Natural Resources Canada
Ressources naturelles Canada

INDUSTRIAL CONSUMPTION OF ENERGY SURVEY

Statistical Report of Energy Use in the Canadian Manufacturing Sector, 2000–2019

The Office of Energy Efficiency (OEE) at Natural Resources Canada (NRCan) changed the base year of the National Energy Use Database (NEUD) from 1990 to 2000, beginning with the release of 2018 data. This rebasing is to ensure that NEUD reflects developments in trends and structures of Canada's energy end use and efficiency data across sectors. It also synchronizes Canada's energy use data reporting with changes recently made by the International Energy Agency. Although new estimates for years before 2000 are no longer available, data with the new base year are expected to be of better use. The new data will service the development, implementation and monitoring of government policies, programs and projects; evidence-based decision making; industrial and market analysis and projection; and energy use literacy, education and stakeholder engagement.

Statistics Canada annually conducts the Industrial Consumption of Energy (ICE) survey (co-sponsored by the OEE of NRCan and Environment and Climate Change Canada). The survey collects energy use data from establishments in Canada's Manufacturing sector. The survey is an essential tool for monitoring the evolution of energy consumption by manufacturing industries. It 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 2019 ICE survey. The estimates are based on the North American Industry Classification System (NAICS) and include all 21 subsectors (three-digit code) of the Manufacturing sector (NAICS 31 to 33).

Key Facts

- Energy intensity continued to decline in the manufacturing sector in 2019; 11 percent below its 2009 peak. The change is mostly the result of changing to less energy-intensive industries and efficiency improvements.
- Three quarters of total manufacturing energy use is by five subsectors: paper, wood, food, non-metallic mineral product, and petroleum and coal product.
- The fuel mix in manufacturing is evolving – natural gas is accounting for an increasing share of total energy consumption, and electricity use is stable.
- Significant reductions were evident in the consumption of many energy sources in the Manufacturing sector. Most notably the usage of heavy fuel oil decreased by 90 percent from 2000 to 2019.

Canada

Manufacturing continued to reduce energy intensity in 2019

After a brief pause during the 2008–2009 recession, manufacturing **energy intensity** has **continued to decline**.

In 2019, it was about **11.0 percent below the pre-recession peak of 2009**. Longer term, energy intensity declined 8.5 percent from 2000 to 2019.[1] These figures represent an absolute drop in the sector's energy use of about **405.6 petajoules** (PJ), which is roughly equivalent to the amount of energy consumed by cars in Quebec, Manitoba and Prince Edward Island in 2019.[2]

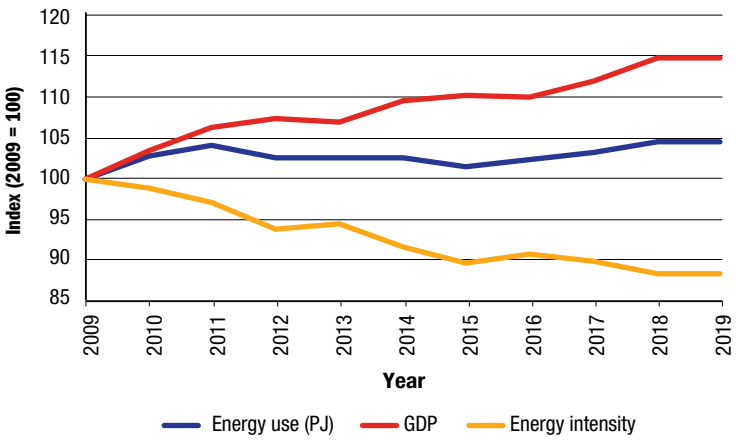
Over the 2000–2019 period, activity in the Manufacturing sector[3] shifted. The shift was from Paper Manufacturing, the subsector with the **highest rate of energy use per unit of gross domestic product** (GDP), toward **less energy-intensive industries** (such as Chemical and Food Manufacturing). This change in manufacturing activity, combined with efficiency improvement in other energy-intensive subsectors, resulted in an **overall reduction in energy intensity of the Manufacturing sector** from **12 megajoules per dollar of GDP (MJ/$GDP) in 2000 to 11 MJ/$GDP in 2019**.

