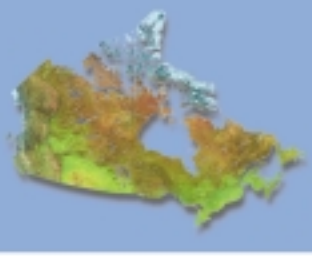
2003



Consumption of Energy Survey for Universities, Colleges and Hospitals

Detailed Report

Natural Resources Canada
Ressources naturelles Canada

Canada

This digital mosaic of Canada, produced by Natural Resources Canada (Canada Centre for Remote Sensing), is a composite of individual satellite images. The colours reflect differences in the density of vegetation cover: bright green for dense vegetation in the humid southern regions; yellow for semi-arid and mountainous regions; brown for the far north where vegetation cover is very sparse; and white for the Artic regions.

Leading Canadians to Energy Efficiency at Home, at Work and on the Road

The Office of Energy Efficiency of Natural Resources Canada
strengthens and expands Canada's commitment to energy efficiency
in order to help address the challenges of climate change.

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I. Introduction

In 2004, Statistics Canada undertook, on behalf of the Office of Energy Efficiency (OEE) of Natural Resources Canada, the first Consumption of Energy Survey (CES) for universities, colleges and hospitals. This CES ties in directly with the OEE's mandate to strengthen and expand Canada's commitment to energy efficiency in order to help address the challenges of climate change.

The primary objective of this survey was to gather 2003 energy consumption data for universities, colleges and hospitals, as these are key sectors in the development of OEE programs. The data gathered through this survey will deepen our understanding of the various aspects of energy consumption in these sectors. The data will also enable Natural Resources Canada to develop and fine-tune its programs designed to support institutions and businesses as they seek to achieve greater energy efficiency and reduce their greenhouse gas emissions.

If you would like to learn more about this publication or the OEE's services, contact us by e-mail at **euc.cec@nrcan.gc.ca**.

This detailed report was prepared by Vincent Fecteau, a staff member of the Demand Policy and Analysis Division, OEE, Natural Resources Canada. Jean-François Bilodeau supervised the project, and David McNabb was the project director.

To learn more about the survey or any other topic touched on in this document, please contact:

Vincent Fecteau
Economist
Office of Energy Efficiency
Natural Resources Canada
580 Booth Street
Ottawa ON K1A 0E4

Tel.: (613) 943-9228
Fax: (613) 947-0535
E-mail: euc.cec@nrcan.gc.ca

II. Survey Findings

Abstract

- *In 2004, Statistics Canada undertook, on behalf of Natural Resources Canada, the first Consumption of Energy Survey (CES) for universities, colleges and hospitals, using 2003 as the base year. The survey's purpose was to gather data on the energy consumption of establishments in all three sectors. The data are disaggregated by energy source and region.*
- *In 2003, the universities, colleges and hospitals surveyed consumed over 100 million gigajoules (GJ): 37 million GJ by the universities, 13 million GJ by the colleges and 52 million GJ by the hospitals.*
- *The survey data can be used to calculate energy intensity for energy use per square metre, per student or per bed. Colleges presented the lowest intensity, with energy use at 1.48 GJ/m^2. Universities used, on average, 2.04 GJ/m^2; hospitals, 2.65 GJ/m^2.*
- *When energy intensity is expressed as energy use per student or per bed, the data show that universities consumed 49 GJ per student, compared with 29 GJ for colleges. Hospitals consumed 660 GJ per bed.*
- *British Columbia and the Territories presented the lowest average energy intensity levels for all regions of Canada. At the other end of the scale, the Prairies had the highest energy intensity levels.*

In 2003, universities, colleges and hospitals consumed more than 100 million gigajoules (GJ), which equals the average annual energy use of 870 000 Canadian households, or over half of the private dwellings in Toronto[a]. Hospitals accounted for 51 percent of the total energy consumption of all three sectors, compared with 36 percent for universities and 13 percent for colleges. In the following sections, the energy consumption of each of the three sectors surveyed is detailed.

A. UNIVERSITIES

The survey population of university campuses was defined using North American Industry Classification System (NAICS) code 611310 and extracted from a list of university campuses provided by Statistics Canada's Public Institutions Division, with the university campus as the statistical unit. The survey covered 123 university campuses. Viewed regionally, the CES covered 23 campuses in the Atlantic region, 22 in Quebec, 37 in Ontario, 30 in the Prairies, and 11 in British Columbia and the Territories.

Table 1 presents a breakdown of the university energy consumption data – in gigajoules – by region.

