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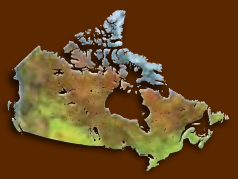

SURVEY OF COMMERCIAL AND INSTITUTIONAL ENERGY USE: BUILDINGS 2009

SUMMARY REPORT
MARCH, 2013

Canada

Natural Resources Canada's Office of Energy Efficiency
Leading Canadians to Energy Efficiency at Home, at Work and on the Road

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SURVEY OF COMMERCIAL AND INSTITUTIONAL ENERGY USE: BUILDINGS 2009

SUMMARY REPORT

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Contents

List of tables

List of figures

Foreword

The Survey of Commercial and Institutional Energy Use (SCIEU) combines the goals of two previous energy-use surveys: The establishment-based Commercial and Institutional Consumption of Energy Survey (CICES) and the buildings-based Commercial and Institutional Building Energy Use Survey (CIBEUS).

Every year Natural Resources Canada's Office of Energy Efficiency (OEE) estimates Canada's energy consumption by economic sector. The objective of the establishment-based component of the SCIEU is to produce statistical estimates of energy consumption for calendar year 2009 for the Commercial and Institutional (C&I) sector based on selected North American Industrial Classification System (NAICS) groupings. These estimates are a key input into estimating the sector's contribution to Canada's overall end-use energy consumption.

The OEE also develops policies and programs to encourage reducing energy consumption for C&I buildings. The objective of the building-based component of the SCIEU is to establish baseline energy consumption figures against which new energy efficiency policies and programs for C&I buildings can be measured. The building-based component of the SCIEU collects building characteristics and energy consumption estimates by building type and by climate zone. This buildings-based survey data is a key feature of the development of the Canadian adaptation of the United States Environment Protection Agency's ENERGY STAR® Portfolio Manager™ energy benchmarking system.

This summary report on the Survey of Commercial and Institutional Energy Use: Buildings 2009 was prepared by Margaretta Do. The project manager was Samuel Blais, while overall direction was provided by Andrew Kormylo, of the Demand Policy and Analysis Division of the OEE. The Buildings Division of the OEE provided invaluable subject matter expertise and advice. An electronic version of the publication is available on the OEE Web site at **oee.nrcan.gc.ca/statistics**.

For more information on this publication or the OEE's services, visit the Web site at **oee.nrcan.gc.ca**. You can also contact the OEE by e-mail at **euc.cec@nrcan-rncan.gc.ca** or by writing to

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Ottawa ON K1A 0E4

Other Office of Energy Efficiency surveys and publications

Over the past few years, the OEE has implemented several initiatives to collect energy data and estimate energy consumption in the C&I sector.

Buildings-based surveys

- The **Survey of Commercial and Institutional Energy Use – Buildings 2009, Detailed Statistical Report**. This report provides detailed statistical information on building characteristics and energy consumption estimates by building type and by climate zone.
- The **Commercial and Institutional Building Energy Use Survey (CIBEUS)** was the first survey of its kind in Canada. This survey gathered year 2000 data on energy consumption, energy intensity and the physical and energy-efficient characteristics of C&I buildings located in Canada's major urban centres.

Establishments-based surveys

- The **Survey of Commercial and Institutional Energy Use: Establishments 2009**, as part of the larger SCIEU project, reports on the establishment component.
- The **Consumption of Energy Survey (CES)** was based on data for 2003. This survey focused exclusively on Canada's universities, colleges and hospitals. Unlike CIBEUS 2000, which surveyed only major urban centres, the CES 2003 covered all Canadian provinces. Moreover, the CES 2003 was based on the NAICS definition of an establishment, whereas the CIBEUS 2000 defined its own building categories based on their usage and physical characteristics.
- For the 2004 survey, the scope of the CES included a much broader cross-section of the C&I sector. To reflect this change, the survey was renamed the **Commercial and Institutional Consumption of Energy Survey**. The CICES survey was updated in 2005, 2007 and 2008.

Other reports

- Each year, the OEE publishes its *Energy Use Data Handbook*. Part of what this handbook provides is data on energy consumption by activity type for the C&I sector and indicators that impact energy use. The data are collected by using various sources of information, including the establishment-based surveys mentioned above and the *Report on Energy Supply and Demand in Canada* (RESD) (described below).
- The annual *Energy Efficiency Trends in Canada* publication presents an analysis based on data from the *Energy Use Data Handbook*. The trends report provides an overview of energy use and related greenhouse gas emissions in the C&I sector. In addition to providing detailed information about current energy intensity and energy efficiency, this report also analyses trends starting from 1990.
- Through various other programs, the OEE has also published sectoral studies based on comparative analyses. These studies have centred on the hospitality sector, the retail sector and schools. Owners of commercial buildings can use these studies to compare their facility's energy consumption with that of similar facilities.

All of the above mentioned publications are available online or in paper from the OEE's Web site (**oee.nrcan.gc.ca**).

Another publication that includes energy data on the C&I sector is Statistics Canada's annual publication of the *Report on Energy Supply and Demand in Canada*. The RESD presents data on the production, sale, interprovincial transfer and consumption of energy by sector. The estimates in the RESD vary from those in this summary report because the two initiatives define the C&I sector differently. The RESD definition is somewhat broader. Furthermore, there are several differences in methodology because the RESD estimates Canada's energy supply and demand figures by using supply and distribution models based on data from several annual surveys on energy availability (energy sales and distribution information reported by suppliers), as well as from many other data sources.

Note: All these surveys, handbooks and studies are fundamentally different in that there are important conceptual and methodological differences among them. Therefore, exercise caution when you compare data from these sources.

How to read these tables

Scope of the report

This summary report provides estimates of the number of buildings, total floor space, total energy consumption and total energy intensity at a desegregated level for commercial and institutional (C&I) buildings in Canada. The survey's target population includes buildings in which at least 50 percent of the floor space is devoted to the following commercial or institutional activities:

- office buildings (non-medical)
- medical office buildings
- elementary and secondary schools
- nursing and residential care facilities
- warehouses
- hotels and motels
- hospitals
- food and beverage stores
- non-food retail stores
- other

For more detail on the survey and how the data were gathered by Statistics Canada, see "Appendix A. Methodology" in the *Survey of Commercial and Institutional Energy Use – Buildings 2009, Detailed Statistical Report*.

Table layout

All data in this report are presented in a data table format. A typical data table is presented below.

For each category listed in the left column of a table, the building's characteristic is listed under the appropriate column on the right. The numbers in the tables are rounded to varying degrees according to the characteristic. As a result, these numbers may not add up to the totals indicated and may differ slightly among tables.

The example below provides data estimates for the number of buildings, floor space, energy use and energy intensity for the various climate zones. For example, if the reader wants to know how many C&I buildings were in the Atlantic climate zone in 2009, one would look for those categories in each column and row (see the arrows) and locate the data estimate that lines up with both categories (see the orange rectangle).

Example Table 2.1 – Building characteristics and energy use by climate zone, 2009

Climate zone	Buildings			Floor space			Energy use			Energy intensity	
		QI	Share	millions of m^2	QI	Share	PJ	QI	Share	GJ/m^2	QI
Atlantic	47 911	A	9.9%	69.8	A	9.1%	71.6	A	8.5%	1.03	A
Great Lakes	233 880	A	48.5%	417.3	A	54.5%	437.2	A	51.9%	1.05	A
Pacific Coast	38 092	A	7.9%	64.6	A	8.4%	64.0	B	7.6%	0.99	A
Other*	162 383	A	33.7%	214.2	A	28.0%	269.4	A	32.0%	1.26	A
Canada	482 266	A	100.0%	765.9	A	100.0%	842.2	A	100.0%	1.10	A

Data quality

It is important to note that the Survey of Commercial and Institutional Energy Use (SCIEU) is a survey, not a census. Despite the best efforts of Statistics Canada to maintain a high level of quality for each of the survey's phases, the data estimates produced are inevitably subject to variance in the level of confidence, as is the case with any survey. In addition, the SCIEU was not designed as a longitudinal survey in which the same respondents are surveyed for each survey iteration. Therefore, you should not compare these results with previous surveys of the C&I sector such as the Commercial and Institutional Building Energy Use Survey (CIBEUS) 2000, the Commercial and Institutional Consumption of Energy Survey (CICES) 2007 or the CICES 2008.

The quality of the data estimates must be assessed because the estimates represent 482 266 buildings but were created from a sample of 5704 buildings. When estimates are calculated, coefficients of variation are also provided. The coefficients indicate the reliability of the estimate. An example of the letter coding is circled in orange in the table presented on the previous page. The letter coding is defined as follows.

Quality indicators associated with the coefficients of variation

Coefficient of variation	Quality indicator	Quality of estimate
20% or less	A	Excellent
21 to 30%	B	Good
31 to 40%	C	Acceptable
more than 40%	F	Too unreliable to be published
Confidential	X	suppressed to meet the confidentiality requirements of the *Statistics Act*

The data in this report are estimates. The real values differ from the estimates by 1.96 times the coefficient of variation (CV) 95 percent of the time. In other words, if the survey was repeated 20 times, the estimated value of the survey would be expected to fall between certain values 19 times out of 20.

The following example uses the total energy intensity for Canada presented in Table 1.2, 1.10 gigajoules per square metre (GJ/m^2) and a quality indicator (QI) of A (CV = 3.45 percent).

Value {1 +/- 1.96 [CV]} = 1.10 {1 ±1.96 [3.45%]}
= {1.03, 1.17}

If this survey was repeated 20 times, it is expected that the Canadian total energy intensity would be between 1.03 and 1.17 GJ/m^2 19 times. This means that, with 95 percent certainty, the true value lies within this range, and therefore the estimate is very reliable. Similarly, the number of C&I buildings would be between 443 413 and 521 119 (CV = 4.11 percent) 19 times out of 20.

In the tables, there are some instances where there are poor QIs for both floor space and energy use (sometimes even F quality and hidden values), yet total energy intensity (calculated as the ratio of energy use to floor space) will appear with a good QI.

This may appear to be counterintuitive because the QI is mostly based on the CV and because the total energy intensity is a ratio of two variables. But, if both estimates of each contributing record (the numerator and denominator) vary in the same direction, the resulting ratio is stable and can therefore have a better QI.

The methodology used to calculate estimates, as well as to collect data, is summarized in "Appendix A" of the *Survey of Commercial and Institutional Energy Use – Buildings 2009, Detailed Statistical Report*.

How to interpret energy intensity information

Comparing the energy intensities of a particular building or group of buildings with the reported total energy intensity in this report can be misleading, so a distinction between total energy intensity and average of energy intensities must be made:

- **total energy intensity** – the sum of all the energy used by all buildings in the designated category divided by the sum of the floor space of all buildings in the same category
- **average of energy intensities** – the sum of the energy intensities of every category divided by the number of categories. Note that using a weighted average that uses floor space as the weight yields exactly the same value as total energy intensity.

The following example illustrates the differences in the various measures by using the climate zone information in the following table.

Climate zone	Floor space (millions of m^2)	Energy use (PJ)	Energy intensity (GJ/m^2)
Atlantic	69.8	71.6	1.03
Great Lakes	417.3	437.2	1.05
Pacific Coast	64.6	64.0	0.99
Other	214.2	269.4	1.26
Canada	**765.9**	**842.2**	**1.10**

Total energy intensity (GJ/m^2)

$$\frac{\sum_i Energy\ use_i}{\sum_i Floor\ space_i} = \frac{842.2}{765.9} = 1.10$$

Average of energy intensities (GJ/m^2)

$$\frac{\sum_i Energy\ intensity_i}{Number\ of\ categories} = \frac{(1.03 + 1.05 + 0.99 + 1.26)}{4} = \frac{4.32}{4} = 1.08$$

