Natural Resources Canada | Ressources naturelles Canada

INDUSTRIAL CONSUMPTION OF ENERGY SURVEY

Statistical Report of Energy Use in the Canadian Manufacturing Sector, 1995–2016

Every year, Statistics Canada conducts the Industrial Consumption of Energy (ICE) survey, which collects energy use data from establishments in Canada's Manufacturing sector. The survey is co-sponsored by the Office of Energy Efficiency (OEE) of Natural Resources Canada (NRCan) and Environment and Climate Change 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 efficiency.

This statistical report examines energy use patterns for the Canadian Manufacturing sector by using the results of the 2016 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).

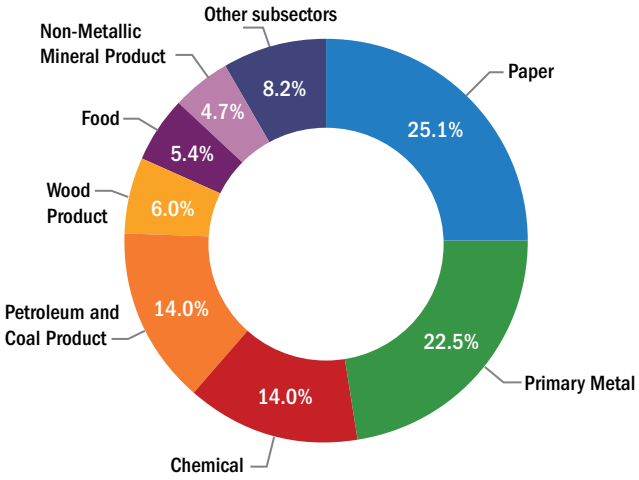
Manufacturing continued to reduce energy intensity in 2016

After a brief pause during the 2008–2009 recession, Manufacturing energy intensity has **continued to fall** and in 2016 was about **10 percent below the pre-recession peak of 2004**. Longer term, energy intensity declined 30 percent since 1995. These figures represent an absolute drop in the sector's energy use of about **400 petajoules** (PJ), which is equivalent to the amount of energy consumed by cars in Ontario, Quebec and the Atlantic provinces in 2016.[1]

Paper Manufacturing, the subsector with the highest rate of energy use per unit of gross domestic product (GDP), experienced a decline in output (GDP) of 21.5 percent between 1995 and 2016. The change re-weighted activity in the Manufacturing sector toward less energy-intensive industries. This re-weighting, combined with improvement in other energy-intensive subsectors, resulted in an **overall reduction in Manufacturing energy intensit**y from **17.2** megajoules per dollar of GDP (MJ/$GDP) in 1995 to **12.0** MJ/$GDP in 2016.

Although there are 21 subsectors within the Manufacturing sector, **7 subsectors** accounted for almost **92 percent** of the energy consumption in the sector in 2016.

Figure 1. Share of energy consumption in the Manufacturing sector, 1995–2016



[1] Natural Resources Canada, Comprehensive Energy Use Database, 1990–2016, Transportation Sector, Canada, Table 31.

Canada

In 2016, the Manufacturing sector generated **$174.2 billion in GDP**, in constant 2007 dollars and, according to ICE estimates, consumed **2,092.9 PJ** of energy. To put this into perspective, this amount is roughly equal to the energy consumed for space heating and cooling, water heating, and lighting by all residential and commercial/institutional buildings in Canada in 2016.

The trend in improved energy intensity is evident over both the long and short term. The sector continued its recovery from the global economic downturn in 2009 as GDP increased steadily in the following years. Figure 2 indicates that **output of the Manufacturing sector has outpaced energy use**, resulting in continued **improvement in energy intensity**.

Table 1 provides these comparisons for the seven most energy-consuming subsectors. **Three subsectors reported a decline in energy use** in 2016 compared to 1995, with the most significant decline being in **Paper** Manufacturing (-41.6 percent). Several **factors** can influence the amount of energy used by a particular industry, such as its level of **economic activity**, its **structure** and **how efficiently it uses energy**. Adopting more efficient energy-related processes or technologies would help an industry reduce its demand for energy. Examples are **waste energy recovery** and **re-use and cogeneration** in the Paper Manufacturing subsector.

