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Surface freshwater use in Canada's manufacturing industry, 2017

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Surface freshwater use in Canada's manufacturing industry, 2017

Without water, many companies and the products that they provide would fail to exist. Water is a fundamental commodity for nearly every step of manufacturing and production processes around the world.

In manufacturing industries, water is necessary for various uses, such as cooling, condensing and steam, and sanitary service or domestic use. Sometimes, water needs treatment to meet strict quality specifications to be of use in specific industrial processes. In addition to consuming vast quantities of freshwater for manufacturing, industries also produce wastewater, often laced with waste by-products created during industrial processes. This water may also need treatment before being discharged.

The main source of intake water for all manufacturing industries was surface freshwater. The three industries that accounted for the majority of this water intake were primary metal, petroleum and coal product, and paper manufacturing. Surface freshwater can require intake treatment prior to use, as well as treatment prior to discharge back into the environment. Treatment depends on the use of the water, as well as the process methods.

More than three-quarters of manufacturing industry water intake is from a surface freshwater source

The two main sources of intake water are freshwater and saline or brackish water. Freshwater can come from a public utility system, a self-supplied surface water system or a self-supplied groundwater system. Saline or brackish water can come from a self-supplied groundwater system or a self-supplied tide or salt water body (please see Statistics Canada definitions below).

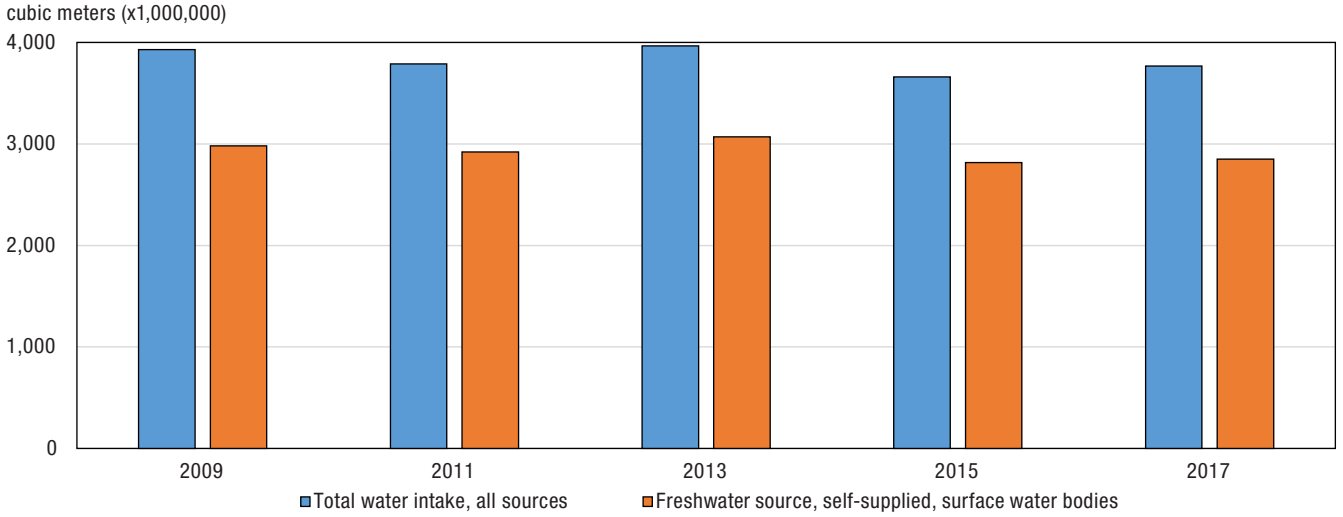
Canada is known for its abundance of freshwater. In fact, the area of freshwater in Canada, which includes surface water and ground water, is 1.2 million square kilometres, accounting for 11.7% of the country's total area.[1] When only surface water is taken into account, nearly 9% of the total area of Canada is covered by freshwater, including lakes, rivers and glaciers. Also, there are 31,752 lakes in Canada that are greater than 3 square kilometres in size[2] and 563 lakes that have a surface area larger than 100 square kilometres. This is more than any other country.[3]