In 2019, the Manufacturing sector generated **$199 billion in GDP** (constant 2012 dollars) and consumed **2,191 PJ** of energy. This amount is roughly equal to twice the consumption of motor gasoline in passenger transportation in 2019. (Table 2, CEUD)

The improvement in the energy intensity trend 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 1 indicates that **output of the Manufacturing sector has outpaced energy use,** resulting in continued **improvement in energy intensity**.

An important contributor to this improvement is the Canadian Industry Partnership for Energy Conservation (CIPEC). CIPEC supports a network of almost 2,400 facilities and more than 50 trade associations working together to **reduce costs, improve energy efficiency and reduce industrial greenhouse gas (GHG) emissions**. To encourage and support industry's energy efficiency efforts, NRCan offers Canadian industry **tools and services** through CIPEC. These include benchmarking reports, best practice guides and cost-shared assistance.

Figure 1. Indexed growth of energy use, GDP and energy intensity for the Manufacturing sector, 2009–2019



[1] GDP figures are reported in constant 2012 prices.

[2] Natural Resources Canada, Comprehensive Energy Use Database, 2000-2019, Transportation Sector, Canada, Table 10

[3] Although there are 21 subsectors within the Manufacturing sector, seven subsectors accounted for 92 percent of all energy consumption in the sector in 2019, of which Paper Manufacturing, Primary Metal Manufacturing, Petroleum Refining and Chemical Manufacturing combined accounted for about three quarters of all energy consumed in the Manufacturing sector.

Alcoa Aluminerie de Deschambault LP **became the first aluminum smelter in Canada to be certified ISO 50001: 2018 for energy management. Several reduction projects that have already been implemented have reduced natural gas consumption by more than 1,000 Mt CO_2 eq.**

The ISO 50001: 2018 standard commits Alcoa to reduce its impact on the climate, conserve energy resources and improve its results through the efficient management of all forms of energy. This certification was issued by the Bureau de normalisation du Quebec (BNQ).

The support of two major partners was essential to this project. The natural gas distribution company Energir contributed through its Energy audit and implementation program with the energy management system component, and NRCan contributed through the Financial assistance for industrial energy management projects program. The plant already distinguished itself in 1997 by being the first aluminum producer in Canada to be certified to the ISO 14001:2015 standard for its environmental management. Several reduction projects have been implemented at the Deschambault plant, including the installation of a solar wall that resulted in significant energy savings. This project has reduced natural gas consumption by more than **1,000 Mt CO_2 eq**.

Table 1 demonstrates that **five of the seven most energy-consuming subsectors reported a decline in energy use** in 2019 compared to 2000, with the **most significant** decline being in **Paper Manufacturing** (34.2 percent). However, Paper Manufacturing's energy intensity still rose by 12 percent over that period, because its GDP declined by more than its reduction in energy use.

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 helps an industry reduce its demand for energy. Examples are **waste energy recovery and re-use** and **cogeneration** in the Paper Manufacturing subsector.

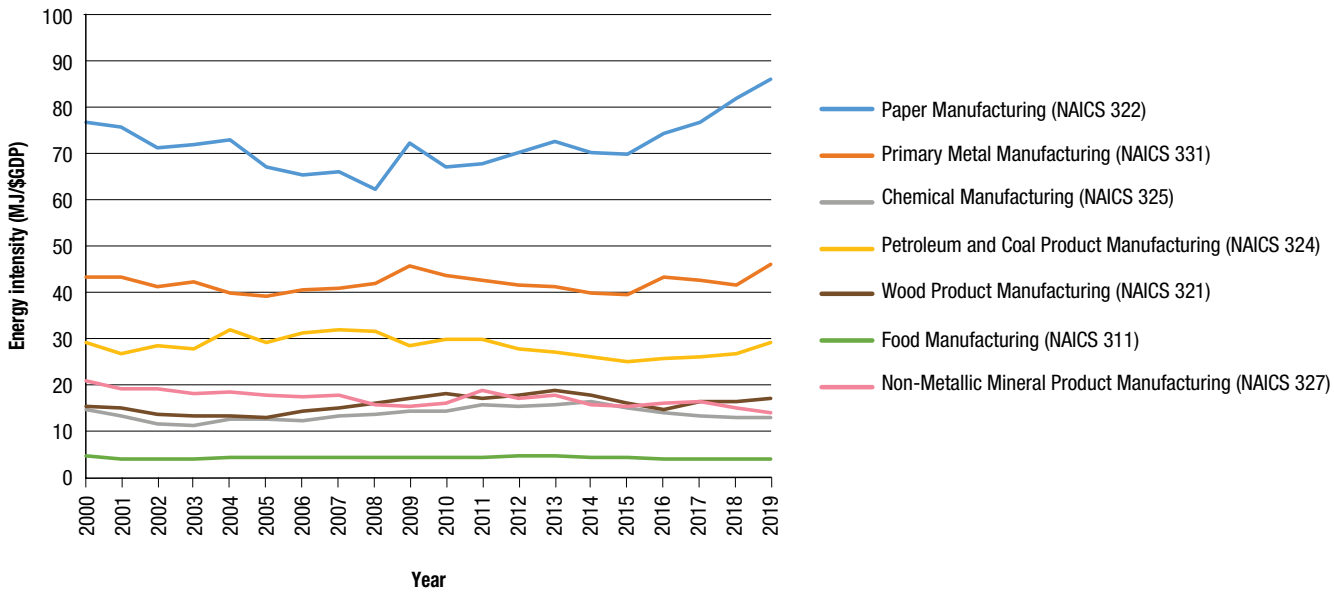
Table 1. Comparison of energy use, GDP and energy intensity of the Manufacturing sector and selected subsectors, 2000–2019

