minerals with chemicals and other additives; and heat non-metallic mineral preparations to make products, such as bricks, refractories, ceramic products, cement and glass.

Exclusion(s): Establishments primarily engaged in

- beneficiating non-metallic minerals (212, Mining and Quarrying (except Oil and Gas))

331 Primary Metal Manufacturing

This subsector comprises establishments primarily engaged in smelting and refining ferrous and non-ferrous metals from ore, pig or scrap in blast or electric furnaces. Metal alloys are made with the introduction of other chemical elements. The output of smelting and refining, usually in ingot form, is used in rolling and drawing operations to produce sheet, strip, bars, rods and wire, and in molten form to produce castings and other basic metal products.

Exclusion(s): Establishments primarily engaged in manufacturing metal forgings or stampings (332, Fabricated Metal Product Manufacturing)

The remaining 14 three-digit NAICS codes (subsectors) belonging to the Manufacturing sector are as follows:

- 312 Beverage and Tobacco Product Manufacturing
- 313 Textile Mills
- 314 Textile Product Mills
- 315 Clothing Manufacturing
- 316 Leather and Allied Product Manufacturing
- 323 Printing and Related Support Activities
- 326 Plastics and Rubber Products Manufacturing
- 332 Fabricated Metal Product Manufacturing
- 333 Machinery Manufacturing
- 334 Computer and Electronic Product Manufacturing

335 Electrical Equipment, Appliance and Component Manufacturing
336 Transportation Equipment Manufacturing
337 Furniture and Related Product Manufacturing
339 Miscellaneous Manufacturing

For a complete description of the structure of the Manufacturing sector, visit Statistics Canada's Web site: stds.statcan.gc.ca/naics-scian/2007/ts-rt-eng.asp?criteria=31-33

D Methodology

This appendix summarizes the methodology used in the Industrial Consumption of Energy (ICE) Survey, which was conducted by Statistics Canada on behalf of Natural Resources Canada and Environment Canada in 2010.

Description

The Industrial Consumption of Energy survey, which is funded by Natural Resources Canada and Environment Canada, provides estimates of energy consumption by manufacturing establishments in Canada. These estimates serve as an important indicator of Canadian economic performance and are used by all levels of government in establishing informed policies in the energy area.

The survey results are used by Natural Resources Canada to track energy efficiency improvements and by Environment Canada to calculate carbon dioxide emissions. Industry also uses the information to monitor the results of their energy reduction efforts and to measure their contributions to Canada's climate change goals. Within Statistics Canada, the data are used as an input into the environmental accounts and statistics as well as into the annual *Report on Energy Supply and Demand in Canada*.

Natural Resources Canada and Environment Canada are provided with data on a regular basis. Statistics Canada has also entered into data sharing agreements with various agencies and government departments for this survey.

Target population

The target population comprises manufacturing establishments in Canada. Under the North American Industry Classification System (NAICS), manufacturing establishments are classified to NAICS 31, 32 and 33. The ICE questionnaire is also sent to some units outside of the manufacturing sector, such as mining, oil and gas extraction and utilities.

Instrument design

The questionnaire requests data on the consumption of various energy commodities such as electricity, natural gas, propane, diesel, wood and steam. It also asks for information on the different usages of energy commodities: as fuel, to produce steam for sale, to produce electricity and for non-energy use.

Sampling

This is a sample survey with a cross-sectional design.

The Industrial Consumption of Energy (ICE) survey began in 1995 with both annual and quarterly components. The quarterly component was discontinued in 2003. Since then, all units have been collected on an annual basis. The cost savings were reinvested into the survey to improve data quality by adding 1000 units to the sample.

The frame used for sampling is Statistics Canada's Business Register. The statistical unit is the establishment. The survey population includes all manufacturing establishments above certain thresholds that vary by industry and by reference year. To minimize the collection of data from smaller establishments, the smallest establishments in each of the industries of interest in terms of their value of shipments or gross business income are excluded from the ICE sample.

Establishments are stratified by industry and by size based on their shipment value. Four strata are defined by size: one take-all, two take-some and a take-none. “Take-alls” are selected based on their uniqueness, their size and their importance in their industry.

The sampling for the take-some strata is done using Statistics Canada’s Generalized Sampling System (GSAM). All sampled units are assigned a sampling weight. The sampling weight is a factor that indicates how many similar units the sampled unit represents in the population. This weight allows estimates for the population to be produced.

The sampling strategy was streamlined for the 2006 reference year while maintaining the same sample size; this allowed production of provincial estimates for use as input into the annual *Report on Energy Supply and Demand in Canada*. Of the 88 industries of interest, provincial estimates are produced for 35 of them.

Data sources

Data collection for this reference period: 2011-01-04 – 2011-03-31

Responding to this survey is mandatory.

Data are collected directly from survey respondents.

The collection period begins in January with the mailing of the questionnaires to the selected establishments. Phone and fax follow-ups begin in February for establishments that have not yet responded. The Regional Office collects data from late responders using Computer Assisted Telephone Interviews. The collection period ends in March.