Figure 2. Indexed growth of energy use, GDP and energy intensity for the Manufacturing sector, 2009–2016

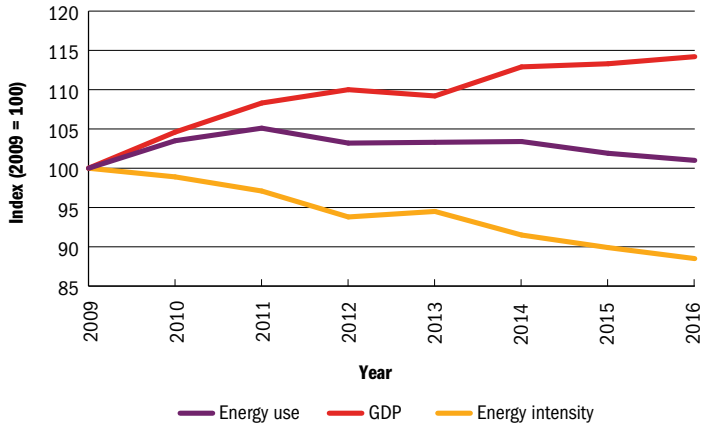


Table 1. Comparison of energy use, GDP and energy intensity of the Manufacturing sector and selected subsectors, 1995–2016

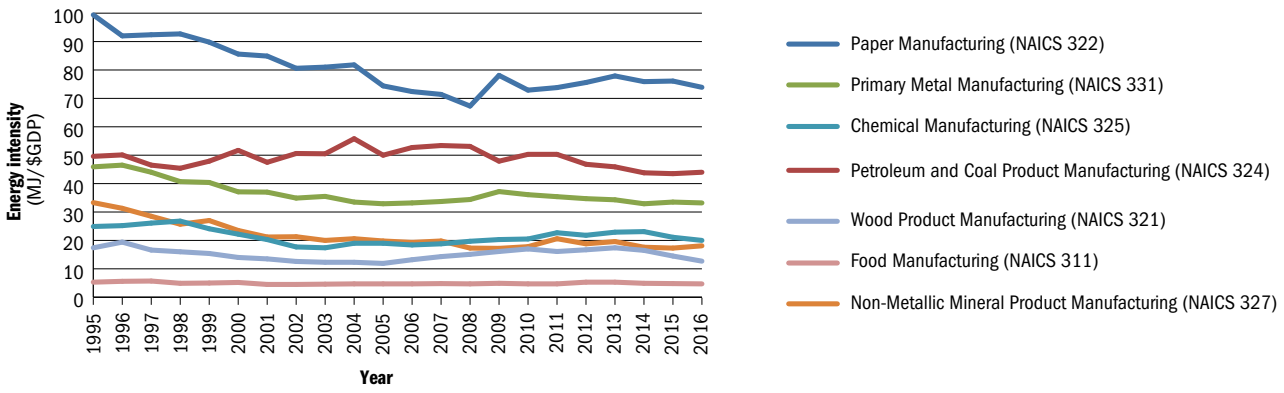
	Change in energy consumption (%)	Change in GDP (%)	Change in energy intensity (%)
Total Manufacturing	**-16.0**	**20.4**	**-30.2**
Paper	-41.6	-21.5	-25.7
Primary Metal	-6.4	29.3	-27.6
Chemical	5.4	31.5	-19.8
Petroleum and Coal Product	0.1	13.0	-11.4
Wood Product	16.4	59.5	-27.0
Food	32.8	47.4	-9.9
Non-Metallic Mineral Product	-15.7	54.9	-45.5

Fortress Cellulose plans to eliminate fossil fuels – Paper (322)

Fortress Cellulose has an ambitious goal to stop using fossil fuels in its mill. The energy team at the mill in Thurso, Quebec, has already implemented many measures and is planning others. Objectives for 2016 included saving 7 million litres of fuel oil and eliminating one boiler that delivered 40 tonnes of steam per hour. Such energy savings also reduced annual GHG emissions by 5 to 10 percent. The company's recent installation of a cogeneration facility was a big step toward reaching its objectives. The facility now produces 5.2 megawatts (MW) of incremental power, allowing the mill to deliver up to 24 MW to Hydro–Québec at any time.