The manufacturing industry, like other industries, is impacted by climate change. Climate change is expected to result in shifts in the location and timing of rain and snow across Canada. The intensity and frequency of floods are projected to increase. Drought is expected to increase in areas that are prone to receiving less snow and rain, such as the Prairies. Higher temperatures associated with climate change are already causing glaciers to recede, and this will also result in long-term changes to the amount of water flowing in some major Prairie rivers.[4]

On the manufacturing level, from 2009 to 2017, more than three-quarters (77%) of the manufacturing sector's water intake was from a surface freshwater source (see Chart 1).

1. Statistics Canada; Government of Canada. (2017, September 28). World Water Day… by the numbers. Statistics Canada. https://www.statcan.gc.ca/en/dai/smr08/2017/smr08_215_2017. Accessed May 26, 2022.
2. World Atlas. (2019, June 3) The Largest Lakes In Canada. World Atlas. https://www.worldatlas.com/articles/which-are-the-largest-lakes-in-canada.html. Accessed May 26, 2022.
3. Government of Canada. (2013, September 9) Water sources: lakes. Government of Canada. https://www.canada.ca/en/environment-climate-change/services/water-overview/sources/lakes.html. Accessed May 26, 2022.
4. Government of Canada. (2022, May 2) Changes to water quantity: drivers and impacts. Government of Canada. https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/changes-water-quantity-drivers-impacts.html. Accessed May 26, 2022.

Chart 1
Total water intake versus freshwater intake for the manufacturing sector, 2009-2017



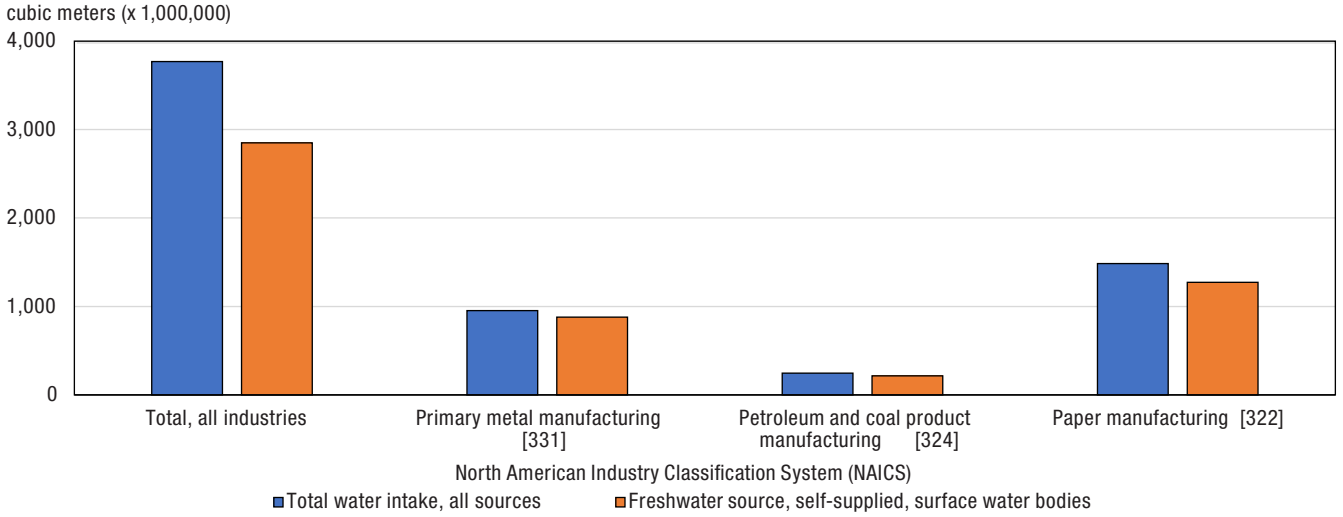
Source: Statistics Canada, Industrial Water Survey, 2009-2017. Table 38-10-0040-01.