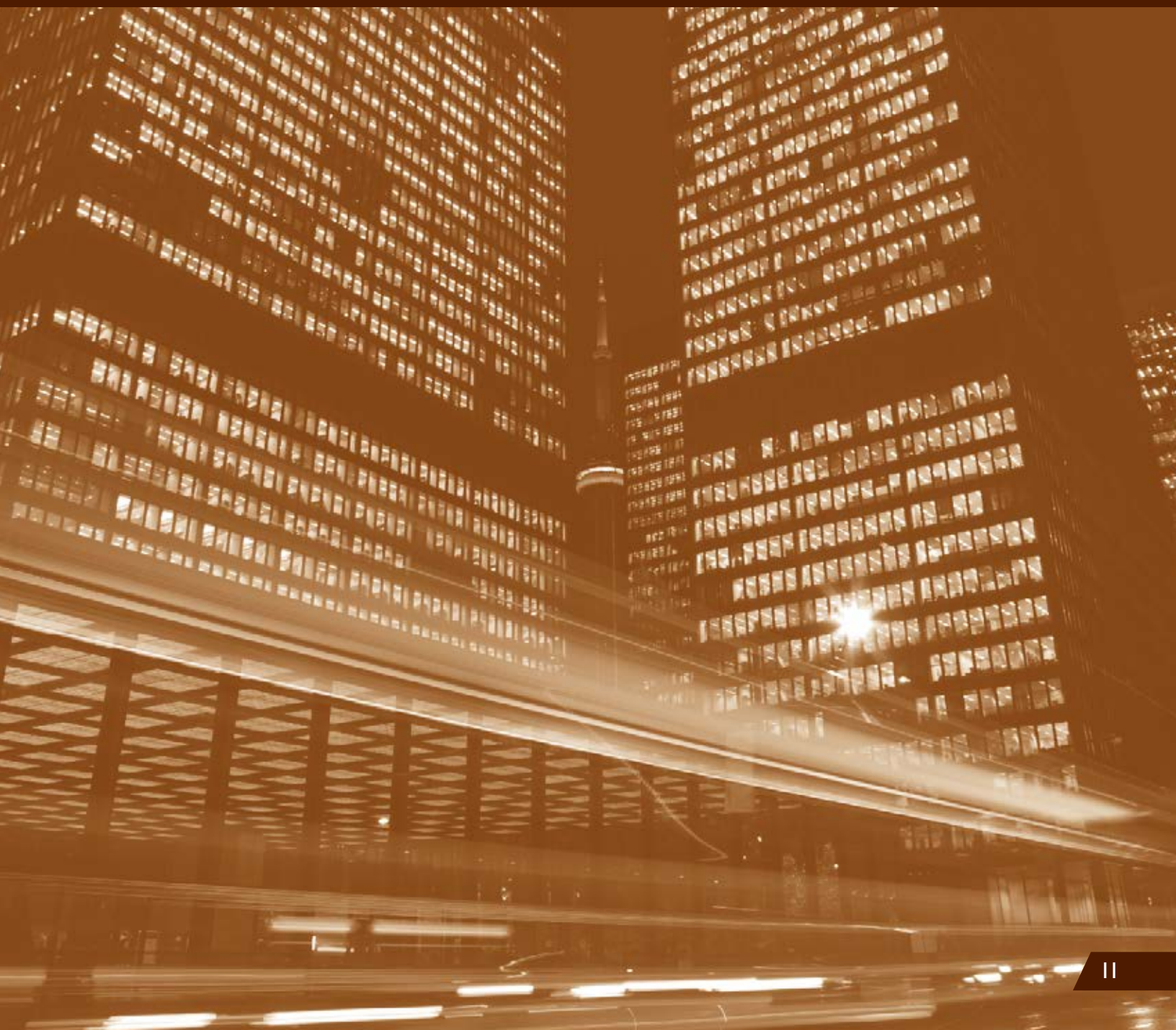
This example shows that the average of energy intensity method results in a different estimate. All methods are mathematically sound, but the total energy intensity calculation is the more appropriate measure to analyze a sector of the economy.

Highlights

- There were an estimated 482 000 C&I buildings in Canada in 2009, occupying about 766 million m^2 of floor space. Nearly half (48.5 percent) of these buildings were in the Great Lakes climate zone.
- In 2009, C&I buildings used approximately 840 petajoules (PJ) of energy, of which 47 percent was electricity and 44 percent was natural gas.
- The overall energy intensity of C&I buildings in Canada was 1.10 GJ/m^2.
- Twenty-seven percent of all C&I buildings in Canada were at least 50 years old, but buildings built in the 1970s had the highest proportions of both floor space and energy use.
- At 2.82 GJ/m^2, the food or beverage store category had the highest energy intensity by principal activity.
- Among the C&I buildings with space heating, 56 percent used natural gas as the primary energy source for heating.
- In 2009, 45 percent of C&I buildings had at least one energy efficiency feature[1] in place.
- Nearly half (46 percent) of all C&I buildings had some type of renovation done between 2005 and 2009.

[1] Energy efficiency features: Energy Conservation Awareness Program, Energy Management Control System for Heating, Ventilating and Cooling (HVAC), Energy Management Control System for Lighting.

CHARACTERISTICS OF COMMERCIAL AND INSTITUTIONAL BUILDINGS IN CANADA



1.1 Age of buildings

The SCIEU 2009 results in Table 1.1 show that, although the largest share of C&I buildings was built during the 1980s, these buildings accounted for smaller shares of both floor space and energy use. Conversely, buildings built in the 1970s represented 15.6 percent of buildings stock in Canada yet accounted for the largest shares of both floor space (20.7 percent) and energy use (21.7 percent).

Energy intensity is defined as the total amount of energy consumed annually per unit of activity (i.e. floor space), which, for this study, is expressed in gigajoules per square metre (GJ/m^2). In 2009, the average energy intensity for C&I buildings in Canada was 1.10 GJ/m^2.

Table 1.1 shows that, even though newer C&I buildings (2000 or later) represented about 12 percent of the share of stock in Canada, these buildings occupied 15 percent (115 million m^2)

Table 1.1 – Building characteristics and energy use by year of construction, 2009

Year of construction	Buildings			Floor space			Energy use		
		QI	Share	millions of m^2	QI	Share	PJ	QI	Share
Before 1920	46 951	A	9.7%	54.0	A	7.1%	50.5	A	6.0%
1920 to 1959	83 521	A	17.3%	91.1	A	11.9%	98.9	A	11.7%
1960 to 1969	67 758	A	14.1%	126.1	A	16.5%	120.6	A	14.3%
1970 to 1979	75 107	A	15.6%	158.6	A	20.7%	183.1	A	21.7%
1980 to 1989	91 404	A	19.0%	116.2	A	15.2%	131.9	A	15.7%
1990 to 1999	58 106	A	12.0%	105.3	A	13.7%	120.1	A	14.3%
2000 or later	59 418	A	12.3%	114.6	A	15.0%	137.1	A	16.3%
Canada	482 266	A	100.0%	765.9	A	100.0%	842.2	A	100.0%

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

Figure 1.1 – Energy intensity by year of construction

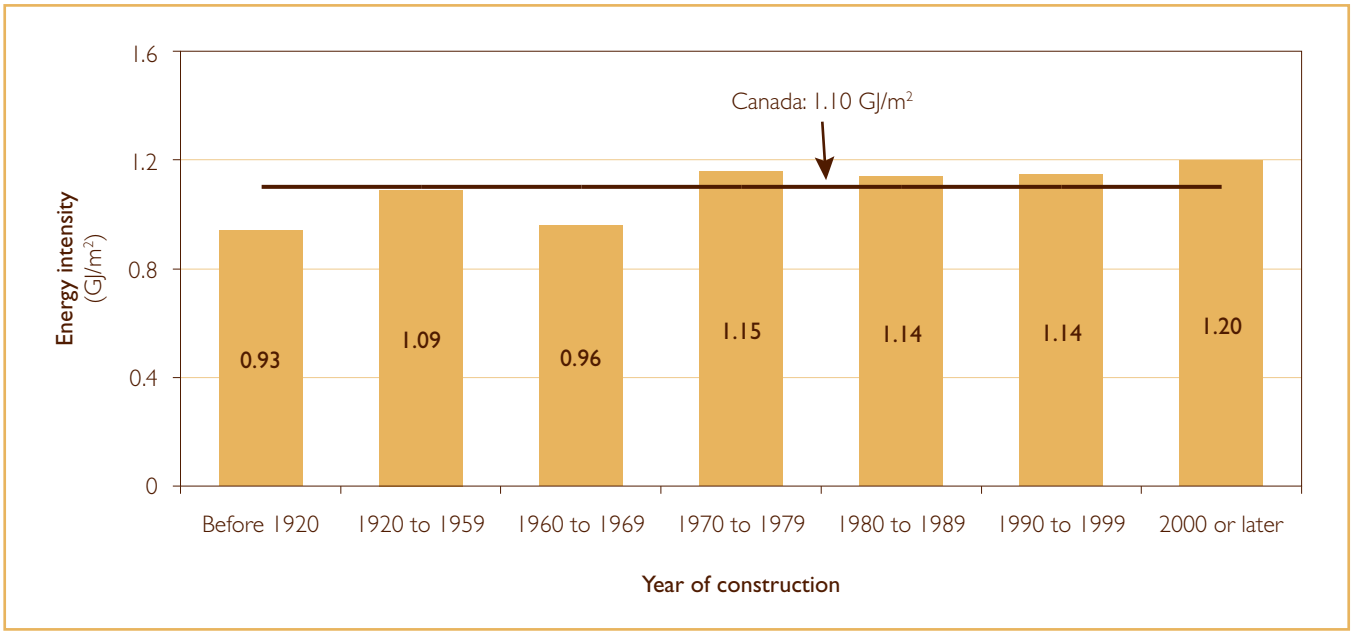


Table 1.2 – Characteristic of buildings with space cooling by year of construction, 2009

Year of construction	National total	QI	Buildings with space cooling	QI	Share	Floor area with space cooling (millions of m²)	QI	Share
Before 1920	46 951	A	30 318	A	64.6%	37.2	A	68.9%
1920 to 1959	83 521	A	52 881	A	63.3%	69.2	A	76.0%
1960 to 1969	67 758	A	45 368	A	67.0%	100.3	A	79.6%
1970 to 1979	75 107	A	48 094	A	64.0%	134.4	A	84.8%
1980 to 1989	91 404	A	67 926	A	74.3%	99.7	A	85.8%
1990 to 1999	58 106	A	39 563	A	68.1%	91.7	A	87.1%
2000 or later	59 418	A	47 534	A	80.0%	103.1	A	90.0%
Canada	**482 266**	**A**	**331 682**	**A**	**68.8%**	**635.7**	**A**	**83.0%**

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

of floor space, and consumed more than 16 percent of total energy use. As a result of high energy consumption and more limited floor space, this category of year of construction had the highest energy intensity, 1.20 GJ/m² (see Figure 1.1).

One factor that could influence the high energy intensity of the newest building category is the prevalence of space cooling. As shown in Table 1.2, fully 80 percent of buildings built since 2000 are space cooled – more than 5 percentage points higher than the next highest age category (1980 to 1989) and more than 11 percentage points higher than the total for all Canadian buildings.

The energy intensity of buildings can also be influenced by other factors, such as the building's primary activity, climate zone, hours of operation, size and the source of energy. These factors will be examined in further detail in this summary report.

1.2 Size of buildings

The SCIEU 2009 disaggregated C&I buildings into five categories according to floor space, as shown in Table 1.3.

Table 1.3 – Categories for floor space

Category	Square metres	Square feet (approximately)
Very small	≤465	<5 000
Small	466 to 929	5 001 to 10 000
Medium	930 to 4 645	10 001 to 50 000
Large	4 646 to 18 580	50 001 to 200 000
Very large	>18 580	>200 000

Table 1.4 shows that even though nearly half (49 percent) of C&I buildings in Canada were in the very small category, their share of the floor space was only 7.5 percent. However, buildings in the medium category represented about 26 percent of the buildings stock yet they had the highest shares in floor space (33 percent) and energy use (30.8 percent).

For energy intensity, as floor space increases, generally the energy intensity decreases. In a larger building, heat can be gained from people, equipment, lighting, etc. There are also many factors that can influence energy intensity such as geographical location, age of the building, activities in the building, energy saving measures in place, etc. As illustrated in Figure 1.2,

Table 1.4 – Building characteristics and energy use by building size, 2009

Building size	Buildings			Floor space			Energy use		
		QI	Share	millions of m^2	QI	Share	PJ	QI	Share
Very small	236 539	A	49.0%	57.3	A	7.5%	93.8	A	11.1%
Small	91 680	A	19.0%	61.6	A	8.0%	72.7	A	8.6%
Medium	123 565	A	25.6%	252.4	A	33.0%	259.3	A	30.8%
Large	25 319	A	5.3%	208.3	A	27.2%	226.1	A	26.8%
Very large	5 162	A	1.1%	186.4	A	24.3%	190.4	A	22.6%
Canada	482 266	A	100.0%	765.9	A	100.0%	842.2	A	100.0%

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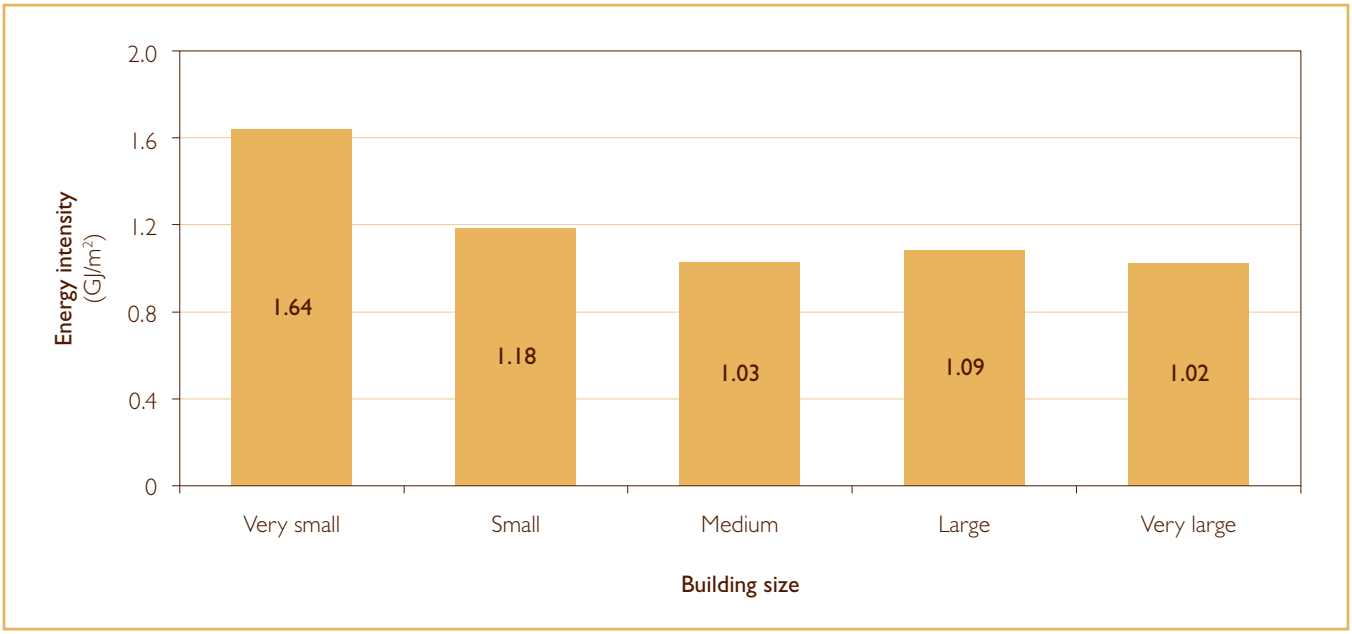
Figure 1.2 – Energy intensity by building size