Sector and subsectors	Change in energy consumption (%)	Change in GDP* (%)	Change in energy intensity (%)
Total Manufacturing	-15.6	-7.8	-8.5
Paper	-34.2	-41.3	12.0
Primary Metal	-5.3	-10.8	6.2
Chemical	-8.3	5.0	-12.7
Petroleum and Coal Product	-4.6	-5.2	0.6
Wood Product	7.9	-1.7	9.8
Food	14.7	34.4	-14.6
Non-Metallic Mineral Product	-17.5	22.3	-32.5

*Note: GDP figures are reported in constant 2012 prices.

Figure 2 shows that **three of the seven** most energy consuming subsectors **experienced a decrease in energy intensity** from 2000 to 2019. **Significant decreases** occurred for **Non-Metallic Mineral Product** Manufacturing (-32.5 percent), **Food** Manufacturing (-14.6 percent) and **Chemical** Manufacturing (-12.7 percent).

Figure 2. Energy intensity of the seven selected subsectors, 2000–2019

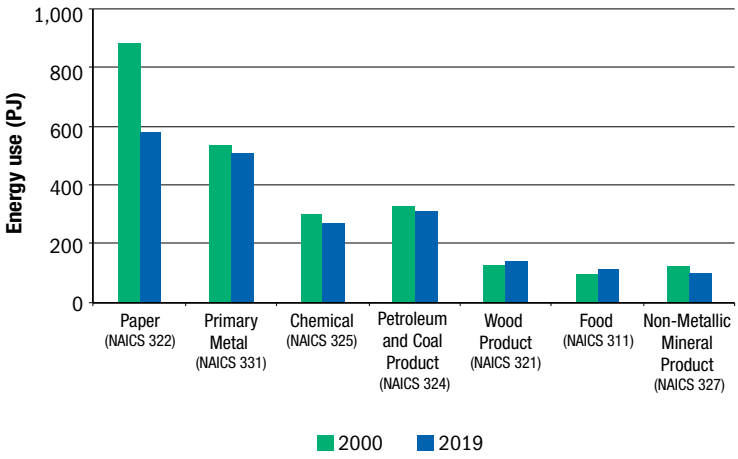


Energy consumption has varied by subsector

Some of the biggest changes in energy consumption levels occurred in subsectors that had large fluctuations in outputs, including:

- Energy consumption in Paper Manufacturing decreased **34.2 percent** from 2000 to 2019 (GDP also fell **41.3 percent**).
- Food Manufacturing consumed **14.7 percent** more energy in 2019 compared to 2000 (GDP increased **34.4 percent**).

Figure 3. Energy consumption of the seven selected Manufacturing subsectors, 2000 and 2019



CNH Industrial **achieved ISO 50001 certification for all of its North American sites in 2015 under the ISO 50001 multi-site program. The Building Automation System (BAS) at the Saskatoon plant has reduced annual electricity consumption by 6,500 GJ, annual natural gas consumption by 12,640 GJ and annual CO_2 emissions by 2,030 tonnes.**

CNH Industrial Canada Ltd. is in Saskatoon, Saskatchewan, and is part of the Agriculture, Construction and Mining Machinery Manufacturing Industry. Installing the BAS has contributed significantly to the plant's energy efficiency performance. Annual savings from projects that use the BAS are forecasted to be about $31,300. CNH Industrial's Saskatoon plant received the **2018 Process Integration award** at the 2018 Energy Summit for its continued work to improve its energy efficiency performance.

