

Water Usage in Canada

Introduction

Water needed for domestic purposes is likely the first use that comes to mind, but the industrial and agricultural sectors are the heaviest users of water in Canada. Water is essential to the productivity of the Canadian economy. In 2005, for example, over 90% of all the water withdrawn in Canada was used to support economic activity (Statistics Canada 2010b). Water is also a critical determinant of future growth. A plentiful supply of quality water facilitates business development and population growth. On the other hand, water shortages can result in the relocation of water-dependent businesses (Maxwell 2010).

Types of Water Use

Viewed broadly, water is typically used in one of two ways. First is in-stream water use. In-stream use does not involve removing water from a water source. Examples of in-stream use are hydroelectric power generation, transportation, fisheries and recreational activities (Environment Canada 2006). While in-stream use does not remove water, some of these uses do involve diverting water. Second is water withdrawal. Here, water is actually withdrawn from a water source. Examples of water withdrawals are removing water for industrial cooling, commercial food processing and household use. Withdrawals can be made from surface or groundwater sources.

When it comes to withdrawals of water, it is important to make a number of clear distinctions between water intake/withdrawal, water discharge/return flow, water consumption and gross water use.

→ **Water withdrawal or water intake:** This is the total amount of water that is withdrawn or taken from a water source. Water withdrawal is not the same as water consumption as water that is withdrawn may eventually be returned to the source.

→ **Water discharge or return flow:** This is water that has been withdrawn from a water source, used for human or economic purposes, and then returned to the source at approximately the same location from which the withdrawal was originally made.

→ **Water consumption:** This is the difference between water withdrawal and water discharge. Consumption is the actual amount of water that is not returned to the source from which it was removed or it is ultimately returned at a much different place from where it was withdrawn. Generally, water that is consumed is viewed as unavailable for further use. In 2006, nearly one third of all water withdrawn in Canada was consumed (Environment Canada 2010).

→ **Gross water use:** This is the total amount of water that is used in a process. Gross water use differs from water intake as gross water use includes water that has been recycled or re-circulated.

Water Use by Sector

Water use is typically divided among five sectors: 1) thermal power generation; 2) manufacturing and processing; 3) municipalities; 4) agriculture; and 5) mining, forestry, petroleum production and other primary resource development and extraction.

The single largest use of water in Canada—60% of all water withdrawals—is thermal power generation (Figure 1). Manufacturing and processing is the second largest withdrawer of water at about 20%.

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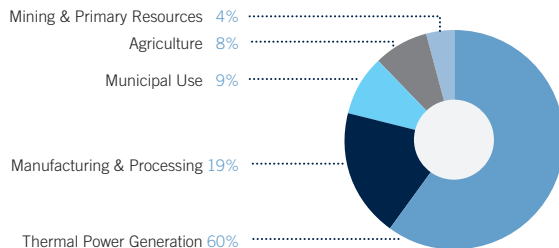
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FIGURE 1: Water Withdrawals in Canada by Sector, 2005



Source: Derived by Canada West Foundation from *A Primer on Fresh Water: Questions and Answers*, 2006. Environment Canada.

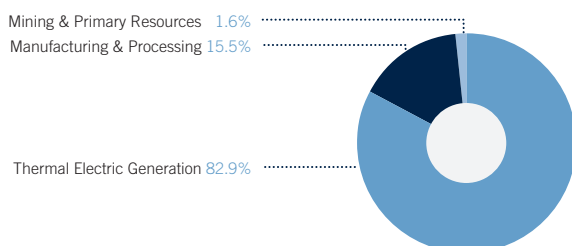
Industrial Water Use

Thermal power generation, manufacturing and processing, mining and other resource development are often grouped together under the heading “industrial” water use. Water is used as a raw material, as a coolant, as a solvent, as a transport agent for various substances required in manufacturing and even as a source of energy (Environment Canada 2010).

In Canada, the productivity value of water is generally seen as being quite high. For example, industrial use of water can produce up to 70 times as much value from one litre of water than agriculture (The Economist 2010).

While the industrial sector is the primary user of water in Canada, this sector does not consume the majority of water withdrawn. In 2007, the total amount of water used by industry—for thermal electric generation, manufacturing and processing and mining and resource development—was 33.6 billion m³. Of this amount, about 32.8 billion m³ was discharged. Thus, almost 98% of all the water withdrawn was ultimately returned. Within industry, the heaviest user of water is thermal electric generation followed by manufacturing (Figure 2).

FIGURE 2: Industrial Water Withdrawals in Canada, 2007



Source: Derived by Canada West Foundation from the *Industrial Water Survey*, 2007. Statistics Canada.