In 2003, the universities consumed nearly 37 million GJ, an amount equal to the annual average consumption of approximately 320 000 Canadian households, or of all the private

[a] *The equivalent of each sector's energy consumption for number of households was calculated using the energy intensity (GJ/household) index established for 2002 by the Office of Energy Efficiency in the* Energy Use Data Handbook*, June 2004. Private dwelling data are taken from the 2001 Census.*

Table 1

University energy consumption (GJ), 2003

Region	Electricity	Natural gas	Heavy fuel oil	Diesel	Other middle distillates	Propane	Steam	Wood	Total
Atlantic	1 011 100 A	x	2 137 846 A	15 548 D	428 298 B	9 124 A	26 511 C	x	**3 628 427 A**
Quebec	2 452 002 A	3 671 017 A	369 294 B	1 193 B	65 222 B	10 878 B	51 864 B	x	**6 621 471 A**
Ontario	3 881 060 A	10 005 331 A	74 774 D	9 710 C	38 162 D	x	99 265 B	x	**14 108 302 A**
Prairies	3 103 865 A	6 289 870 A	F	7 782 B	18 186 D	F	F	x	**9 604 469 A**
British Columbia/ Territories	1 025 850 A	1 864 731 A	45 628 C	1 186 B	x	19 772 C	2 924 C	x	**2 960 091 A**
Total	**11 473 877 A**	**21 830 950 A**	**2 705 318 A**	**35 418 B**	**549 867 A**	**83 922 C**	**243 408 A**	**x**	**36 922 760 A**

The letter to the right of each estimate indicates its quality, as follows: A – excellent, B – good, C – acceptable, D – use with caution, F – too unreliable to be published, and x – not reported in compliance with the confidentiality provisions of the *Statistics Act.*

dwellings in the metropolitan area of Québec. The main source of energy for universities was natural gas at 59 percent, followed by electricity at 31 percent and heavy fuel oil at 7 percent.

Regionally, the universities in Quebec used proportionally less natural gas (55 percent) than those in the other regions, excluding the Atlantic region. In Ontario, natural gas represented 71 percent of university energy use, compared with 65 percent for the Prairies, and 63 percent for British Columbia and the Territories.

In the Atlantic region, heavy fuel oil represented 59 percent of university energy use. This fuel is used mainly for space heating. When compared with the other Canadian regions, the Atlantic region alone accounts for nearly 80 percent of all the heavy fuel oil consumed by universities.

Energy Intensity

In addition to the numbers on energy consumption, the survey collected data on total campus floor area and the number of enrolled students. These data were used for establishing energy intensity ratios.

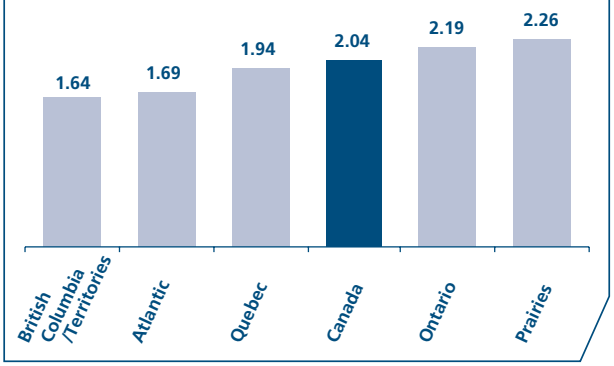
Many factors have a direct bearing on energy intensity. One of the leading factors, the weather, affects energy consumption in different ways across Canada's regions. Its impact is noticeable especially in regions where heating and cooling account for a significant portion of energy consumption. For example, the Prairies are relatively cooler than British Columbia, and the quantity of energy used for heating in the Prairies is accordingly greater.

Energy intensity also depends on the age of the building, the energy source,[b] the physical characteristics of the building, the air-conditioning settings, the floor area, the type of facilities, the degree to which energy conservation measures

[b] *For example, natural gas and heavy fuel oil are by nature more energy intensive than electricity. Their energy conversion losses are included in the CES data, but when considering electricity, the energy losses are accounted for at the primary energy use level and, accordingly, do not appear in this report. The Canadian regions using mainly natural gas (e.g. the Prairies) will therefore tend to present higher levels of energy intensity than those using mainly electricity.*