Fuel mix has evolved

The fuel mix used by the Manufacturing sector has changed since the 2008–2009 recession. **Natural gas represented 31.3 percent** of energy use in 2019, up from **27 percent** in 2009, while **electricity** use has remained constant during that period (29 percent share).

The price of natural gas fell from 33.4¢ per cubic metre (¢/m^3) in 2008 to 10¢/m^3 in 2019 while industrial electricity prices, on a national basis, increased 28 percent from 7.1¢/kWh in 2008 to 9.1¢/kWh in 2019. Increased use of natural gas could be attributed to industries looking to reduce their carbon emissions because natural gas is a cleaner burning fossil fuel. Lower natural gas prices could also be a contributing factor to the increased use of this energy source.

Significant **reductions** were evident in the consumption of many energy sources from 2000 to 2019. In particular, use of **heavy fuel oil, propane, middle distillates, coal, coke, and spent pulping liquor** was reduced whereas **steam use increased** substantially as surplus steam produced during power generation and industrial processes was being recovered.

Table 2. Manufacturing sector's energy use by energy source, 2000 and 2019

Energy source	2000 energy (PJ)	2019 energy (PJ)	Growth, 2000–2019 (%)
Natural gas	782.8	685.9	-12.4
Electricity	690.2	636.7	-7.8
Coal	49.1	36.6	-25.3
Coke	103.4	77.9	-24.7
Coke oven gas	27.1	22.1	-18.4
Petroleum coke and coke from catalytic cracking catalyst	68.4	76.5	11.7
Heavy fuel oil	139.2	13.6	-90.2
Middle distillates	24.9	16.5	-33.9
Propane	13.2	10.3	-22.5
Refinery fuel gas	151.4	142.9	-5.6
Butane	..	1.4	N/A
Spent pulping liquor	319.7	241.7	-24.4
Steam	37.4	46.1	23.2
Wood	190.2	183.4	-3.6
Total	2,597.0	2,191.5	-15.6

Notes:
.. stands for not available for a specific reference period.
N/A stands for not applicable.

Most notably the use of heavy fuel oil in the Manufacturing sector decreased by **90 percent**. According to Statistics Canada, heavy fuel oil is second only to coal as a carbon-intensive fuel, and consequently has been the target of environmental restrictions on emissions. The decline can thus be attributed to manufacturers substituting other energy sources, as well as the reduced use of energy overall by users of heavy fuel oil. The paper manufacturing subsector has experienced the largest reduction in the use of heavy fuel oil, by **93 percent from 2000 to 2019**.

New Gold Mines Inc. used ISO 50001 to reduce energy costs by 10 percent for the gold and copper mining company.

New Gold Mines Inc. is a gold, silver and copper mining company, with two core locations in Rainy River, a gold-silver mine in Ontario, and New Afton, a gold-copper mine in British Columbia. Energy at a mining company is typically its second biggest expense after labour. The implementation of ISO 50001 allowed the company to reduce its energy costs significantly. Energy performance improvement measures give them an **energy savings equivalent to more than 10 percent of total energy consumption**. That energy savings is enough to provide over 3,100 homes with energy for an entire year, and therefore has led to reductions in both costs and GHG emissions. New Gold Mines Inc. has also received several awards from NRCan for energy performance improvement.

For a full breakdown of energy use, GDP and energy intensity for the Manufacturing sector and selected subsectors, see the OEE Web site at oee.nrcanrncan.gc.ca/corporate/statistics/neud/dpa/menus/ice/2019/tables.cfm.

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

Office of Energy Efficiency
Natural Resources Canada
580 Booth Street
Ottawa ON K1A 0E4
Email: statistics_and_analysis-statistiques_et_analyses@nrcan-rncan.gc.ca
Web site: natural-resources.canada.ca/energy-efficiency

Cat. No. M141-24E-PDF (Online)
ISSN 2371-5820

Aussi disponible en français sous le titre: Enquête sur la consommation industrielle de l'énergie – Rapport statistique sur l'utilisation de l'énergie dans le secteur manufacturier canadien, 2000–2019.