View the questionnaire and reporting guide (www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getInstrumentLink&SurvItem_Id=44545&Query_Id=88243&Query=instance&lang=en&db=imdb&adm=8&dis=2).

Error detection

The following methods of error detection are used

Edits are performed during data capture to ensure that keying errors are corrected. For example, a boundary edit identifies large changes in fuel consumption from one year to the next. Historical edits identify whether an establishment is using a fuel it has never reported consumption for in the past or whether it is not using a fuel that it has reported past consumption for.

During and after the collection period, year-over-year validity of data is verified for large contributors to the industry and fuel estimates. Unusual, unexplained movements are questioned and, if need be, respondents are called to confirm the data.

All cases where the unit of measure has not been specified, or where the respondent has reported in the “other fuel” category, are looked at manually.

For establishments that have no previous data to compare with, an outlier detection method that uses Statistics Canada’s generalized BANFF system compares the energy consumption of establishments with similar shipments within the establishment’s industry to identify whether the data are reasonable or not.

Finally, for some industries, data reconciliation at the micro-level is done with other survey results.

Imputation

Imputation is used to determine plausible values for all variables that are missing or inconsistent with historical data. A number of statistical techniques are employed for this purpose that use survey data collected during the current and previous cycles.

For partial data records, missing fuel consumption values are calculated using the change in fuel consumption of the industry to which the establishment belongs.

Starting in 2006, an automated donor imputation program is used in addition to the other imputation methods mentioned above, using Statistics Canada's generalized BANFF system. Donor imputation involves identifying a respondent record that is similar to a non-respondent based on information that is available for both establishments (such as industry, value of shipments, and types of fuel consumed). The data available for the donor establishment are then used for the non-respondent.

Estimation

The Generalized Estimation System is applied to calculate energy consumption estimates for each of the 88 manufacturing NAICS of interest. The estimates are calibrated to the most recent shipment values available from the Annual Survey of Manufactures for these industries. This corrects for sampling errors and includes an adjustment for the uncovered portion of each industry that was excluded from the sample, that is, the take-none stratum.

Starting in 2006, coal, coal coke, petroleum coke, coke on catalytic cracking catalyst, refinery fuel gas, butane and steam purchased are weighted, which they were not previously. This change allows the production of estimates that represent the population.

Quality evaluation

Throughout the collection and processing of the data, every effort was made to ensure that the results would be of superior quality. As part of the quality evaluation stage, initial survey results are validated by industry experts such as the Canadian Industry Program for Energy Conservation and the Canadian Industrial Energy End-use Data and Analysis Centre. Natural Resources Canada and Environment Canada are also important partners in this data validation stage. Data quality indicators are included in the CANSIM tables in order to provide users with information about the reliability of the data.

Disclosure control

Statistics Canada is prohibited by law from releasing any data which would divulge information obtained under the Statistics Act that relates to any identifiable person, business or organization without the prior knowledge or the consent in writing of that person, business or organization. Various confidentiality rules are applied to all data that are released or published to prevent the publication or disclosure of any information deemed confidential. If necessary, data are suppressed to prevent direct or residual disclosure of identifiable data.

Confidentiality analysis includes the detection of possible direct disclosure, which occurs when the value in a tabulation cell is composed of a few respondents or when the cell is dominated by a few companies.

Data accuracy

While considerable effort is made to ensure high standards throughout all stages of collection and processing, the resulting estimates are inevitably subject to a certain degree of error. These errors can be broken down into two major types: non-sampling and sampling.

Non-sampling error is not related to sampling and may occur for many reasons. For example, non-response is an important source of non-sampling error. Population coverage, differences in the interpretation of questions, incorrect information from respondents, and mistakes in recording, coding and processing data are other examples of non-sampling errors.

For the 2010 Annual Industrial Consumption of Energy Survey, the non-sampling errors were controlled through careful design of the questionnaire, the use of a minimal number of simple concepts and consistency checks. Of the units contributing to the estimate, the response rate was 85 percent.

Sampling error occurs because population estimates are derived from a sample of the population rather than the entire population. Sampling error depends on factors such as sample size, sampling design and the method of estimation. An important property of probability sampling is that sampling error can be computed from the sample itself by using a statistical measure called the coefficient of variation (CV). The assumption is that over repeated surveys, the relative difference between a sample estimate and the true value that would have been obtained from an enumeration of all units in the universe would be less than twice the CV, 95 times out of 100. The range of acceptable data values yielded by a sample is called a confidence interval. Confidence intervals can be constructed around the estimated by using the CV. The standard error is calculated by multiplying the sample estimate by the CV. The sample estimate plus or minus twice the standard error is then referred to as a 95 percent confidence interval.

For the 2010 Annual Industrial Consumption of Energy Survey, CVs were calculated for each estimate. Generally, the more commonly reported variables obtained very good CVs (of less than 10 percent), while the less commonly reported variables were associated with higher but still acceptable CVs (under 25 percent). Some data might not be released because of poor data quality.