More than four-fifths of the manufacturing sector's total surface freshwater intake was from three main industries

In 2017, 71% (2.7 billion m^3) of the manufacturing sector's total water intake from all sources (3.8 billion m^3) was attributable to the paper manufacturing, petroleum and coal product manufacturing, and primary metal manufacturing industries. However, given that over 11% of Canada's total area is covered by freshwater, it is not surprising that the main source of water intake within the manufacturing sector was from a surface freshwater source. These three manufacturing industries together accounted for 83% (2.4 billion m^3) of the manufacturing sector's surface freshwater intake (2.9 billion m^3) in 2017.

The total water intake from all sources for primary metal manufacturing was 954 million m^3, of which 92% (880 million m^3) was from a surface freshwater source. In petroleum and coal product manufacturing, surface freshwater accounted for 87% (216 million m^3) of the total water intake from all sources (247 million m^3). The proportion of surface freshwater to total intake (1.5 billion m^3) within the paper manufacturing industry was 86% (1.3 billion m^3) (see Chart 2).

Chart 2
Surface freshwater intake, 2017



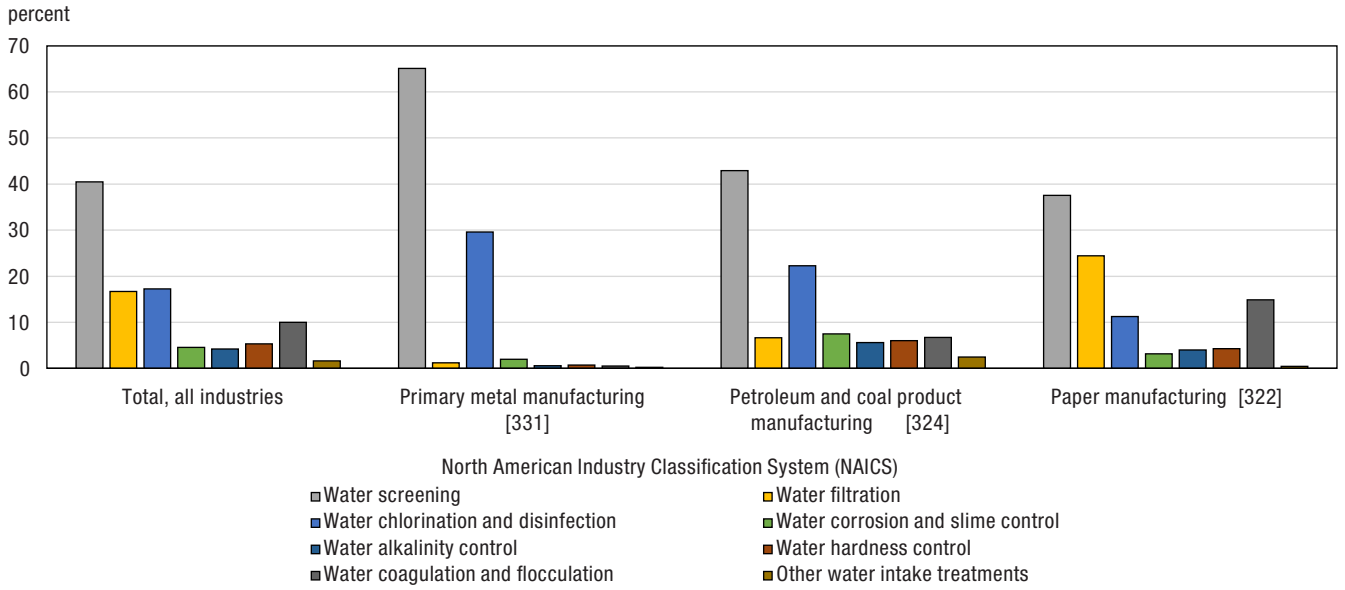
Source: Statistics Canada, Industrial Water Survey, 2017. Table 38-10-0040-01.