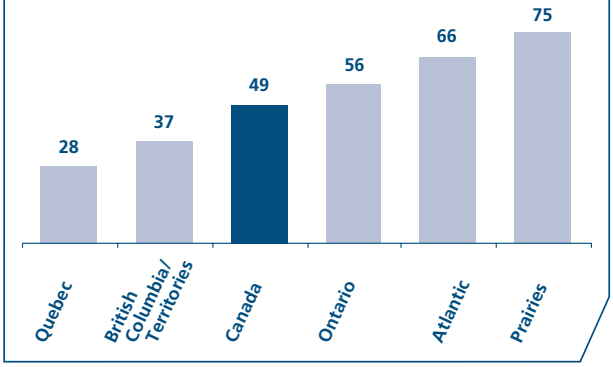
Graph 1

Energy intensity (G.J/m²), universities, 2003



Graph 2

Energy intensity (G.J/student), universities, 2003



are implemented, and so forth. Each factor affects the level of energy intensity independently and in its own complex way. In this study, each individual factor is not dealt with.[c] Moreover, none of these factors can alone explain the variations among the energy intensities of the Canadian regions, as described in the following sections.

Graph 1 shows, for each region, the energy intensity of universities, expressed in gigajoules per square metre (GJ/m²). Floor area is the total area of all the buildings of a sector, excluding indoor parking and mechanical areas. The average energy intensity of Canadian universities was 2.04 GJ/m². British Columbia and the Territories, and the Atlantic region, had the lowest ratios (1.64 GJ/m² and 1.69 GJ/m², respectively). The universities in Quebec had a ratio of 1.94 GJ/m², compared with 2.19 GJ/m² for Ontario and 2.26 GJ/m² for the Prairies.

The data gathered through this survey can also be used to calculate energy intensity ratios per full-time and part-time university student. These results are presented by region in Graph 2.

The average energy intensity for all universities was 49 GJ per student. The region with the lowest ratio was Quebec, with 28 GJ per student, followed by British Columbia and the Territories, with 37 GJ per student, and Ontario with 56 GJ per student. Although the Atlantic region was among the least energy intensive in gigajoules per square metre, it was one of the most energy intensive by this measure, with a ratio of 66 GJ per student. The Prairies had the highest ratio, with 75 GJ per student, more than two and a half times that of Quebec.

Greenhouse Gas Emissions

The survey did not directly gather data on greenhouse gas (GHG) emissions. However, for each of the energy sources, an emissions factor can be used to calculate the GHG emissions stemming from the energy consumption of each of the sectors.[d] The quantity of GHG emissions

[c] *Each year the OEE publishes* Energy Efficiency Trends in Canada*. This report describes how energy use is affected by the level of activity, weather, structure, level of service and energy efficiency. It may be consulted at oee.nrcan.gc.ca/neud/apd.*

[d] *To calculate the volumes of GHG emissions, we used the emissions factors calculated on a national, not regional, basis. These factors are set by Environment Canada (see* Canada's Greenhouse Gas Inventory, 1990–2001, *Environment Canada, August 2003). The GHG emissions described in this report are indirect emissions (they include emissions stemming from electricity use).*

depends not only on total energy consumption, but also on the GHG intensity of each of the energy sources. In this report, three types of GHGs are considered: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Table 2 shows, for each region, the total GHG emissions of universities associated with their three main energy sources, namely natural gas, electricity and heavy fuel oil. In 2003, the energy consumption of universities alone produced more than 2 million tonnes of GHG emissions, which is equivalent to the average annual emissions of approximately 595 000 compact cars or 389 000 sport utility vehicles.[e] Ontario universities accounted for 37 percent of the total emissions, compared with 25 percent for the Prairies, 18 percent for Quebec, 12 percent for the Atlantic region, and 8 percent for British Columbia and the Territories.

Graph 3 shows the percentage of GHG emissions attributed to each of the energy sources. The use of natural gas accounted for 54 percent of the universities' GHG emissions, compared with 34 percent for electricity and 10 percent for heavy fuel oil. Regionally, the use of natural gas accounted for 67 percent of the universities' GHG emissions in the Prairies, 57 percent in British Columbia and the Territories, 52 percent in Quebec and 50 percent in Ontario. The use of heavy fuel oil was the main source of emissions for the Atlantic region, as it accounted for 62 percent of this region's emissions.