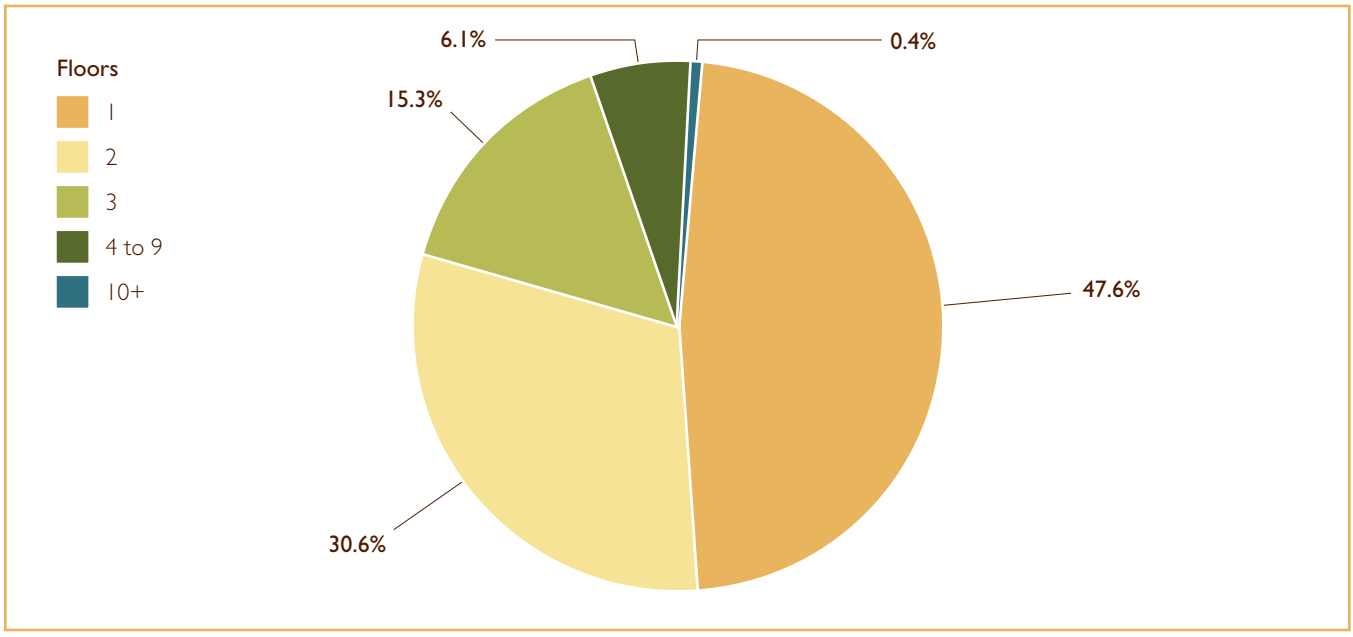


the very small buildings category used 93.8 PJ of energy for a floor space of about 57 million m^2, yielding an energy intensity of 1.64 GJ/m^2 for this category; the highest among all C&I building categories. In contrast, the lowest energy intensity came from the very large buildings category (1.02 GJ/m^2).

1.3 Number of floors

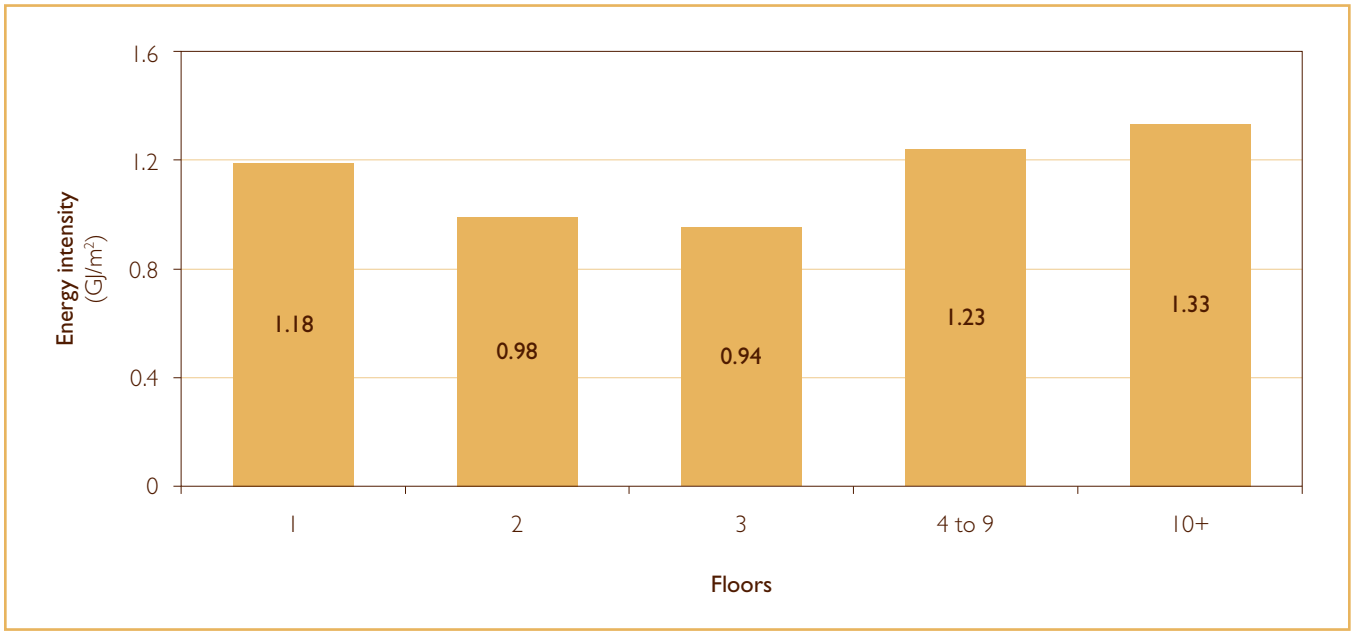
According to the SCIEU 2009, more than three quarters (78.2 percent) of C&I buildings had only one or two floors. The shares of the total C&I buildings declined drastically as the number of floors increased (as shown in Figure 1.3). High-rise commercial buildings (10 or more floors) only accounted for approximately 0.4 percent of the total number of buildings (or 1900 buildings).

Figure 1.3 – Share of buildings by number of floors



Note that there is a distinction between the number of floors and the size of buildings (as discussed in Section 1.2). A "very large" building that has a lot of floor space may not have many floors. For example, 40 percent of the floor space in the warehouse category was classified to the very large buildings category, yet 94 percent of the floor space occupied by these buildings had only one or two floors.

Figure 1.4 – Energy intensity by number of floors



As illustrated in Figure 1.4, energy intensities were lowest in buildings that had two or three floors. The survey results suggested that high energy intensities in the remaining categories were likely due to the primary activities associated with these buildings. For example, 59 percent of the buildings categorized as food or beverage stores had one floor, and the energy intensity for this group was 3.44 GJ/m^2. Similarly, 55 percent of hospitals have more than four floors. As Section 1.4 explains, these two activity types are the most energy-intensive among C&I buildings.

1.4 Buildings by primary activity

In 2009, approximately 17 percent of C&I buildings in Canada were categorized as office buildings (non-medical). Aside from the "Other" activity, this activity had the largest shares of both floor space (19.3 percent) and energy use (21 percent). Although 46 percent of the buildings were classified as "Other," this category includes such a wide array of activities that analysis of this category is impractical. Appendix C has more detail of what is included in the "Other" activity.

While the food or beverage store and the hospital categories both had relatively small shares of total C&I floor space, their respective shares of total energy use were considerably larger. Consequently, these two activities yielded the highest energy intensities, 2.82 GJ/m^2 and 2.42 GJ/m^2, respectively. These high values are largely due to the use of very energy-intensive equipment such as refrigerators and specialized medical equipment, as well as extended business operating hours.

As illustrated in Figure 1.5, the lowest energy intensities by primary activity were the warehouse (0.66 GJ/m^2) and elementary or secondary school (0.77 GJ/m^2) categories. The warehouse category includes warehouses that were designed strictly as storage lockers that have no reported energy use. In the elementary or secondary school category, this type of activity tends to consume less energy compared to other activity types because it is generally operated within business hours for only 10 months per year.

Table 1.5 – Floor space and energy use by primary activity, 2009

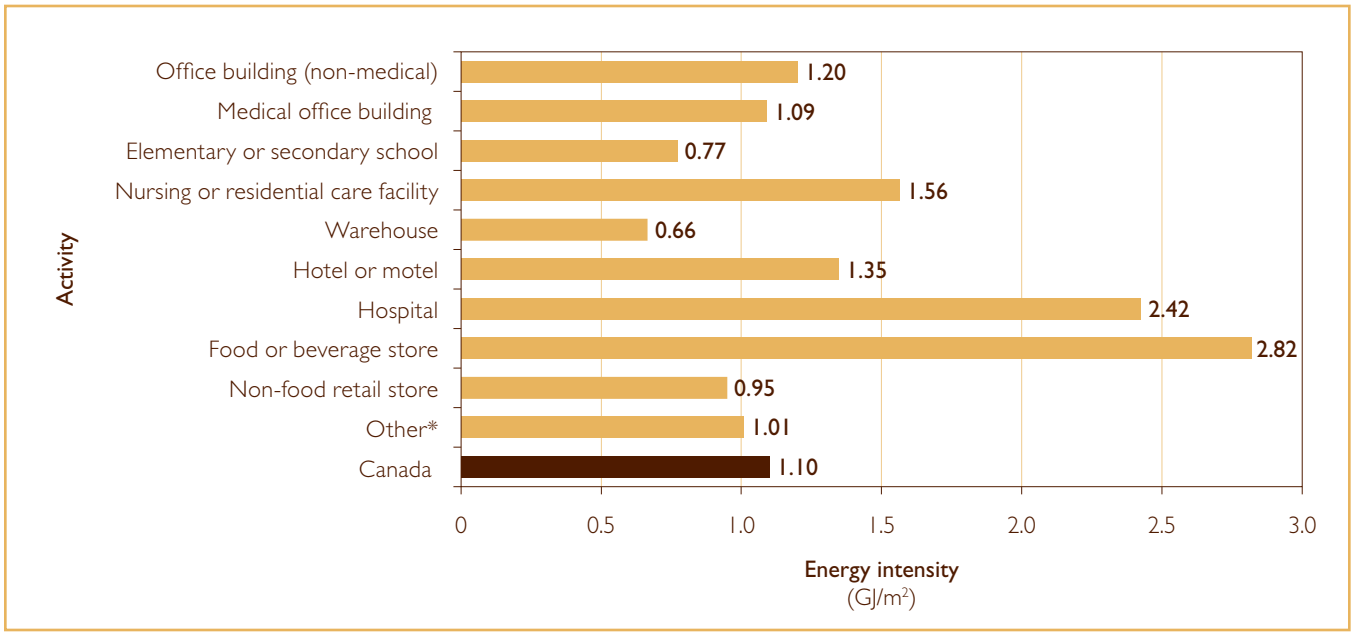
Primary activity	Buildings			Floor space			Energy use		
		QI	Share	millions of m^2	QI	Share	PJ	QI	Share
Office building (non-medical)	83 583	A	17.3%	147.5	A	19.3%	176.6	A	21.0%
Medical office building	10 525	A	2.2%	9.6	A	1.3%	10.5	A	1.2%
Elementary or secondary school	18 425	A	3.8%	83.6	A	10.9%	64.4	A	7.6%
Nursing or residential care facility	6 482	A	1.3%	25.0	B	3.3%	39.1	B	4.6%
Warehouse	32 879	A	6.8%	83.0	A	10.8%	55.0	A	6.5%
Hotel or motel	9 963	C	2.1%	19.7	B	2.6%	26.5	C	3.1%
Hospital	752	A	0.2%	15.1	A	2.0%	36.5	A	4.3%
Food or beverage store	40 403	A	8.4%	29.3	A	3.8%	82.7	A	9.8%
Non-food retail store	56 750	A	11.8%	68.9	A	9.0%	65.2	A	7.7%
Other*	222 505	A	46.1%	284.3	A	37.1%	285.8	A	33.9%
Canada	482 266	A	100.0%	765.9	A	100.0%	842.2	A	100.0%

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

* Other includes all other commercial buildings. See Appendix C for more details.

Figure 1.5 – Energy intensity by primary activity



* Other includes all other commercial buildings. See Appendix C for more details.