Industry is very unique in its water use when compared to other sectors. The majority of water taken by industry is recycled or re-circulated numerous times throughout the production process. The ability to recycle and re-circulate water is a hallmark of industrial water usage. While other sectors also have the ability to recycle water, they typically cannot achieve the same scale as industry. This ability to recycle and reuse water, however, does not mean that there is no potential for adverse environmental impacts. For example, water can be withdrawn at less than optimal times or during periods of low flow and there is the potential for pollution and contamination if discharged water is not appropriately treated before being returned. But even if the water discharged is very clean, environmental effects can still occur if the water is returned at a different place than where it was withdrawn or if it is returned at a different temperature.

→ **Thermal Electric Generation:** Fossil fuel and nuclear electric generation comprise the thermal electric generation sector. After fuel, water is the most important input used in large-scale power production. Large quantities of water are required to produce each kilowatt hour of electricity—140 litres of water for fossil fuel plants and 205 litres for nuclear power plants (Statistics Canada 2010a). The thermal electric generation sector accounted for over half of all water withdrawals in Canada in 2005, and for 80% of total industrial water use (Environment Canada 2010a). This high level of water usage can be partly attributed to the high water recirculation rates in power plants. This sector does face challenges with a particular type of water pollution. Thermal electric plants discharge water used for cooling at higher temperatures. Such “thermal” pollution occurs frequently in this sector.

→ **Manufacturing and Processing:** This activity is comprised of numerous sub-sectors such as construction, chemical production, metal refining, textiles, pulp and paper and food processing. While water in manufacturing is used in many different ways, one of the largest uses is to cool intermediate inputs and to produce steam (Renzetti 2005). The largest manufacturing and processing water users in 2007 were paper industries (38%) and primary metals industries (33%) (Statistics Canada 2010a). The importance of manufacturing to the Canadian economy has decreased slightly in recent years, resulting in a decline in total manufacturing water withdrawals. This decline is attributed to changes in the make-up of the manufacturing industry and the

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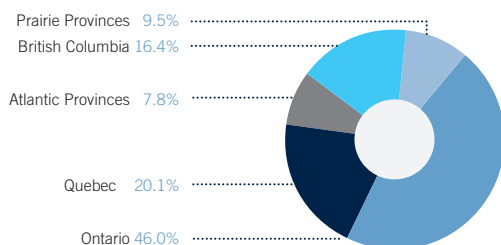
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implementation of more strict water quality regulations rather than any changes in provincial rate schemes for water withdrawals (Renzetti 2005). As can be expected, there are interprovincial differences in industrial water use. Ontario—the manufacturing heartland of Canada—is responsible for 46.0% of all industrial water use in the country (Figure 3). Running second is Quebec at 20.1%.

→ **Mining and Resource Development:** The mining industry includes coal, metal and non-metallic mineral mines. Water in mining is used primarily as a coolant, as a solvent to carry away unwanted materials and to separate ore from rock (McFarlane & Nilsen 2003). The mining sector also recycles and re-circulates its water, but is one of the smallest users of water in the Canadian economy.

FIGURE 3: Manufacturing Water Withdrawals by Province, 2007



Source: Derived by Canada West Foundation from the *Industrial Water Survey, 2007*. Statistics Canada.

Agricultural Water Use

An essential component of the nation's economy, the agricultural sector accounts for about 8% of total water withdrawals. The majority of water used in agriculture is for crop irrigation, with the remainder being used for livestock watering. Agriculture stands out from all other sectors because the majority of water that is used—up to 70%—is actually consumed and subsequently unavailable for further use.

→ **Irrigation in Canada:** Crop irrigation in Canada is most prominent in the semi-arid parts of the West, especially central and southeastern British Columbia, southern Alberta and southwest Saskatchewan. Here, irrigation is a regular and perennial feature of crop cultivation. In other parts of Canada, irrigation is generally used to offset the lack of soil moisture during the occasional dry period. Not only is irrigation essential to many Canadian crops such as cereals, oilseeds, alfalfa, sugar beets and potatoes, but it also results in higher crop yields and increased profitability (Poirier 2009). Water for irrigation comes from a variety of sources including underground aquifers and well water, diversions of on-farm surface water and various off-farm sources. In western Canada, there is an elaborate irrigation infrastructure system comprised of dams, reservoirs, canals and pipes that are owned and operated through farmer-elected Irrigation Districts.