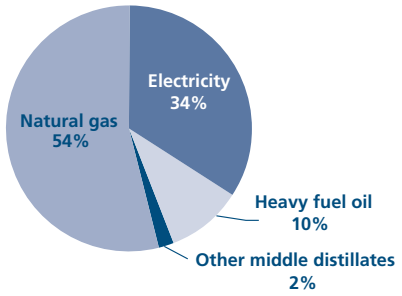
Table 2

GHG emissions (thousands of tonnes) by energy source, universities, 2003

Region	Natural gas	Electricity	Heavy fuel oil	Total (all energy sources)
Atlantic	x	62 A	156 A	**251 A**
Quebec	183 A	150 A	27 B	**366 A**
Ontario	500 A	237 A	5 D	**746 A**
Prairies	314 A	190 A	F	**514 A**
British Columbia / Territories	93 A	63 A	3 C	**160 A**
Total	**1 090 A**	**701 A**	**198 A**	**2 037 A**

Graph 3

Percentage of GHG emissions by energy source, universities, 2003



B. COLLEGES

The survey population of college campuses was defined using NAICS code 611210. Colleges, like universities, are analysed using the campus as the statistical unit. The survey considered only campuses with 20 or more employees. This threshold was applied in order to exclude associations and entities that may have this NAICS code but do not have the mandate or mission of a college (e.g. a Board of Directors).

[e] *These equivalents are based on the OEE's* 2004 Fuel Consumption Guide. *The GHG emissions of a compact car are calculated based on the fuel consumption of an automatic-transmission Honda Civic (Honda Canada Inc.); the emissions of a sport utility vehicle are calculated based on the characteristics of an eight-cylinder, automatic-transmission Ford Escape 4x4 equipped with a 4.6-litre engine (Ford Motor Company of Canada, Limited). The estimated GHG emissions are based on travelling 20 000 kilometres annually, of which 55 percent is city driving and 45 percent is highway driving. With these parameters, a Honda Civic annually uses 1393 litres of fuel and thereby produces about 3.4 tonnes of GHGs. A Ford Escape annually uses 2129 litres of fuel and produces about 5.2 tonnes of GHGs.*

Table 3

College energy consumption (GJ), 2003

Region	Electricity	Natural gas	Heavy fuel oil	Diesel	Other middle distillates	Propane	Steam	Wood	Total
Atlantic	263 064 A	F	x	F	319 237 A	12484 C	x	x	**676746 A**
Quebec	1 492 404 A	2 063 214 A	x	6 033 B	48 803 A	27 424 C	54 289 C	x	**3 692 166 A**
Ontario	1 295 386 A	1 647 780 A	x	4 004 C	20 305 B	709 C	21 485 C	x	**2 989 670 A**
Prairies	971 224 A	2 482 016 A	x	10 053 B	x	6 553 D	1 060 D	x	**3 470 906 A**
British Columbia/ Territories	768 267 A	1 328 013 A	x	45 844 B	x	5 499 C	14 749 C	x	**2 162 372 A**
Total	4 790 346 A	7 554 273 A	x	114 644 B	388 345 A	52 669 B	91 582 B	x	12 991 860 A

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The Consumption of Energy Survey (CES) covered 228 college campuses. Viewed regionally, the CES covered 38 campuses in the Atlantic region, 78 in Quebec, 43 in Ontario, 33 in the Prairies and 36 in British Columbia and the Territories. It should be noted that the colleges in Quebec, also known as cégeps, have a more extensive mandate than those in the other regions. Cégeps offer both collegiate and pre-university programs, which is not the case in the other Canadian regions. This situation explains the large number of campuses in Quebec, which account for more than one third of the campuses surveyed.

Table 3 shows a breakdown of the college energy consumption data by region. In 2003, colleges consumed nearly 13 million GJ, an amount equal to the annual average consumption of approximately 113 000 Canadian households, or of all the private dwellings in a city the size of Windsor, Ontario.

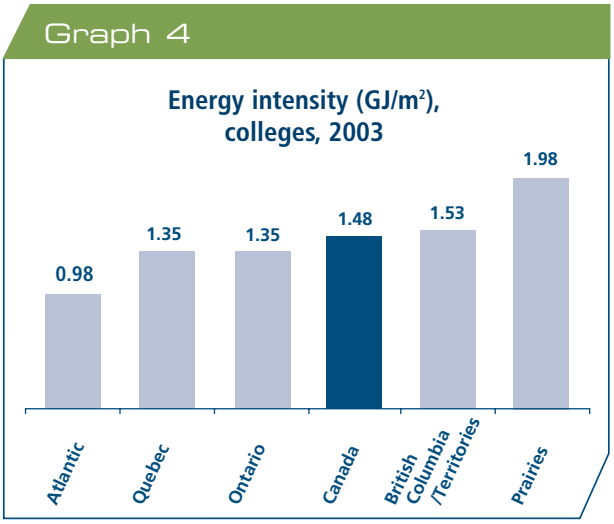
Natural gas represented 58 percent of the colleges' total energy use, followed by electricity at 37 percent and other middle distillates at 3 percent. Regionally, natural gas accounted for 72 percent of college energy use in the Prairies, compared with 61 percent in British Columbia and the Territories, and 55 percent in Ontario and in Quebec.