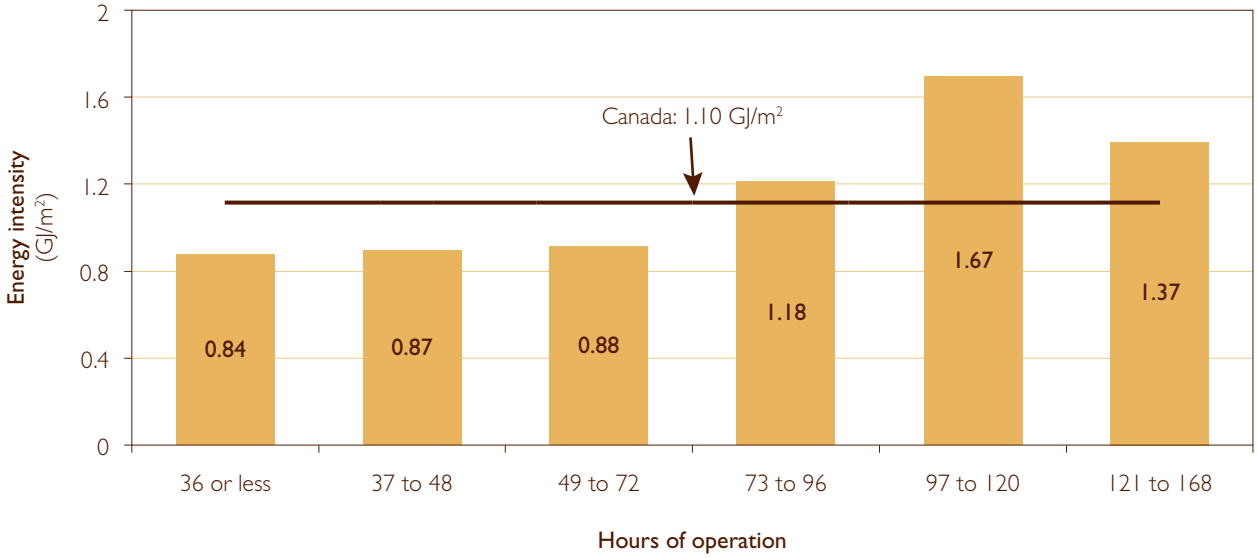
1.5 Hours of operation

The SCIEU 2009 shows that most buildings (31 percent) operated between 49 to 72 hours per week. These C&I buildings occupied the largest share of floor space (31 percent), and they consumed approximately 25 percent (207 PJ) of the total energy use. The highest energy consumption came from the 121 to 168 hours category (29.2 percent). As expected, these are typical operating hours for activities such as hotels or motels and hospitals. Hours of operation is defined as the time when the building is open for normal operation, not including the time when only maintenance, housekeeping or security staff are in the building.

Figure 1.6 shows that generally, as hours of operation increase, so does energy intensity. The one exception is the 97 to 120 hours per week category, which has a considerably higher energy intensity than the 121 to 168 hours per week category. Food or beverage stores tend to have energy-intensive equipment (such as commercial refrigerators and freezers) that runs 24 hours per day, even though the store may only operate between 97 and 120 hours per week. As a result, the food and beverage store category is very energy-intensive (2.91 GJ/m^2). The impact that the food and beverage store category has on the 97 to 120 hours of operation category may help explain the spike in energy intensity for this hours of operation category.[2]

[2] For detailed survey results on hours of operation by primary activity, see Table 1.18 in the *Survey of Commercial and Institutional Energy Use – Buildings 2009, Detailed Statistical Report*. http://oee.nrcan.gc.ca/publications/statistics/scieu09/scieu_e.pdf

Figure 1.6 – Energy intensity by hours of operation



2 ENERGY CONSUMPTION AND ENERGY INTENSITY BY CLIMATE ZONE

This section looks at the survey results by climate zone. A climate zone is a climatically distinct area, defined by long-term weather conditions that affect the heating and cooling loads in buildings. See Appendix D for the map of climate zones in Canada used for the SCIEU 2009.

As shown in Table 2.1, almost half (48.5 percent) of all C&I buildings in Canada were in the Great Lakes climate zone, while nearly 10 percent were in the Atlantic climate zone. Approximately 8 percent of the buildings classified as commercial or institutional were in the Pacific Coast climate zone. The rest of the country was home to the remaining 34 percent of C&I buildings.

The SCIEU 2009 estimated that the total floor space of C&I buildings in Canada was nearly 766 million m^2, while their total energy use was 842 PJ. These two variables yield an energy intensity of 1.10 GJ/m^2 in 2009 for Canadian C&I buildings.

By climate zone, the Great Lakes climate zone had the largest shares of both floor space and energy use, 54.5 percent and 51.9 percent, respectively. This climate zone's energy intensity was 1.05 GJ/m^2. The Atlantic climate zone represented 9.1 percent of the total floor space and 8.5 percent to the total energy use; therefore its average energy intensity was 1.03 GJ/m^2.

The Pacific Coast climate zone had the lowest shares of floor space (8.4 percent) and energy use (7.6 percent). At 0.99 GJ/m^2, this climate zone had the lowest energy intensity in Canada.

What likely contributed to the low energy intensity in the Pacific Coast climate zone is the fact that this climate zone has the mildest weather in Canada. Furthermore, the survey also shows there were far more buildings with energy efficiency features in this climate zone. This will be further discussed in the "Energy efficiency features and retrofits" chapter.

The SCIEU 2009 not only collected data on energy consumption by C&I buildings but also on specific energy sources consumed. As shown in Figure 2.1, electricity and natural gas were the two energy sources most widely used by C&I buildings in Canada. At 46.6 percent, the share of electricity was slightly ahead of natural gas in terms of total energy used. Distillates, which include light fuel oil, diesel and kerosene, only accounted for 4.2 percent of the total energy used in 2009, and most of it was consumed in the Atlantic climate zone. Other fuels accounted for the remaining 5.4 percent.

Table 2.1 – Building characteristics and energy use by climate zone, 2009

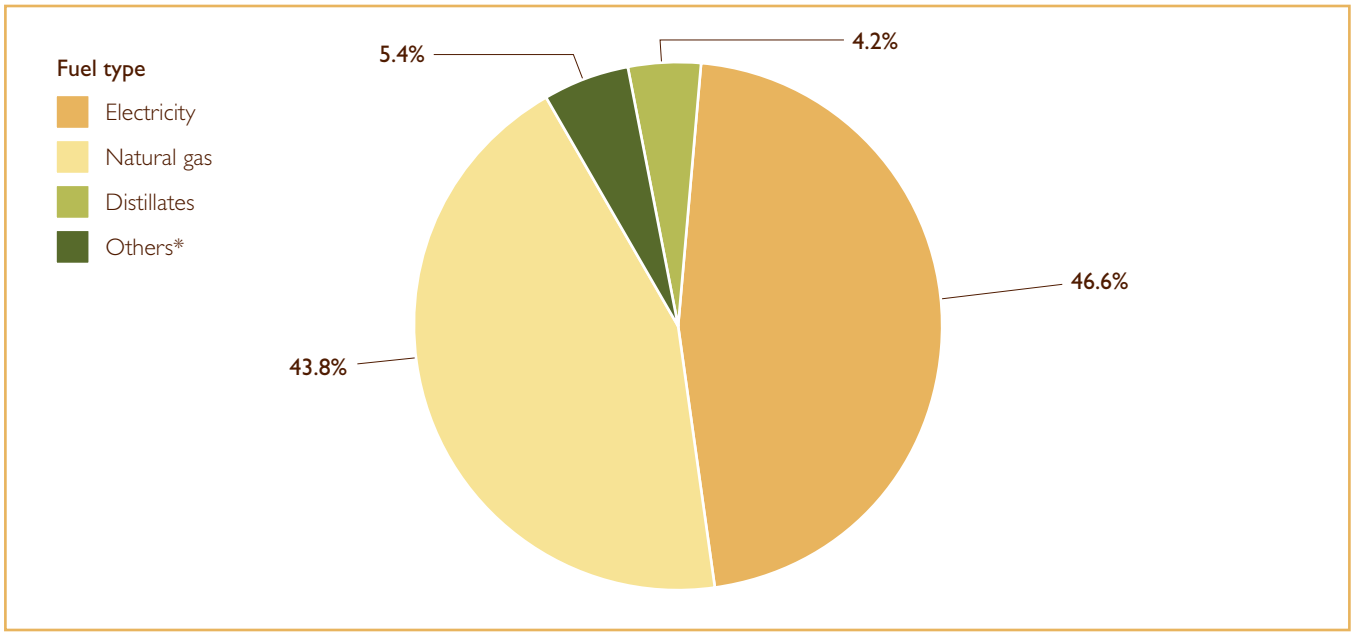
	Buildings			Floor space			Energy use			Energy intensity	
Climate zone		QI	Share	millions of m^2	QI	Share	PJ	QI	Share	GJ/m^2	QI
Atlantic	47 911	A	9.9%	69.8	A	9.1%	71.6	A	8.5%	1.03	A
Great Lakes	233 880	A	48.5%	417.3	A	54.5%	437.2	A	51.9%	1.05	A
Pacific Coast	38 092	A	7.9%	64.6	A	8.4%	64.0	B	7.6%	0.99	A
Other*	162 383	A	33.7%	214.2	A	28.0%	269.4	A	32.0%	1.26	A
Canada	**482 266**	**A**	**100.0%**	**765.9**	**A**	**100.0%**	**842.2**	**A**	**100.0%**	**1.10**	**A**

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

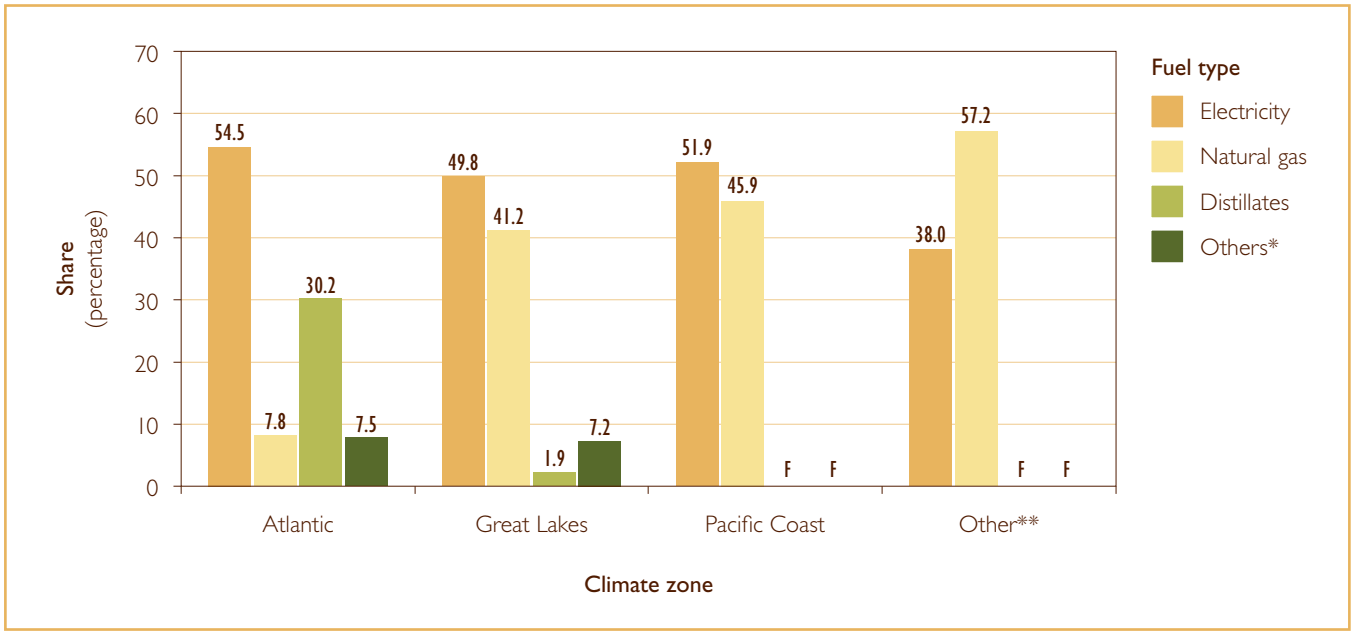
* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

Figure 2.1 – Canada's share of energy use by fuel type



* Others include propane, district energy sources, wood, on-site electricity generation, and other fuel sources not listed.

Figure 2.2 – Share of energy consumption by fuel type



* Others include propane, district energy sources, wood, on-site electricity generation, and other fuel sources not listed.

** Other includes all other Canadian climate zones not listed. See Appendix D for a map.

The composition of energy consumption by C&I buildings varied by climate zone depending on fuel availability. As illustrated in Figure 2.2, electricity was most widely used in the Atlantic, the Great Lakes and the Pacific Coast climate zones; 54.5 percent, 49.8 percent and 51.9 percent, respectively. The second most prevalent energy source for the Atlantic climate zone was distillates, 30.2 percent. This climate zone also had the greatest share of propane in the country, (3.3 percent).

In addition to electricity, 41.2 percent of the energy used in the Great Lakes climate zone was natural gas, while another 7.2 percent was other fuels. In the Pacific Coast climate zone, more than half of the energy used (51.9 percent) was electricity, while almost all the rest (45.9 percent) was natural gas.

Natural gas was the most widely used energy source (57.2 percent) by C&I buildings in the Other climate zone, but electricity also accounted for 38 percent of total energy use in 2009. The high use of natural gas is likely due to the abundance of this source of energy in provinces such as Alberta, Saskatchewan and British Columbia.