Figure 3 shows that the **seven selected subsectors experienced a decrease in energy intensity** from 1995 to 2016, but **significant decreases** were shown for **Non-Metallic Mineral Product** Manufacturing (-45.5 percent), **Primary Metal** Manufacturing (-27.6 percent), **Wood Product** Manufacturing (-27.0 percent) and **Paper** Manufacturing (-25.7 percent).

Figure 3. Energy intensity of the seven selected subsectors, 1995–2016

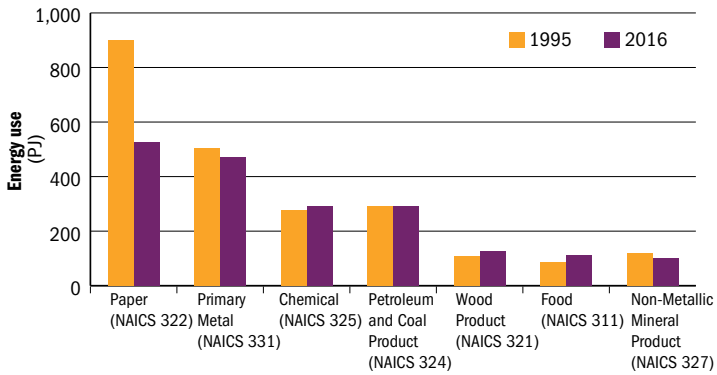


Energy consumption has varied by subsector

For example, some of the biggest changes in energy consumption levels occurred in subsectors that have large fluctuations in outputs:

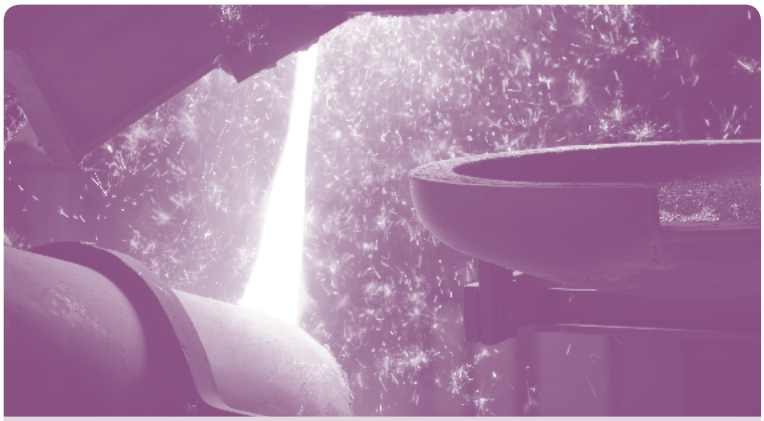
- Energy consumption in Paper Manufacturing decreased **41.6 percent** from 1995 to 2016 (GDP fell **21.5 percent**)
- Food Manufacturing consumed **32.8 percent** more energy in 2016 compared to 1995 (GDP increased **47.4 percent**).

Figure 4. Energy consumption of the seven selected Manufacturing subsectors, 1995 and 2016



Contempra offers an energy-efficient alternative to Portland Cement – Cement (327310)

Contempra is a new cement compound that requires 10 percent less carbon dioxide (CO_2) to produce than regular Portland Cement. Yet Contempra produces concrete of comparable strength and durability. Contempra is becoming the preferred standard in the construction industry and is now allowed in sulphate-exposure environments. Once Contempra is used for all suitable applications, it is estimated that CO_2 emissions could be reduced by 900,000 tonnes annually. Contempra is relatively new in Canada but has a proven track record in Europe, where it has been used in residential and commercial applications for 35 years.