The use of other middle distillates was more common in the Atlantic region, where it accounted for nearly half of the total energy consumption, than elsewhere in Canada. These energy sources are used mainly for space heating.

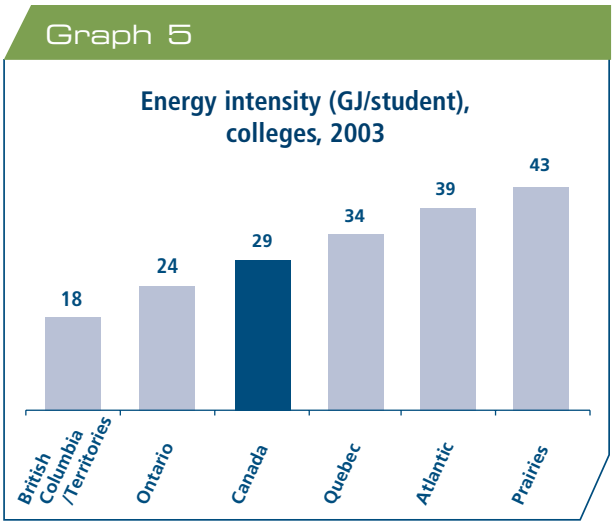
Energy Intensity

Graph 4 shows, for each region, the energy intensity of colleges, expressed in gigajoules per square metre. The average energy intensity of colleges in Canada was 1.48 GJ/m^2. Colleges were therefore less energy intensive than universities, whose average energy intensity was 2.04 GJ/m^2. This gap between the gross ratios stems in part from the dissimilar vocation of the two types of institutions: colleges focus more on teaching, whereas universities often focus more on research. The facilities and equipment therefore differ significantly between these sectors.

Graph 4



Graph 5



The Atlantic region was the least energy intensive of all Canadian regions, with a ratio of 0.98 GJ/m². Quebec and Ontario both had ratios of 1.35 GJ/m², compared with 1.53 GJ/m² for British Columbia and the Territories, and 1.98 GJ/m² for the Prairies.

The comparative results change considerably, however, when another measure of energy intensity is used, namely energy consumption per full-time and part-time college student. Graph 5 shows, for each region, the energy intensity of colleges, expressed in gigajoules per student. The average energy intensity for all colleges in Canada was 29 GJ per student. While British Columbia and the Territories rank above the average for all colleges when energy intensity is expressed in gigajoules per square metre, the same region proved to be the least energy intensive from this perspective, with 18 GJ per student. Ontario and Quebec had ratios of 24 and 34 GJ per student, respectively. In gigajoules per square metre, the Atlantic region was the least energy intensive. Again, this ranking is reversed when energy intensity is viewed as a function of the number of students. The Atlantic region was well above the Canadian average, with a ratio of 39 GJ per student. Lastly, the Prairies were the most energy intensive, with energy consumption at 43 GJ per student.

Greenhouse Gas Emissions

The energy consumption data from the survey can be used to calculate the colleges' GHG emissions. Table 4 shows, for each region, the GHG emissions of colleges associated with their three main energy sources, namely natural gas, electricity and other middle distillates. In 2003, the energy consumption of colleges alone produced more than 700 000 tonnes of GHGs, which is equivalent to the average annual emissions of 207 000 compact cars or 136 000 sport utility vehicles. Quebec colleges generated 28 percent of the total GHG emissions of

Table 4

GHG emissions (thousands of tonnes) by energy source, colleges, 2003

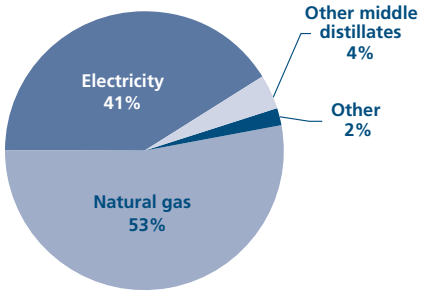
Region	Natural gas	Electricity	Other middle distillates	Total (all energy sources)
Atlantic	F	16 A	23 A	**45 A**
Quebec	103 A	91 A	4 A	**200 A**
Ontario	82 A	79 A	1 B	**163 A**
Prairies	124 A	59 A	x	**184 A**
British Columbia/ Territories	66 A	47 A	x	**117 B**
Total	**377 A**	**293 A**	**28 A**	**710 A**

Canada's colleges. The Prairies followed at 26 percent of the total GHG emissions. Ontario produced 23 percent of the GHG emissions, compared with 16 percent for British Columbia and the Territories, and 6 percent for the Atlantic region.