The SCIEU 2009 indicated that certain activities occupied more floor space in a certain climate zone than others (see Table 2.2). For example, the Great Lakes climate zone had the highest proportion (21 percent) of floor space categorized as office building (non-medical). Similarly, the Atlantic climate zone had the highest proportion of floor space in the categories of hospital (3.5 percent) and food or beverage store (5.1 percent) compared to other climate zones. The differences in distributions of building activities can also help explain differences in energy intensities across climate zones.

Table 2.2 – Climate zone characteristics by primary activity, 2009

Primary activity	Atlantic						Great Lakes						Pacific Coast						Other*					
	Floor space		Energy use		Energy intensity		Floor space		Energy use		Energy intensity		Floor space		Energy use		Energy intensity		Floor space		Energy use		Energy intensity	
	millions of m^2	QI	PJ	QI	GJ/m^2	QI	millions of m^2	QI	PJ	QI	GJ/m^2	QI	millions of m^2	QI	PJ	QI	GJ/m^2	QI	millions of m^2	QI	PJ	QI	GJ/m^2	QI
Office building (non-medical)	6.8	A	6.6	B	0.97	A	87.2	B	99.3	B	1.14	A	12.5	B	11.9	B	0.95	A	41.1	A	58.8	B	1.43	A
Medical office building	0.7	B	0.6	B	0.80	A	3.1	B	3.6	B	1.17	A	1.3	B	1.4	C	1.05	A	4.5	B	4.9	B	1.09	A
Elementary or secondary school	8.2	A	6.4	B	0.77	A	40.7	A	32.2	A	0.79	A	7.6	A	4.8	A	0.64	A	27.0	A	21.0	A	0.78	A
Nursing or residential care facility	1.7	B	2.4	B	1.40	A	17.7	C	24.4	C	1.38	A	0.8	B	1.2	B	1.44	A	4.8	A	11.1	B	2.32	A
Warehouse	4.2	B	2.0	B	0.47	A	56.6	B	32.4	B	0.57	A	–	F	–	F	0.86	B	16.1	A	15.3	A	0.95	A
Hotel or motel	1.6	A	1.8	A	1.09	A	6.3	C	8.2	C	1.31	B	2.4	B	2.6	B	1.11	A	–	F	–	F	1.47	A
Hospital	2.4	B	6.3	B	2.61	A	8.2	A	20.6	A	2.49	A	1.5	B	2.4	B	1.58	A	2.9	A	7.3	B	2.50	A
Food or beverage store	3.5	C	7.8	C	2.22	A	15.5	B	45.2	B	2.92	A	2.6	B	7.6	B	2.89	A	7.7	A	22.0	A	2.87	A
Non-food retail store	6.8	C	5.2	C	0.76	A	21.2	B	18.0	B	0.85	A	–	F	5.3	C	0.65	B	32.7	B	36.7	C	1.12	A
Other**	33.8	B	32.6	C	0.96	A	160.8	A	153.2	A	0.95	A	21.6	B	–	F	1.00	C	68.1	A	78.4	A	1.15	A
Total	69.8	A	71.6	A	1.03	A	417.3	A	437.2	A	1.05	A	64.6	A	64.0	B	0.99	A	214.2	A	269.4	A	1.26	A

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

** Other includes all other commercial buildings. See Appendix C for more details.

3 ENERGY SOURCES USED FOR SPACE HEATING, SPACE COOLING AND WATER HEATING

In the C&I sector, most of the energy used is for space heating, space cooling and water heating. The following section examines the use of these energy sources by climate zone.

3.1 Space heating

As shown in Table 3.1, natural gas was a key energy source for space heating in Canada; 56.4 percent of the C&I buildings used this fuel type. The second most widely used energy source was electricity at 28.5 percent, followed by distillates at 10.8 percent.

In the Atlantic climate zone, the two primary energy sources for space heating were electricity (48.9 percent) and distillates (41 percent). In the Great Lakes climate zone, the majority of C&I buildings (56.2 percent) used natural gas as their primary space heating fuel whereas C&I buildings in the Pacific Coast climate zone split their space heating energy source almost equally between natural gas and electricity. Nearly three quarters (73.9 percent) of C&I buildings in the Other climate zone used natural gas as the primary fuel for space heating.

Table 3.1 – Buildings with space heating by climate zone and primary fuel, 2009

	Buildings		Natural gas			Electricity			Distillates			Other fuels*		
Climate zone		QI		QI	Share		QI	Share		QI	Share		QI	Share
Atlantic	46 586	A	2 022	B	4.3%	22 785	A	48.9%	19 090	A	41.0%	2 689	B	5.8%
Great Lakes	221 028	A	124 132	A	56.2%	60 011	A	27.2%	24 881	B	11.3%	12 004	C	5.4%
Pacific Coast	36 183	A	17 320	A	47.9%	17 462	B	48.3%	–	F	NA	270	C	0.7%
Other**	158 504	A	117 075	A	73.9%	31 401	A	19.8%	4 801	B	3.0%	–	F	NA
Canada	**462 301**	**A**	**260 550**	**A**	**56.4%**	**131 659**	**A**	**28.5%**	**49 903**	**A**	**10.8%**	**20 189**	**B**	**4.4%**

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

* Other fuels include all other fuels not listed.

** Other includes all other Canadian climate zones not listed. See Appendix D for a map.

Table 3.2 shows that natural gas was consistently the main energy source used for space heating among all the primary activities. This is especially the case for nursing or residential care facilities, warehouses and elementary or secondary schools where more than 70 percent of floor space was heated with natural gas. With respect to year of construction, buildings built in the 1970s had the highest proportion of floor space heated by electricity (39 percent). The share of floor space heated by distillates has been shrinking over the decades such that only 3 percent of heated floor space in buildings built in 2000 or later used this fuel as the primary energy source for space heating.

Table 3.2 – Floor space with space heating by primary fuel, primary activities and year of construction, 2009

	Total space heating		Floor space using natural gas			Floor space using electricity			Floor space using distillates		
	millions of m^2	QI	millions of m^2	QI	Share	millions of m^2	QI	Share	millions of m^2	QI	Share
Primary Activities	**755.6**	**A**	**460.4**	**A**	**61%**	**185.2**	**A**	**25%**	**52.5**	**A**	**7%**
Office building (non-medical)	147.1	A	75.2	A	51%	59.8	C	41%	3.2	C	2%
Medical office building	9.6	A	6.0	A	63%	3.4	A	36%	–	F	NA
Elementary or secondary school	83.6	A	59.5	A	71%	15.9	B	19%	6.8	A	8%
Nursing or residential care facility	25.0	B	18.8	C	75%	5.3	B	21%	0.8	B	3%
Warehouse	80.5	A	60.7	A	75%	14.4	B	18%	1.2	C	1%
Hotel or motel	19.4	B	–	F	NA	7.6	B	39%	0.3	C	1%
Hospital	15.1	A	9.8	A	65%	2.2	B	15%	2.2	C	15%
Food or beverage store	29.1	A	18.1	B	62%	8.1	B	28%	1.7	C	6%
Non-food retail store	67.3	A	43.4	B	64%	15.1	B	22%	–	F	NA
Other*	279.0	A	158.9	A	57%	53.5	A	19%	30.8	B	11%
Years of construction	**755.6**	**A**	**460.4**	**A**	**61%**	**185.2**	**A**	**25%**	**52.5**	**A**	**7%**
Before 1920	53.8	A	34.6	B	64%	5.0	B	9%	9.0	C	17%
1920 to 1959	89.5	A	55.9	A	63%	17.0	B	19%	9.2	C	10%
1960 to 1969	125.0	A	73.0	A	58%	18.0	A	14%	–	F	NA
1970 to 1979	157.7	A	80.4	A	51%	61.5	C	39%	5.6	B	4%
1980 to 1989	114.2	A	72.6	A	64%	29.2	A	26%	–	F	NA
1990 to 1999	100.9	A	64.8	A	64%	29.6	B	29%	1.8	C	2%
2000 or later	114.4	A	79.1	A	69%	24.8	B	22%	3.6	C	3%

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

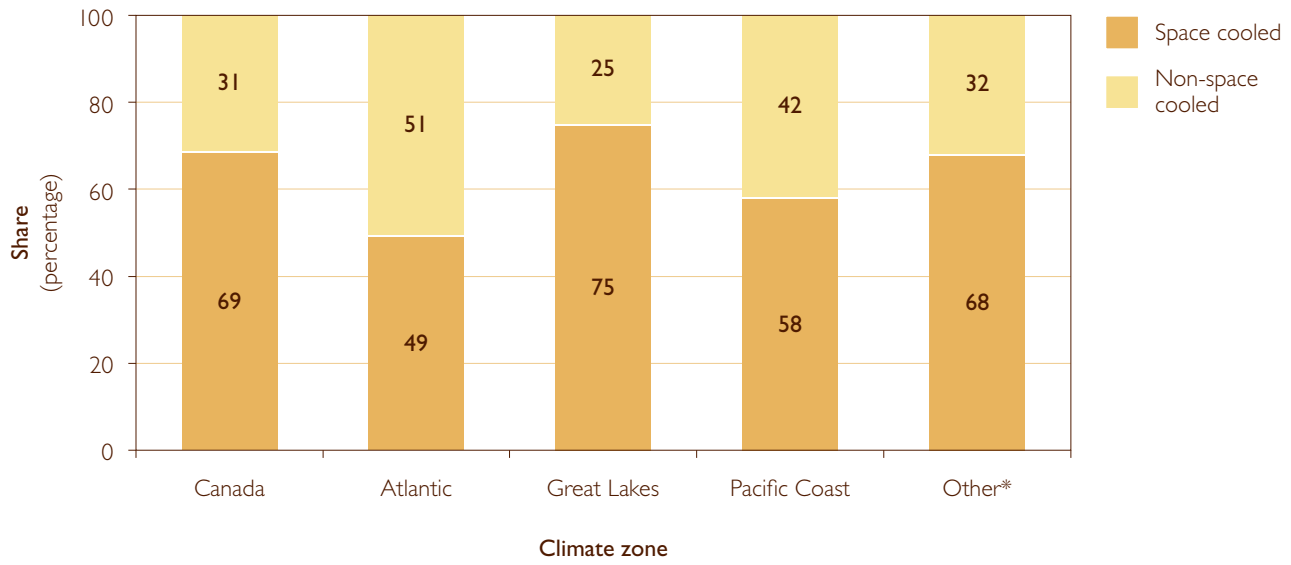
* Other includes other commercial buildings. See Appendix C for more details.

3.2 Space cooling

According to the SCIEU 2009, 69 percent of C&I buildings in Canada were space cooled. The proportion of space cooled and non-space cooled buildings varied from one climate zone to another. As illustrated in Figure 3.1, only 49.3 percent of C&I buildings in the Atlantic zone were space cooled.

The Great Lakes climate zone, on the other hand, had the highest percentage of space cooled C&I buildings, 74.9 percent. This is likely because the Great Lakes climate zone has a humid continental climate such that summers are hotter and more humid than the other climate zones.

Figure 3.1 – Share of space cooled buildings by climate zone

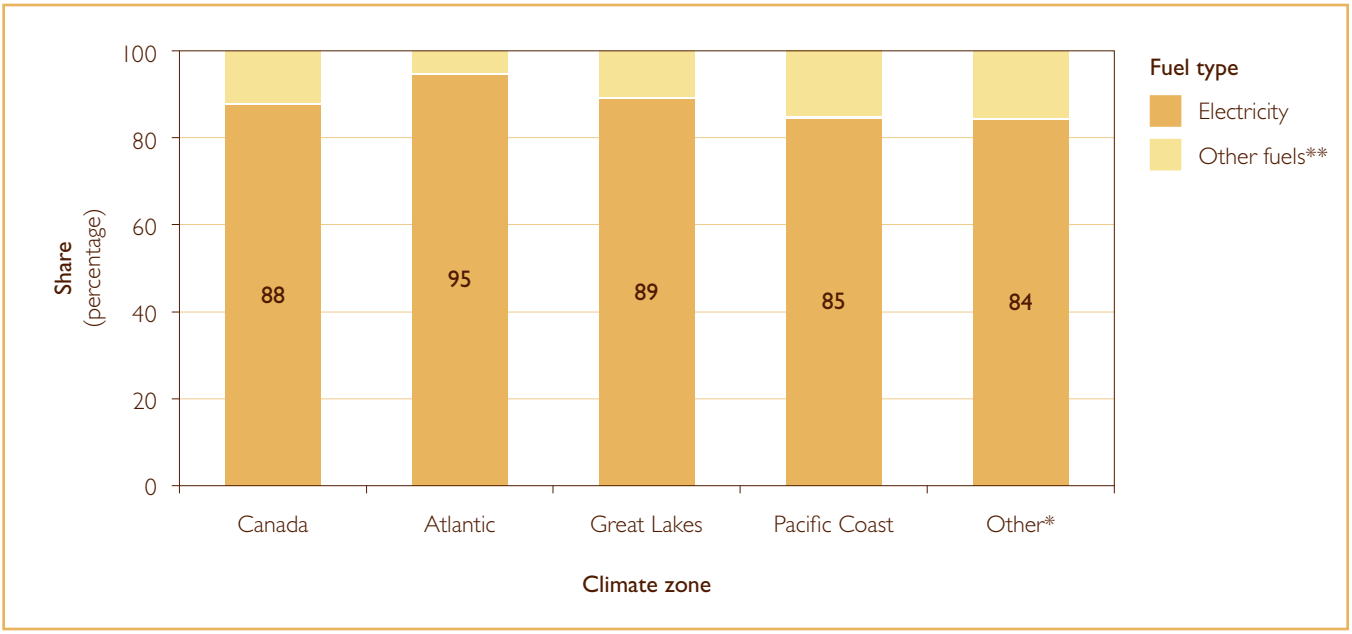


* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

The survey results also show that 80 percent of buildings constructed after 2000 were space cooled compared to 65 percent of those built before 1920. In terms of building size, the bigger the building, the more likely it is to have space cooling. This is probably because larger buildings require conditioned air to maintain indoor air quality. As well, many of the largest building types (e.g. offices, warehouses, large hospitals) are more likely to be found in the Great Lakes climate zone. Indeed, 67 percent of the floor space in the very large building category is in this climate zone.