Almost half of all manufacturing industries' water intake treatment was the process of water screening

The main method of treatment for intake water in all manufacturing industries in 2017 was water screening. This was the case in the primary metal manufacturing (65%), petroleum and coal manufacturing (43%), and paper manufacturing (38%) industries in particular (see Chart 3). Water screening is the process of passing the intake water through different-sized screens to trap and remove suspended material from the water. Screening is typically the first step in the treatment process. The next step that is commonly used is water filtration. This involves using a series of filters with progressively smaller holes to remove sediment. Water chlorination is another method used in the manufacturing sector. This method is used to kill certain bacteria and microbes in the water.

Also of interest is the considerable variation in water treatments used depending on the industry. These differences reflect the unique production methods in each industry, as well as the different levels of water quality that are required.

Chart 3
Types of water intake treatment (%), 2017



Source: Statistics Canada, Industrial Water Survey, 2017. Table 38-10-0055-01.

Manufacturing industry discharge water treatment

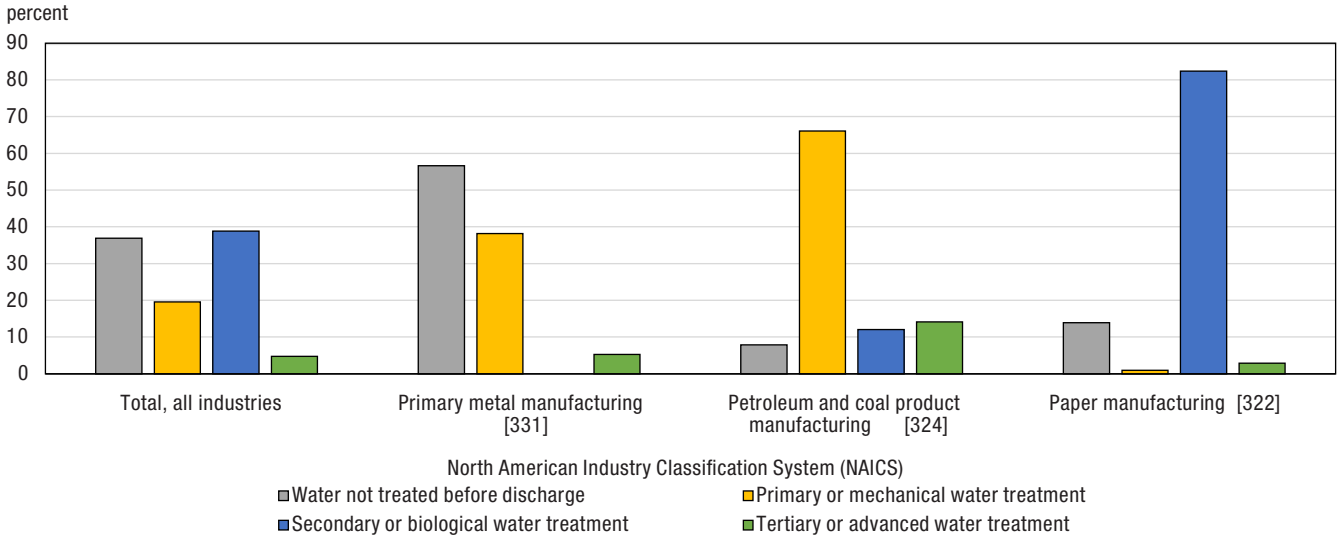
When water is discharged out of a manufacturing facility, various treatments can be applied to the wastewater. These include primary or mechanical, secondary or biological, and tertiary or advanced water treatment. Some industries do not treat their wastewater at all before discharge.

Primary wastewater treatment uses simple mechanical and physical processes to remove solid contaminants from wastewater. Primary treatment consists of methods like coarse screening, grit removal, communicator, flow equalization and primary sedimentation tanks. Secondary wastewater treatment is a process that uses microorganisms to biologically remove contaminants from wastewater. Less commonly used is tertiary or advanced water treatment. This process removes the load of nitrogen and phosphorus present in the water that was not removed in the secondary treatment process.