Graph 6 shows the percentage of GHG emissions attributed to each of the energy sources for the college sector. The use of natural gas accounted for 53 percent of the GHG emissions, compared with 41 percent for electricity and 4 percent for other middle distillates. Regionally, the use of natural gas accounted for 67 percent of the GHG emissions in the Prairies, 57 percent in British Columbia and the Territories, 52 percent in Quebec and 50 percent in Ontario. The use of other middle distillates was the main source of emissions for the Atlantic region, as it accounted for 51 percent of this region's emissions.

Graph 6

Percentage of GHG emissions by energy source, colleges, 2003



C. HOSPITALS

The hospital complex survey population was extracted from the Business Register using the following NAICS codes: 622111 General (except paediatric) Hospitals; 622210 Psychiatric and Substance Abuse Hospitals; and 622112 Paediatric Hospitals. Only complexes with 50 or more employees were surveyed in order to exclude associations and entities that may have the NAICS code of a hospital but not the same mandate or mission (e.g. a Board of Directors). The survey covered 729 hospital complexes in Canada. Viewed regionally, the Consumption of Energy Survey (CES) covered 82 complexes in the Atlantic region, 162 in Quebec, 199 in Ontario, 196 in the Prairies, and 90 in British Columbia and the Territories.

Table 5 shows a breakdown of the hospital energy consumption data by region.

In 2003, hospitals consumed nearly 52 million GJ, an amount equal to the average annual consumption of approximately 450 000 Canadian households, or all the private dwellings of a metropolitan census area the size of Ottawa–Gatineau.

Natural gas accounted for 49 percent of the total energy use of Canadian hospitals, followed by electricity at 31 percent and heavy fuel oil at 6 percent. Regionally, natural gas accounted for nearly 60 percent of hospital energy use in the Prairies and in British Columbia and the Territories, 55 percent in Ontario, and 44 percent in Quebec. Heavy fuel oil accounted for 30 percent of hospital energy use in the Atlantic region, with electricity accounting for an almost identical percentage.

Energy Intensity

The average energy intensity of hospitals in Canada was 2.65 GJ/m^2. This was the highest ratio among the three sectors covered by the survey. As was observed for colleges and universities, the gap between the gross ratios among the three sectors stems from their dissimilar vocations. The high energy intensity of hospitals is probably due to their nearly constant use of numerous types of medical equipment as well as lighting.

Graph 7 shows, for each region, the energy intensity of hospitals expressed in gigajoules per square metre. Hospitals in British Columbia and the Territories were the least energy

Table 5

Hospital energy consumption (GJ), 2003

Region	Electricity	Natural gas	Heavy fuel oil	Diesel	Other middle distillates	Propane	Steam	Wood	Total
Atlantic	1 779 243 A	280 330 B	1 761 312 B	27 309 C	1 125 024 A	6 009 B	294 382 B	533 122 B	**5 806 733 A**
Quebec	3 618 627 A	4 711 555 A	1 184 487 A	43 68 B	606 112 A	13 784 A	229 340 C	372 436 B	**10 780 026 A**
Ontario	4 956 529 A	7 893 639 A	53 535 B	596 89 C	196 957 A	69 475 D	1 006 635 B	x	**14 773 667 A**
Prairies	3 814 809 A	9 116 222 A	x	F	F	86 153 C	747 752 C	x	**15 156 774 A**
British Columbia/ Territories	1 711 813 B	3 183 718 C	F	F	F	138 927 D	F	x	**5 245 535 B**
Total	15 881 021 A	25 185 464 A	3 035 683 A	1 943 154 D	2 139 916 A	314 349 B	2 357 590 A	905 559 A	51 762 735 A

The letter to the right of each estimate indicates its quality, as follows: A – excellent, B – good, C – acceptable, D – use with caution, F – too unreliable to be published, and x – not reported in compliance with the confidentiality provisions of the *Statistics Act.*