Space cooling has always been dominated by electric technology. As shown in Figure 3.2, 88 percent of C&I buildings in Canada used electricity as the primary energy source for space cooling. The Atlantic climate zone had the largest percentage of buildings with electric space cooling (95 percent).

Figure 3.2 – Share of space cooled buildings by primary fuel and climate zone



* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

** Other fuels include natural gas, light fuel oil, propane, diesel, heavy fuel oil and other types.

3.3 Water heating

Nation-wide, most commercial buildings have water heating. Nevertheless, a small percentage of buildings do not. Only 12 percent of C&I buildings in 2009 did not have water heating. However, in terms of floor space, this is only about 5 percent of the national total. Most of these buildings were in the Great Lakes and the Pacific Coast climate zones.

In Canada, storage water tanks are the most common type of water heater. The energy sources used for these include natural gas, electricity and fuel oil. The SCIEU 2009 shows that more than half of C&I floor space (53 percent) used natural gas to heat water, while 37 percent used electricity. Only 4 percent of commercial floor area used distillates (which also include fuel oil) to heat water.

Table 3.3 – Floor space with water heating by primary fuel and climate zone, 2009

Climate zone	Floor space													
	National total		No water heating			Natural gas			Electricity			Distillates		
	millions of m^2	QI	millions of m^2	QI	Share	millions of m^2	QI	Share	millions of m^2	QI	Share	millions of m^2	QI	Share
Atlantic	68.5	A	1.3	B	2%	–	F	NA	37.3	A	54%	23.9	C	35%
Great Lakes	394.9	A	22.3	B	6%	212.7	A	54%	148.3	A	38%	3.8	C	1%
Pacific Coast	61.5	A	3.1	B	5%	35.6	A	58%	23.4	B	38%	–	F	NA
Other*	207.2	A	7.0	B	3%	135.7	A	65%	63.1	A	30%	–	F	NA
Canada	**732.2**	**A**	**33.7**	**A**	**5%**	**388.5**	**A**	**53%**	**272.0**	**A**	**37%**	**30.3**	**C**	**4%**

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

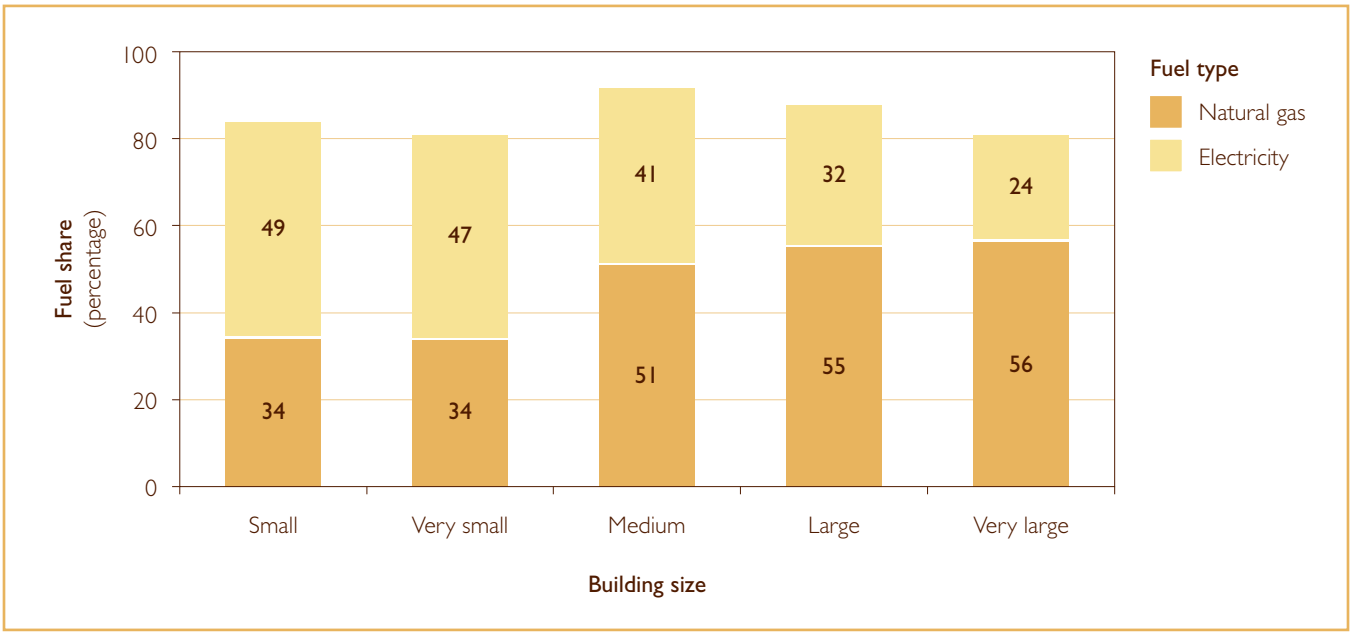
Due to rounding, numbers may not add up to the total shown.

* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

For most climate zones, natural gas was the most widely used energy source to heat water, especially in the Other climate zone where natural gas is readily available. However, in the Atlantic climate zone, more than half of the commercial floor space (54 percent) used electricity to heat water, and more than a third (35 percent) used distillates.

Figure 3.3 shows that as the building size expands, so does the use of natural gas for water heating. This is because water heating is often part of the heating, ventilating and air-conditioning system in large buildings, whereas small buildings are likely to have a separate system for heating and water heating.

Figure 3.3 – Fuel share for water heating by building size



4 ENERGY EFFICIENCY FEATURES AND RETROFITS

4.1 Energy efficiency features

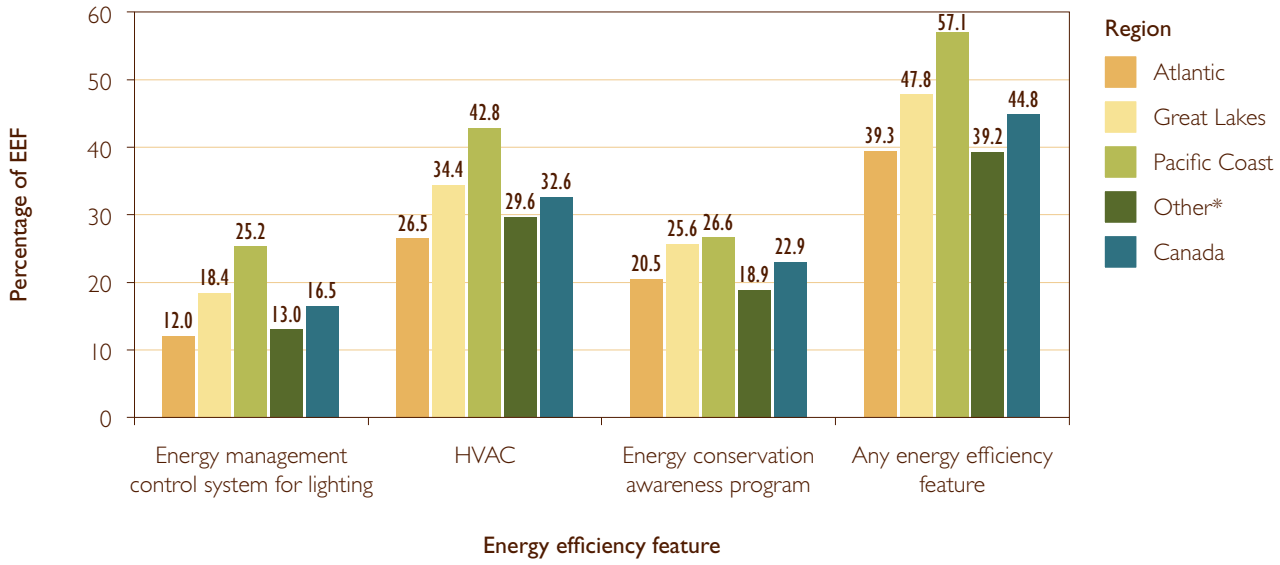
As defined in the SCIEU 2009, an energy efficiency feature (EEF) consisted of one of the following conservation measures:

- Energy Conservation Awareness Program
- Energy Management Control System for Heating, Ventilating and Cooling (HVAC)
- Energy Management Control System for Lighting.

Nearly 45 percent of C&I buildings in Canada had at least one EEF. Furthermore, the survey results show that the Pacific Coast climate zone had the most EEFs because 57.1 percent of its C&I buildings have at least one EEF.

Of the three EEFs, Energy Management Control Systems for HVAC was the most pervasive feature in the C&I sector with nearly one third of the building stock having this common feature. Significantly, in the large and very large building size categories at least 65 percent[3] of these buildings had an Energy Management Control System for HVAC.

Figure 4.1 – Percentage of EEF by climate zone



* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

4.2 Retrofits

The SCIEU 2009 estimated that 46 percent of the C&I buildings were renovated between 2005 and 2009. As illustrated in Table 4.1, the most common type of renovation was lighting (26 percent).

Only 4.6 percent of C&I buildings underwent additions or reductions over the study period. This may be because of the larger scale and/or financial investment required to undertake such retrofit.

[3] For detailed survey results on characteristics of buildings with Energy Management Control Systems for HVAC, see Table 5.3 in the *Survey of Commercial and Institutional Energy Use – Buildings 2009, Detailed Statistical Report*. http://oee.nrcan.gc.ca/publications/statistics/scieu09/scieu_e.pdf

At 51.9 percent, the Great Lakes climate zone had the highest percentage of buildings that were retrofitted. By type of renovation, the Great Lakes climate zone also had more buildings with retrofits to space heating (21.1 percent), space cooling (15.5 percent) and additions or reductions (5.2 percent). The Atlantic climate zone had the highest share of buildings that had undergone window or insulation renovations (21.8 percent).

Table 4.1 – Building characteristics by climate zone and type of renovation, 2005–2009

Climate zone	Type of renovation	Buildings		Share of total buildings
			QI	
Atlantic	Total	47 911	A	
	No renovation	25 756	A	53.8%
	Any type of renovation	22 155	A	46.2%
	Space heating	7 616	A	15.9%
	Space cooling	5 441	A	11.4%
	Lighting	10 108	A	21.1%
	Windows/insulation	10 444	A	21.8%
	Additions/reductions	1 832	B	3.8%
	Other**	9 875	A	20.6%
Great Lakes	Total	233 880	A	
	No renovation	112 596	A	48.1%
	Any type of renovation	121 284	A	51.9%
	Space heating	49 455	A	21.1%
	Space cooling	36 185	A	15.5%
	Lighting	75 126	A	32.1%
	Windows/insulation	42 154	A	18.0%
	Additions/reductions	12 133	B	5.2%
	Other**	43 691	A	18.7%
Pacific Coast	Total	38 092	A	
	No renovation	21 201	A	55.7%
	Any type of renovation	16 891	B	44.3%
	Space heating	6 417	C	16.8%
	Space cooling	–	F	NA
	Lighting	12 726	B	33.4%
	Windows/insulation	–	F	NA
	Additions/reductions	–	F	NA
	Other*	–	F	NA

(continued)

Table 4.1 – Building characteristics by climate zone and type of renovation, 2005–2009 (continued)

Climate zone	Type of renovation	Buildings		Share of total buildings
			QI	
Other*	Total	162 383	A	
	No renovation	102 802	A	63.3%
	Any type of renovation	59 581	A	36.7%
	Space heating	20 897	A	12.9%
	Space cooling	14 931	A	9.2%
	Lighting	27 558	A	17.0%
	Windows/insulation	24 190	A	14.9%
	Additions/reductions	6 463	B	4.0%
	Other**	23 122	A	14.2%
Canada	Total	482 266	A	
	No renovation	262 355	A	54.4%
	Any type of renovation	219 910	A	45.6%
	Space heating	84 385	A	17.5%
	Space cooling	61 219	A	12.7%
	Lighting	125 518	A	26.0%
	Windows/insulation	82 900	A	23.2%
	Additions/reductions	22 226	A	4.6%
	Other**	81 576	A	5.0%

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

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

* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

** Other includes all other renovations not listed.

The SCIEU 2009 estimated that, between 2005 and 2009, about 40 percent of C&I buildings had at least one energy efficiency retrofit. An energy efficiency retrofit is defined as a renovation to one of the following:

- space heating
- space cooling
- lighting
- windows
- insulation

Table 4.2 illustrates the proportion of buildings that underwent energy efficiency retrofits across the four climate zones. The Great Lakes climate zone had the highest proportion (47.4 percent) of buildings with any type of energy efficiency retrofits. The Atlantic and Pacific Coast climate zones had about the same shares, at 41.6 percent and 40.5 percent, respectively.