A modern smelter in Kitimat – Aluminum (331313)

After a multi-billion-dollar modernization project, Rio Tinto's aluminum smelter in Kitimat, British Columbia, is now one of the most efficient and cost-effective smelters in the world. The project increased the smelter's production capacity by nearly 50 percent to 420,000 tonnes annually while reducing overall GHG emissions by half. Key to the project is the company's state-of-the-art Aluminium Pechiney Prebake (AP-40) technology, the cleanest technology available for the aluminum reduction process. The AP-40 technology uses 13,150 kWh/tonne of ore, which is a 33 percent reduction in energy consumption per tonne of aluminum compared to the outgoing technology.

Fuel mix has evolved

Fuel mix has also evolved since the 2008–2009 recession with **natural gas** representing **32 percent** of energy use, up from **27 percent** in 2009, while **electricity** use has remained constant during that period (30 percent share). The price of natural gas fell from 33.5¢ per cubic metre (¢/m^3) in 2008 to 16.1¢ m^3 in 2016, while industrial electricity prices, on a national basis, were more stable.

Significant **reductions** were evident in the consumption of many energy sources from 1995 to 2016, in particular **heavy fuel oil**, **propane** and **spent pulping liquor**, whereas the use of **steam increased** substantially since 1995.

Table 2. Manufacturing sector's energy use by energy source, 1995 and 2016

Energy source	1995 energy (PJ)	2016 energy (PJ)	Growth, 1995–2016 (%)
Natural gas	**777.8**	**675.4**	**-13.2**
Electricity	**624.7**	**620.9**	**-0.6**
Coal	41.3	35.8	-13.2
Coke	102.9	80.0	-22.3
Coke oven gas	27.4	20.0	-27.0
Petroleum coke and coke from catalytic cracking catalyst	64.6	70.3	8.8
Total, coal/coke	**236.2**	**206.1**	**-12.7**
Heavy fuel oil	139.8	20.4	-85.4
Middle distillates	17.2	16.3	-5.3
Propane	12.3	6.9	-43.8
Refinery fuel gas	127.6	135.3	6.0
Butane	..	4.1	N/A
Total, RPP* (incl. natural gas liquids)	**296.9**	**182.9**	**-38.4**
Spent pulping liquor	**343.6**	**200.4**	**-41.7**
Steam	**33.5**	**46.7**	**39.4**
Wood	**178.9**	**160.6**	**-10.3**
Total	**2,491.7**	**2,092.9**	**-16.0**

Note: Because of rounding, the numbers in the table may not add up.
.. stands for not available
N/A stands for not applicable
*RPP = refined petroleum products

For a full breakdown of energy use, GDP and energy intensity for the sector and selected subsectors, see the OEE website at oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/ice/2016/tables.cfm.

For more information on this report or on the OEE's services, contact:

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Did you know?

Since the adoption of the **ISO 50001 Energy Management Systems** standard in Canada in 2011, significant energy and cost savings of **up to $10 million annually** per facility have been achieved by large Canadian industrial facilities.

The **Canadian Industry Partnership for Energy Conservation** (CIPEC) supports a network of over 2,400 facilities and more than 50 trade associations that work together to cut costs, improve energy efficiency and reduce industrial greenhouse gas (GHG) emissions.

To encourage and support industry's energy efficiency efforts, NRCan offers tools and services to Canadian industry through CIPEC. These include Dollars to $ense energy management workshops through the Canadian Institute for Energy Training, benchmarking reports, best practice guides and cost-shared assistance.

For more information on ISO 50001 and CIPEC, see nrcan.gc.ca/energy/efficiency/industry/cipec/20341.

Elkem's Si 2020 project produces solid results – Foundry (3315)

Elkem is working systematically to make its smelting process more energy-efficient through a research and development project called Si 2020. The project aims to improve the entire production process for silicon and ferrosilicon – from the choice and supply of raw materials to casting metal and finishing the silicon product. Elkem's facility in Chicoutimi, Quebec, is using a method that uses excess heat to produce electricity to supply up to 220 gigawatt hours (GWh) of steam per year to Rio Tinto's aluminum plant next door. This results in a recovery rate of 70 to 85 percent of the supplied electrical energy for Elkem Chicoutimi. At all its plants, Elkem is introducing energy management practices that map the potential for saving energy and investing in new solutions to realize those improvements. In fact, it has already implemented measures that have recovered roughly 600 GWh per year.

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