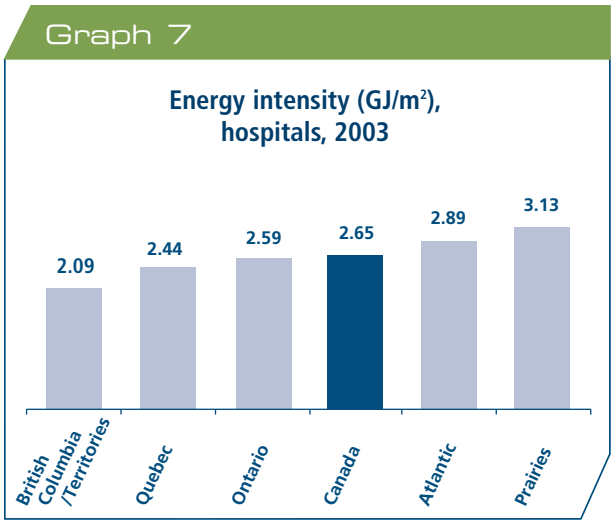
intensive, with a ratio of 2.09 GJ/m^2. Quebec and Ontario also ranked below the average for all Canadian hospitals, with ratios of 2.44 GJ/m^2 and 2.59 GJ/m^2, respectively. The Atlantic region (2.89 GJ/m^2) and the Prairies (3.13 GJ/m^2) were the most energy intensive.

If energy intensity is expressed in gigajoules per available hospital bed, the regions follow the same ranking, but the gaps between their ratios are larger. Graph 8 shows the energy intensity of hospitals in gigajoules per bed. The average energy intensity for all Canadian hospitals is 660 GJ per bed. The region of British Columbia and the Territories shows the lowest energy intensity, with consumption at 382 GJ/bed, followed by Quebec, with 550 GJ/bed, and Ontario, with 679 GJ/bed. The Atlantic region and the Prairies have much higher energy intensities, with ratios of 882 GJ/bed and 903 GJ/bed respectively.

Greenhouse Gas Emissions

By applying the emissions factors set by Environment Canada to the CES data, the GHG emissions of hospitals in Canada can be calculated. Table 6 shows, for each region, the

Graph 7



Graph 8

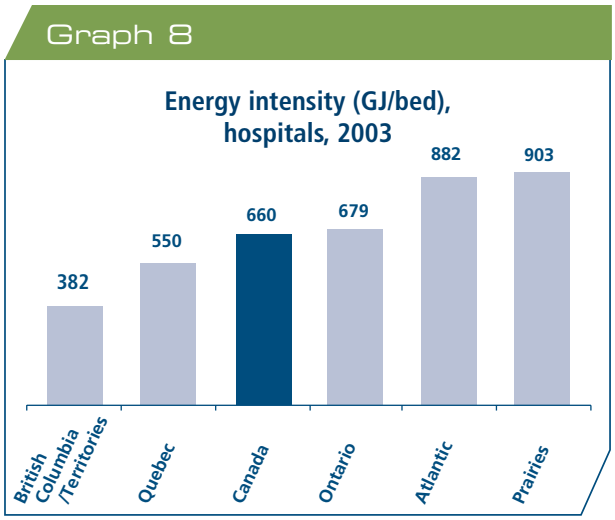


Table 6

GHG emissions (thousands of tonnes) by energy source, hospitals, 2003

Region	Natural gas	Electricity	Heavy fuel oil	Total (all energy sources)
Atlantic	14 B	109 A	129 B	**346 A**
Quebec	235 A	221 A	87 A	**598 A**
Ontario	394 A	303 A	4 B	**764 A**
Prairies	455 A	233 A	x	**796 A**
British Columbia/ Territories	159 C	105 B	F	**282 B**
Total	**1 258 A**	**970 A**	**222 A**	**2 786 A**

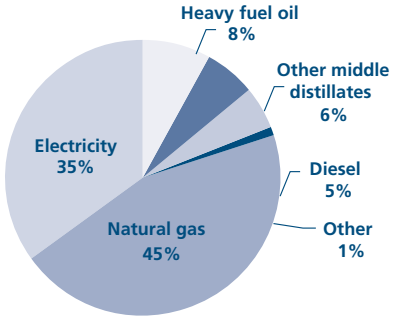
hospitals' GHG emissions associated with their three main energy sources, namely natural gas, electricity and heavy fuel oil. In 2003, the energy consumption of hospitals produced nearly 2.8 million tonnes of GHGs, which is equivalent to the average annual emissions of approximately 814 000 compact cars or 533 000 sport utility vehicles.

The use of natural gas accounted for 45 percent of the hospitals' GHG emissions, compared with 35 percent for electricity and 8 percent for heavy fuel oil. Regionally, the hospitals in the Prairies produced 29 percent of Canadian hospital emissions, even though they accounted for only 14 percent of the hospital complexes surveyed. Ontario hospitals produced 27 percent of the GHGs, compared with 21 percent for Quebec, 12 percent for the Atlantic region, and 10 percent for British Columbia and the Territories.