In 2017, the types of discharge water treatment for all manufacturing industries were split between secondary or biological treatment (39%) and no treatment at all (37%). The majority (82%) of the paper manufacturing industry's discharge water underwent secondary or biological treatment in 2017. Primary or mechanical treatment was the main method (66%) in the petroleum and coal product manufacturing industry, whereas the majority (57%) of the primary metal manufacturing industry discharge water was not treated at all in 2017 (see Chart 4). These results illustrate that there were no similarities between types of discharge treatment for each industry. Each industry had a different main discharge water treatment based on needs, processes and technologies, as well as environmental regulations such as Wastewater Systems Effluent Regulations (SOR/2012-139) that were written under the authority of the federal *Fisheries Act*. These regulations apply to wastewater systems if the average daily collection of influent has a volume of 100 m^3 or more and the effluent is deposited into water frequented by fish or into a place that may enter water frequented by fish. The effluent must meet specific quality standards and may also require monitoring and reporting depending on specific criteria outlined in the Wastewater Systems Effluent Regulations.[5]

5. Government of Canada. (2020, March 10) Factsheet: regulatory requirements for small wastewater systems. Government of Canada. https://www.canada.ca/en/environment-climate-change/services/wastewater/system-effluent-regulations-reporting/overview/factsheet-regulations-owners-operators.html. Accessed May 27, 2022.

Chart 4
Water discharge treatment (%), 2017



Source: Statistics Canada, Industrial Water Survey, 2017. Table 38-10-0060-01.

The revenue from paper, petroleum and coal product, and primary metal manufacturing accounted for 21% ($147 billion) of manufacturing sector revenue in 2017 ($698 billion).[6]

Pulp and paper manufacturing is an important industry and is especially concentrated in Ontario and Quebec. It also plays a significant role in many other provinces. The petroleum and coal products industry is also important in Canada. Comprised mostly of refineries, revenues in the industry amounted to $66 billion in 2017, an amount that was 9% of total manufacturing revenue.[6] The primary metals industry continues to be an important contributor to the Canadian economy. It employs thousands of people directly and, in turn, supplies iron and steel products to many other key manufacturing industries, primarily in Canada and the United States. These three industries are key players in Canadian manufacturing and require most of the surface freshwater intake.

6. Statistics Canada: Government of Canada. (2022, May 27) Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS) (x 1,000). Statistics Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011701. Accessed May 27, 2022.

Statistics Canada definitions

Intake water types and sources

Freshwater contains an average of 900 parts per million or less of total dissolved solids. Possible sources are:

- public utility (i.e., municipal or city system of draining, treating and distributing water)
- self-supplied surface water system (e.g., lakes, rivers)
- self-supplied groundwater system (e.g., wells, springs)
- other freshwater sources (e.g., delivery of water from a private supplier, an adjacent industry, rain water, run-off water).
  This excludes bottled water intended for personal consumption.

Saline or brackish water contains an average of 900 parts per million or more of total dissolved solids. Possible sources are:

- self-supplied groundwater system (e.g., wells, springs)
- self-supplied tide or salt water body (e.g., estuaries, bays, oceans)
- other saline or brackish water sources (e.g., delivery of water from a private supplier, an adjacent industry).

Note to readers

The Industrial Water Survey was conducted under the umbrella of the Canadian Environmental Sustainability Indicators project, a joint initiative of Statistics Canada, Environment Canada and Health Canada. The survey gathered information on the intake and discharge of water by three groups of industries: manufacturing, mining and thermal-electric generating industries. It collected information on sources of water, purposes for which the water was used, whether water was recirculated or re-used, where the water was discharged and what treatments were used. It also collected information on water acquisition costs, treatment costs and operating and maintenance expenses related to water intake and discharge.