Table 4.2 – Building characteristics with energy efficiency retrofits by climate zone, 2005–2009

Climate zone	Type of renovation	Buildings		Share of total buildings
			QI	
Atlantic	Total	47 911	A	
	No renovation	25 756	A	53.8%
	Any type of renovation	22 155	A	46.2%
	Any type of energy efficiency retrofits**	19 939	A	41.6%
	Additions/Reductions	1 832	B	3.8%
	Other***	9 875	A	20.6%
Great Lakes	Total	233 880	A	
	No renovation	112 596	A	48.1%
	Any type of renovation	121 284	A	51.9%
	Any type of energy efficiency retrofits**	110 754	A	47.4%
	Additions/Reductions	12 133	B	5.2%
	Other***	43 691	A	18.7%
Pacific Coast	Total	38 092	A	
	No renovation	21 201	A	55.7%
	Any type of renovation	16 891	B	44.3%
	Any type of energy efficiency retrofits**	15 424	B	40.5%
	Additions/Reductions	–	F	NA
	Other***	–	F	NA
Other*	Total	162 383	A	
	No renovation	102 802	A	63.3%
	Any type of renovation	59 581	A	36.7%
	Any type of energy efficiency retrofits**	47 251	A	29.1%
	Additions/Reductions	6 463	B	4.0%
	Other***	23 122	A	14.2%
Canada	Total	482 266	A	
	No renovation	262 355	A	54.4%
	Any type of renovation	219 910	A	45.6%
	Any type of energy efficiency retrofits**	193 368	A	40.1%
	Additions/Reductions	22 226	A	4.6%
	Other***	81 576	A	16.9%

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

Due to rounding, numbers may not add up to the total shown, and some numbers may differ from one table to the next.

* Other includes all other Canadian climate zones not listed. See Appendix D for a map.

** Energy efficiency retrofits include at least one retrofit to the following: space heating, space cooling, lighting and windows/insulation.

*** Other includes all other renovations not listed.

APPENDIX A
REGIONAL INFORMATION

It is important to note that the SCIEU 2009 was designed to produce reliable estimates at the national level and for four climate zones (see Appendix D). It was possible, however, to derive reasonable quality estimates for geographic regions. Note that these derived regional estimates are not as robust as the climate zone estimates and should, therefore, be used with caution.

As shown in Table A.1, Ontario had the highest shares both in terms of floor space and energy use, 36.2 percent and 37.6 percent, respectively. Although Quebec had second largest share of the total floor space, this region used less energy (18.7 percent) compared to the Prairies (25 percent).

In terms of energy intensity, at 0.89 GJ/m^2, Quebec had the lowest energy intensity, followed by British Columbia at 0.99 GJ/m^2, then Atlantic Canada at 1.03 GJ/m^2. Energy intensity for Ontario (1.14 GJ/m^2) was slightly higher than Canada's average of 1.10 GJ/m^2. It is likely (because of the colder climate in the Prairies) that this region had the highest energy intensity in Canada (1.35 GJ/m^2).

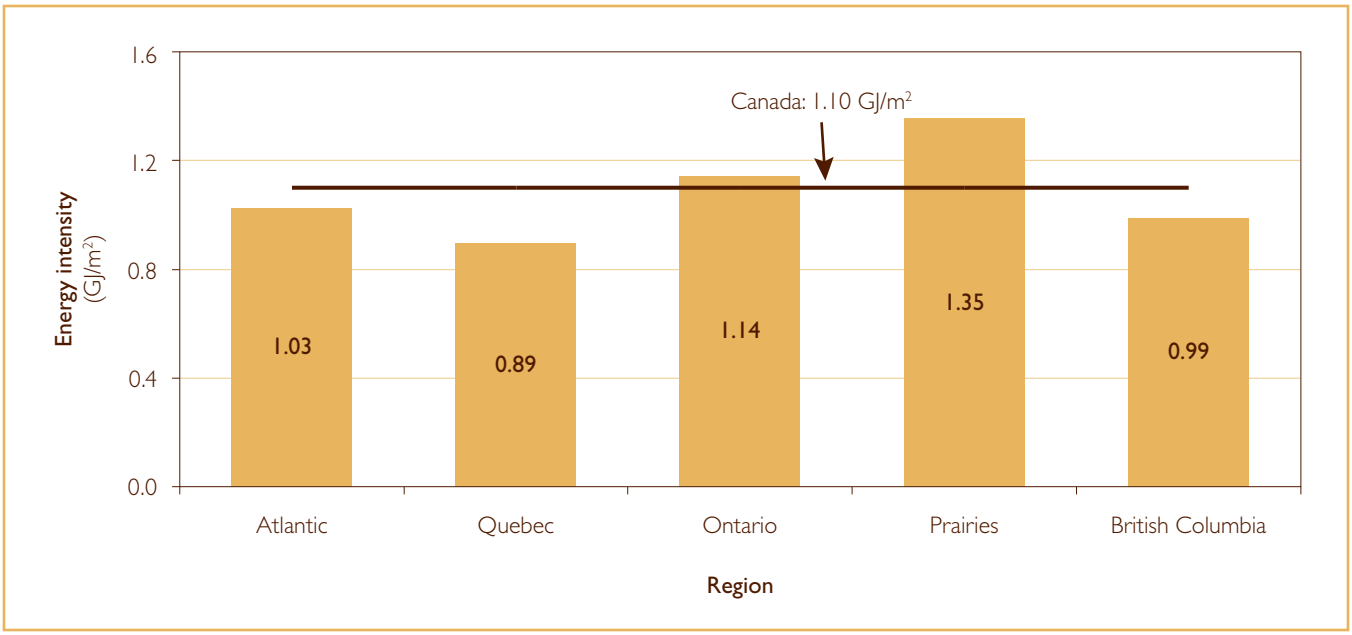
Table A.1 – Building characteristics and energy use by region, 2009

Climate zone	Buildings			Floor space			Energy use		
		QI	Share	millions of m^2	QI	Share	PJ	QI	Share
Atlantic	48 089	A	10.0%	70.1	A	9.2%	72.0	A	8.5%
Quebec	103 684	A	21.5%	176.4	A	23.0%	157.4	A	18.7%
Ontario	163 537	A	33.9%	277.2	A	36.2%	316.9	A	37.6%
Prairies	105 519	A	21.9%	156.1	A	20.4%	210.9	A	25.0%
British Columbia	61 438	A	12.7%	86.2	A	11.3%	85.1	B	10.1%
Canada	482 266	A	100.0%	765.9	A	100.0%	842.2	A	100.0%

The letter to the right of each estimate indicates its quality, as follows: A – Excellent, B – Good, C – Acceptable, F – Too unreliable to be published, X – Suppressed for reasons of confidentiality.

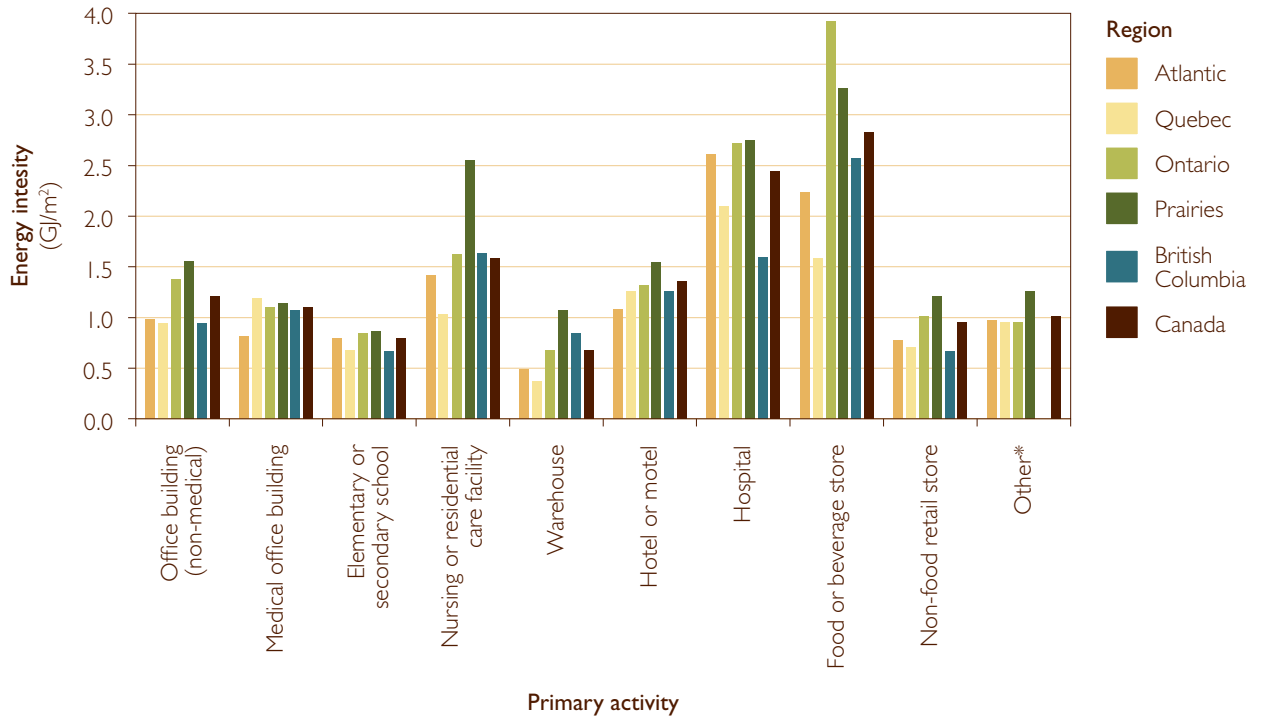
Due to rounding, numbers may not add up to the total shown.

Figure A.1 – Energy intensity by region



By primary activity, the two most energy-intensive activity categories in Canada were the hospital and food or beverage store categories, 2.42 GJ/m^2 and 2.82 GJ/m^2, respectively. In the hospital category, three regions had noticeably high energy intensities: Atlantic (2.60 GJ/m^2), Ontario (2.71 GJ/m^2) and Prairies (2.74 GJ/m^2). In the food or beverage store category, Ontario was the most intensive at 3.91 GJ/m^2 followed by the Prairies at 3.25 GJ/m^2. At 2.54 GJ/m^2, the Prairies had the highest energy intensity in the nursing or residential care facility category, well above the category's average of 1.56 GJ/m^2.

Figure A.2 – Energy intensity by region and primary activity

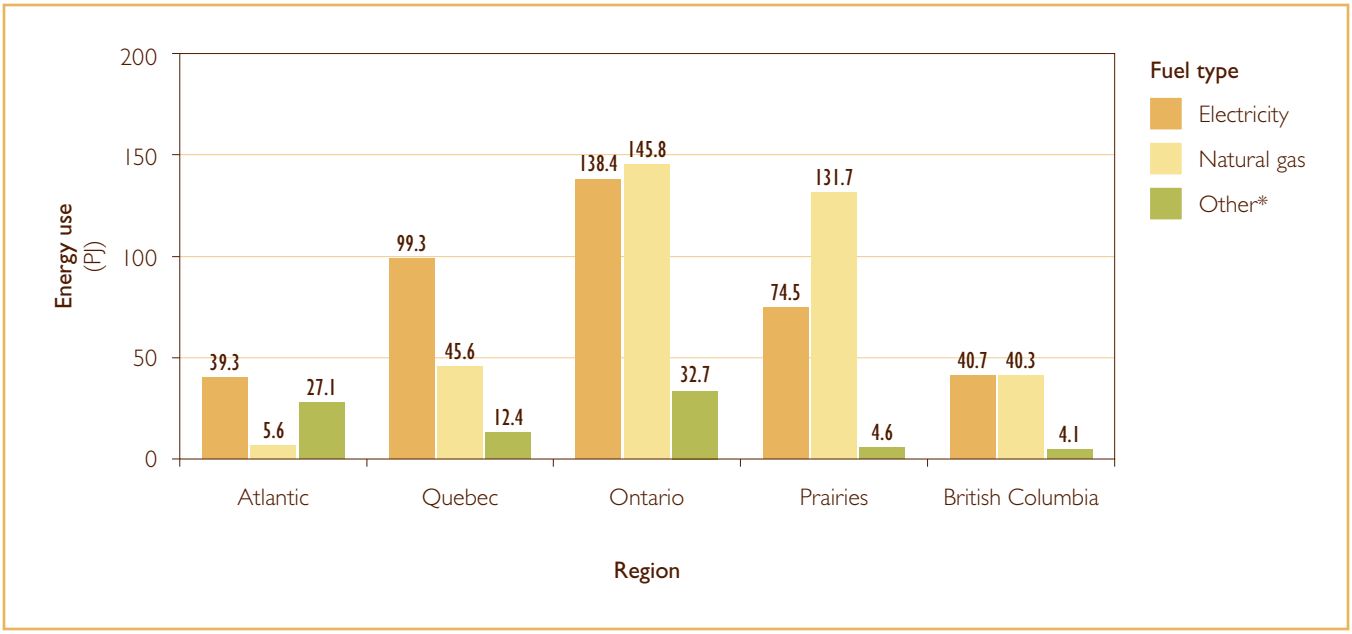


* Other includes all other commercial buildings.

According to the SCIEU 2009, energy use varied significantly across the country. Figure A.3 shows that electricity was the most widely used energy source in both Atlantic (39.3 PJ) and Quebec (99.3 PJ). Nearly 38 percent of energy used (27.1 PJ) by C&I buildings in Atlantic Canada came from other sources, which consisted mostly of distillates. Aside from electricity, about 30 percent (45.6 PJ) of Quebec's energy use came from natural gas.