FIGURE 4: Distribution of Irrigation by Province, 2007

Province	Number of Irrigation Farms		Water Used for Irrigation (000s of M ³)		Irrigated Land Area (Ha)	
	Number	Percentage	Number	Percentage	Number	Percentage
British Columbia	3,470	33.2%	172,483	11.5%	93,466	12.9%
Alberta	2,920	27.9%	1,098,982	73.1%	430,969	59.7%
Saskatchewan	695	6.6%	128,447	8.5%	87,831	12.2%
Manitoba	155	1.5%	29,572	2.0%	21,127	2.9%
Ontario	1,990	19.0%	61,869	4.1%	42,636	5.9%
Quebec	955	9.1%	7,988	0.5%	42,323	5.9%
Atlantic Provinces	280	2.7%	3,323	0.2%	3,544	0.5%
Total Canada	10,465	100.0%	1,502,664	100.0%	721,896	100.0%

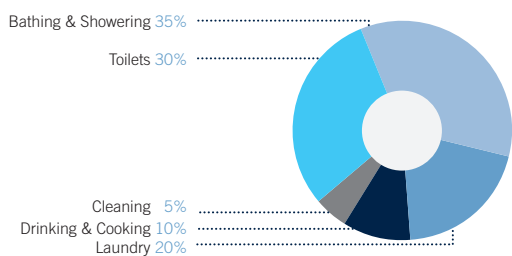
Source: Derived by Canada West Foundation from the *Agricultural Water Use Survey: Methodology Report, 2007*. Catalogue Number 16-001-M2009008. Statistics Canada.

→ **Alberta and British Columbia:** The vast majority of irrigation in Canada occurs in British Columbia and Alberta (Figure 4). Almost 75% of all irrigated agricultural land is contained in these two provinces and together they use almost 85% of the water withdrawn for irrigation nation-wide (Poirier 2009). British Columbia and Alberta contain over 60% of all the irrigated farms in Canada. All of this is a unique function of two intersecting factors. First, the BC interior and southern Alberta contain some of the most productive agricultural land in Canada combined with significant heat units. Second, while the soil and climate is cooperative, precipitation is not. Typically, the southern reaches of these provinces see less than half the precipitation needed. Other provinces such as Manitoba and Ontario receive far more precipitation than Alberta or the British Columbia interior and, in turn, have a less need for irrigation.

On a national scale, municipalities use about the same share of water as agriculture—9% for municipalities compared to 8% for agriculture. Municipalities provide water for a number of purposes including domestic and residential household use, institutions, commercial activities and large industrial uses. It is generally assumed in Canada that municipal water provision is about 50% for residential household purposes and 50% for all other purposes.

It is also generally conceded that Canadians use an enormous amount of water in the home. Canada is ranked second, after the United States, for the greatest domestic water consumption per capita in the developed world (Katz 2010). On average, Canadians use about 330 litres of fresh water for domestic purposes per day. Water for bathing and showering consumes the largest share of typical household use, followed by toilets, laundry, drinking/cooking and cleaning (Figure 5).

FIGURE 5: Water Use in the Typical Canadian Household



Source: Derived by Canada West Foundation from *A Primer on Fresh Water*. 2000. Environment Canada.

Canada's Water Use in International Context

Across the globe, about 70% of all water is dedicated to agriculture. All other forms of industry and commerce use 20%. About 10% of the globe's water is used for household, residential or domestic purposes (Brown 2002). These are all averages. Across developed countries, up to 65% of all water can be used for irrigation, and that rises to 90% in some of the drier developing countries (Nicol 2005).

As such, Canada's water use pattern does diverge from the larger global pattern. Across Canada, agriculture constitutes about 8% of all water withdrawals, while industrial, utility and manufacturing constitute 80% (Agriculture and Agri-Food Canada 2000). As noted, Canadians are also heavy users of water. The OECD ranks Canada second in terms of its total per capita water consumption. While the US uses more water per capita, water use in Canada is growing at a faster rate than the US. Since 1980, water use in Canada has increased by 25.7%, which is five times the OECD average of 4.5% (McFarlane and Nilson 2003). When all uses of water are considered, Canada uses 4,400 litres per person-day (Roach, Huynh and Dobson 2004).

In the Canadian water policy community, relatively "cheap" water has been highlighted as a significant contributor to Canada's heavy use of water. In terms of residential use, this may indeed be the case given the large number of Canadian homes that remain unmetered, and for those that are metered, municipal water rate structures that do little to promote efficient use or conservation. But, it must also be kept in mind that municipal water use is only about 10% of the total water withdrawn and residential use itself is only about half of that 10%.

For more information and to access the Canada West Foundation's water policy research visit: www.cwf.ca

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