C&I buildings in Ontario consumed both electricity and natural gas almost equally, with natural gas being only slightly higher by 7 PJ. A similar mix of energy sources was seen in British Columbia where both sources were split evenly. In the Prairies, on the other hand, natural gas was the most widely used energy source for C&I buildings. The relatively abundant supply of natural gas in Alberta and Saskatchewan is a likely explanation for this phenomenon.

Figure A.3 – Energy use by region



* Other includes all other fuels not listed.

APPENDIX B
GLOSSARY

building

a structure totally enclosed by walls that extend from the foundation to the roof. Included in the survey as a specific exception were structures erected on pillars to elevate the first fully enclosed level but leave the sides at ground level open. Excluded from the survey as non-buildings were the following: structures (other than the exception just noted) that were not totally enclosed by walls and a roof (such as oil refineries, steel mills and water towers), street lights, pumps, billboards, bridges, oil storage tanks, construction sites and mobile homes and trailers, even if they housed commercial activity.

building activity

an activity or function that occupies the majority of the floor space of a building. The categories are designed to group buildings that have similar patterns of energy consumption (see Appendix C for details).

building characteristics

information about the building that includes building floor space, year of construction, number of storeys, size, primary activity and hours of operation

climate zone

a climatically distinct area, defined by long-term weather conditions that affect the heating and cooling loads in buildings (see Appendix D for details)

commercial and institutional building (see Appendix C for details)

a building that has more than 50 percent of its floor space used for commercial activities or for activities focusing on not-for-profit services in the public's interest. These buildings include, but are not limited to, the following:

- office buildings (non-medical)
- medical office buildings
- elementary and secondary schools
- nursing and residential care facilities
- warehouses
- hotels and motels
- hospitals
- food and beverage stores
- non-food retail stores
- vacant buildings
- other

cooling

the conditioning of air in a room for human comfort by a refrigeration unit (such as an air conditioner or heat pump) or by a central cooling or district cooling system that circulates chilled water. Use of fans or blowers by themselves without chilled air or water is not included in this definition of air conditioning.

diesel

a liquid petroleum product that is less volatile than gasoline and that is burned for space or water-heating purposes

district heat

steam or hot water produced outside of a building in a central plant and piped into the building as an energy source for space heating or another end use. The district heat may be purchased from a utility or provided by a central physical plant in a separate building that is part of the same multi-building facility (for example, a hospital complex or university.) District heat includes district steam and/or district hot water.

district hot water

district heat in the form of hot water

district steam

district heat in the form of steam

electricity

electric energy supplied to a building by a central utility via power lines or from a central physical plant in a separate building that is part of the same multi-building facility. Electric power generated within a building for exclusive use in that building is specifically excluded from the definition of electricity as an energy source in this survey (see energy source).

electricity generation

as an energy end use, the onsite production of electricity by means of electricity generators on either a regular or emergency basis

energy end use

a use for which energy is consumed in a building

energy intensity

the amount of energy used per unit of activity. Energy intensity is usually given on an aggregate basis, as the ratio of the total consumption for a set of buildings to the total floor space in those buildings.

energy source

a type of energy or fuel consumed in a building. In this survey, information about the use of electricity, natural gas, oil, district steam heating and district hot water in commercial buildings is obtained from the building respondent and/or the utility selling the energy source to the building respondent. Electric power generated within a building for exclusive use in that building is specifically excluded from the definition of electricity as an energy source in this survey (see electricity).

floor space

all the area enclosed above or below ground by the exterior walls of a building, including hallways, lobbies, stairways, penthouses and elevator shafts, indoor parking and mechanical areas

gigajoule

a unit of measure for energy consumption equal to 1 billion joules (1×10^9)

hours of operation

the time when the building is open for normal operation, not including the time when only maintenance, housekeeping or security staff may be in the building

kerosene

a petroleum distillate with properties similar to those of No. 1 fuel oil; used primarily in space heaters, cooking stoves, and water heaters. In this report, no distinction is made between kerosene and fuel oil; kerosene is included in the "Fuel Oil" category under "Energy source."

light fuel oil

a liquid petroleum product used as an energy source that is less volatile than gasoline. Fuel oil includes distillate fuel oil (Nos. 1, 2, and 4).

lighting

the illumination of the interior of a building by use of artificial sources of light

natural gas

hydrocarbon gas (mostly methane) supplied as an energy source to individual buildings by pipelines from a central utility company. Natural gas does not refer to liquefied petroleum gas or to privately owned gas wells operated by a building owner (see also energy source, liquefied petroleum gas and propane).

number of floors

the number of levels in the tallest section of a building that are actually considered a part of the building, including parking areas, basements or other floors below ground level, but excluding half-floors, mezzanines, balconies and lofts

petajoule

a unit of measure for energy consumption equals 1×10^{15} joules, or equivalent to one million gigajoules

propane

a gaseous petroleum product that liquefies under pressure. Propane is the major component of liquefied petroleum gas.

quality indicators

coefficients of variation, which indicate the reliability of data, are used to determine which estimates may be published. Estimates whose coefficient of variation exceeds 40 percent are deemed too unreliable to be published.

space cooling

as an energy end-use, the conditioning of air in a room for human comfort by a refrigeration unit (such as an air conditioner or heat pump) or by a central cooling or district cooling system that circulates chilled water. Excluded is the use of fans or blowers by themselves, without chilled air or water.

space heating

as an energy end use, the use of mechanical equipment (including wood stoves and active solar-heating devices) to heat all, or part, of a building to at least 10°C

water heating

as energy end use, the use of energy to heat water for purposes other than space heating

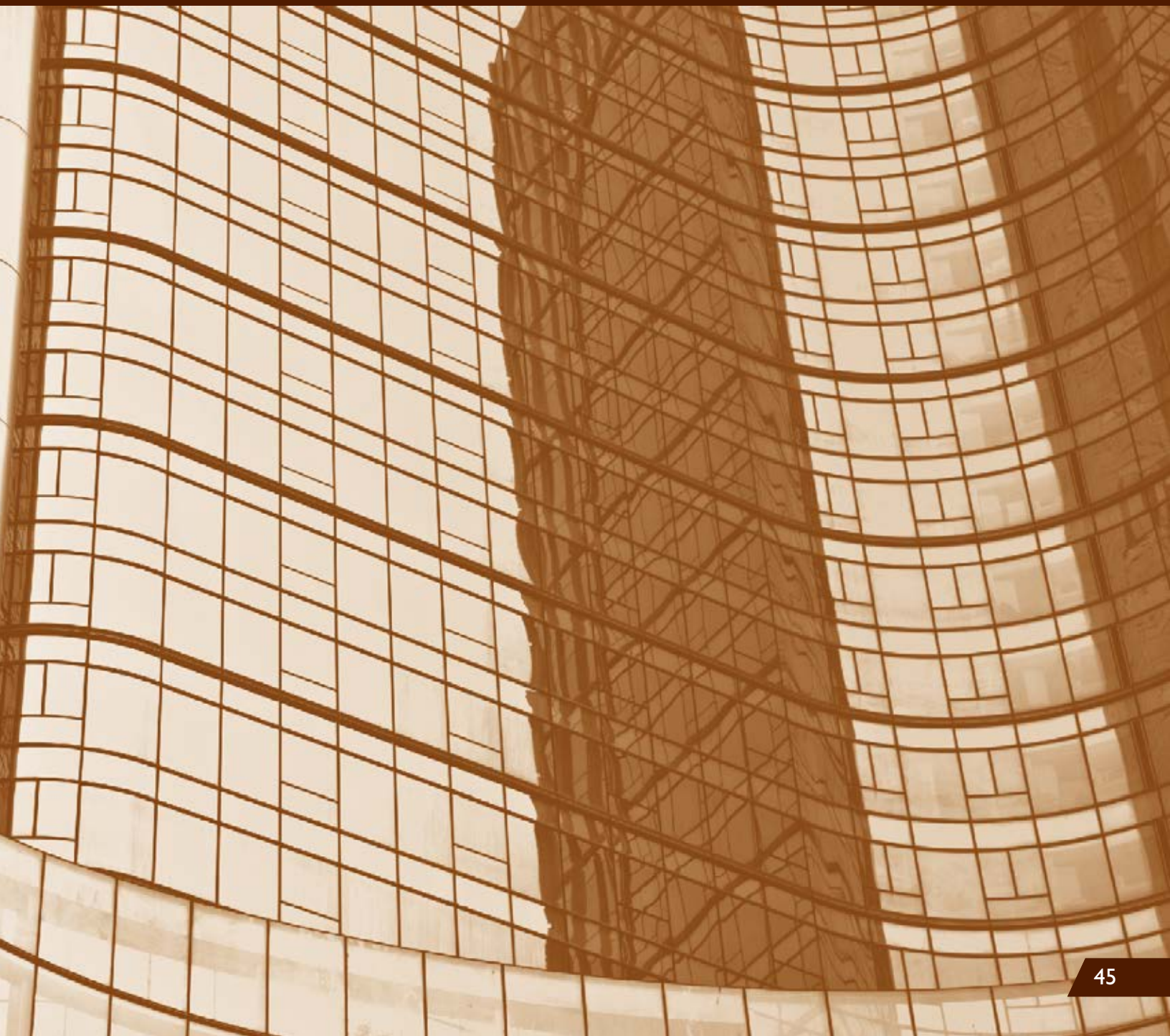
wood

as an energy source, logs or wood products that are used as fuel

year of construction

the year in which the major part or the largest portion of a building was constructed

APPENDIX C
BUILDING ACTIVITY CODES



commercial and institutional building

a building with more than 50 percent of its floor space used for commercial activities or for activities focusing on not-for-profit services in the public's interest. These buildings include, but are not limited to, the following:

- office buildings (non-medical)
- medical office buildings
- elementary and secondary schools
- nursing and residential care facilities
- warehouses
- hotels and motels
- hospitals
- food and beverage stores
- non-food retail stores
- vacant buildings
- other

office buildings (non-medical)

applies to facility spaces used for general office, professional and administrative purposes. The floor area includes all supporting functions such as kitchens used by staff, lobbies, atriums, conference rooms and auditoriums, fitness areas for staff, storage areas, stairways, elevator shafts, etc.

medical office buildings

applies to facility space used to provide diagnosis and treatment for medical, dental or psychiatric outpatient care. The floor area includes all supporting functions such as kitchens used by staff, laboratories, lobbies, atriums, conference rooms and auditoriums, fitness areas for staff, storage areas, stairways, elevator shafts, etc.

elementary and secondary schools

facility space used as a school building for kindergarten through secondary school students. This does not include college or university classroom facilities and laboratories or vocational, technical or trade schools. The floor area includes all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoriums, laboratory classrooms, portable classrooms, greenhouses, stairways, atriums, elevator shafts, storage areas, etc.

nursing and residential care facilities

facilities with permanent occupant care that provides rehabilitative, restorative and/or ongoing skilled nursing care to patients or residents in need of assistance with activities of daily living. Long-term care facilities include nursing homes, residential developmental handicap, mental health and substance abuse facilities. Purely residential retirement homes are not included in this category. The floor area includes all supporting functions such as administrative space, kitchens used by staff, lobbies, cafeterias, etc.

warehouses

applies to unrefrigerated or refrigerated buildings that are used to store goods, manufactured products, merchandise or raw materials. The floor area includes all supporting functions such as offices, lobbies, stairways, rest rooms, equipment storage areas, elevator shafts, etc. Existing atriums or areas with high ceilings should only include the base floor area that they occupy.

hotels and motels

applies to buildings that rent overnight accommodations on a room/suite basis, typically including a bath/shower and other facilities in guest rooms. Hotel and motel properties typically have daily services available to guests including housekeeping/laundry and a front desk/concierge. The floor area includes all interior space, including guestrooms, halls, lobbies, atriums, food preparation and restaurant space, conference and banquet space, health clubs/spas, indoor pool areas, and laundry facilities, as well as all space used for supporting functions such as elevator shafts, stairways, mechanical rooms, storage areas, employee break rooms, back-of-house offices, etc. The term hotel/motel does not apply to fractional ownership properties such as condominiums or vacation timeshares. Hotel properties should be owned by a single entity and have rooms available on a nightly basis.

hospitals

facilities that provide acute care services intended to treat patients for short periods (average less than 25 days) for any brief but severe medical condition, including emergency medical care, physicians' services, diagnostic care, ambulatory care and surgical care. Acute care hospitals typically discharge patients as soon the patient is deemed healthy and stable. Note: Long-term care residences are not considered hospitals.

food and beverage stores

applies to facility space used for the retail sale of food and beverage products. It should not be used by restaurants. The floor area includes all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated and non-refrigerated), administrative areas, stairwells, atriums, lobbies, etc.

non-food retail stores

applies to facility space used for the retail sale of everything other than food and beverage products

vacant buildings

a building in which more floor space was vacant than was used for any single commercial activity at the time of interview. A vacant building may have some occupied floor space.

other

a building with more than 50 percent of its floor space used for commercial activities or for activities focusing on not-for-profit services in the public's interest that is not previously listed in this Appendix. Examples include entertainment, leisure and recreation buildings (arenas), shopping centres, colleges and universities.

APPENDIX D
CLIMATE ZONES

Source(s): Environment Canada, Atmospheric Environment Service, Climate Research Branch, 1998, Climate Trends and Variations Bulletin for Canada, Ottawa

In this report, the climate zone "Other" includes all other climate zones shown in the map above that are not Atlantic, Great Lakes/St. Lawrence or Pacific Coast.

Notes