Graph 9 shows the percentage of GHG emissions attributed to each of the energy sources used by the hospitals. The use of natural gas accounts for 45 percent of the hospitals' GHG emissions, compared with 35 percent for electricity, 8 percent for heavy fuel oil and 6 percent for other middle distillates. Regionally, the use of natural gas was the main source of emissions for the Prairies (57 percent of all hospital GHG emissions), British Columbia and the Territories (56 percent), Ontario (52 percent) and Quebec (39 percent). Heavy fuel oil was the main source of the GHG emissions of hospitals in the Atlantic region, accounting for 37 percent of total emissions.

Graph 9

Percentage of GHG emissions by energy source, hospitals, 2003



Appendix A

SCOPE OF SURVEY AND METHODOLOGY

Target population and sample design

The Consumption of Energy Survey (CES) constitutes a census survey of university, college and hospital campuses or complexes in Canada. A questionnaire was sent to each of the campuses or complexes in order to obtain data on the consumption of electricity, natural gas, heavy fuel oil, other middle distillates, propane, steam and wood in each sector. A copy of the questionnaire can be obtained from Statistics Canada.

The questionnaire also asked for data on the floor area of campuses or complexes, as well as the number of hospital beds or students enrolled at the universities and colleges. These data are used to calculate energy intensity indices for each of the sectors covered by the survey. In this analysis, gross energy intensity is used. For example, the gross energy intensity for a region in a specific sector is defined as the total energy consumption of all campuses or complexes of the sector, divided by the total gross floor area of the campuses or complexes consuming energy. This report does not consider average energy intensity, i.e. the average of the intensities of all campuses or complexes, which can be used to compare individual campuses or complexes.

The survey population was extracted from comprehensive lists developed or used by Statistics Canada. A questionnaire was sent in January 2004 to 1098 campuses and complexes. The initial survey frame comprised 126 university campuses belonging to 111 institutions, 230 college campuses belonging to 178 institutions, and 742 hospital complexes. There were 763 respondents, 325 refusals, non-responses or partial responses, and 61 out-of-scope units. The response rate was 70 percent. The data were therefore estimated from 95 university campuses belonging to 86 institutions, 168 college campuses belonging to 138 institutions, and 500 hospital complexes.

Validation of data and imputation

Control rules ensured the validity and internal consistency of responses. The data were reviewed manually. No data were imputed. An adjustment was made for non-response (refusals and unable to locate) and responses that could not be used.

To that end, each campus and complex was attributed a weighting coefficient indicating how many campuses or complexes of the population are represented by each statistical unit. The CES is a census: each unit has an initial weight of one (1). An adjustment of the weighting was applied to compensate for unresolved responses. After removing institutions that no longer operated and weighting the respondents' data, this survey covers 123 university campuses, 228 college campuses and 729 hospital complexes.

Data sharing and confidentiality

Regional blocks ensured the quality of the data and preserved confidentiality. The Atlantic region block is Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick. The Prairies block is Manitoba, Saskatchewan and Alberta. The Canadian Territories – Yukon, Northwest Territories and Nunavut – were grouped with British Columbia for the survey.

Certain measures ensured that the estimates based on CES data are reliable enough for publication. The letters used in the tables indicate the degree of sampling error, represented by a coefficient of variation of the estimate. The letter "A" indicates that the estimate has a very low coefficient of variation; the letter "B" indicates a somewhat higher coefficient of variation, and so on. Estimates graded "A" or "B" are considered accurate enough for most uses. Data whose coefficient of variation is higher – graded "C" or "D" – are accurate enough for a few uses, but should be used with caution. The letter "F" means that the coefficient of variation of the estimate exceeds 50 percent. These estimates are not published because they may present too great a sampling error.

Appendix B

GLOSSARY

CAMPUS OR COMPLEX: The campus or complex is the statistical unit used for survey purposes: campuses for colleges and universities, and entire complex facilities for hospitals.

COLLEGE: The college survey population covered by the Consumption of Energy Survey (CES) was defined using NAICS code 611210. The survey considered only campuses with 20 or more employees.

DIESEL: All grades of low-sulphur (lower than 0.05 percent) distillate fuel used for diesel engines.

ELECTRICITY: A form of energy emanating from electric charges at rest or in movement.

ENERGY INTENSITY (FLOOR AREA): Amount of energy used by a group of units divided by the floor area of the same group of units.

ENERGY INTENSITY (NUMBER OF STUDENTS OR BEDS): Amount of energy used by a group of units divided by the number of enrolled students in the same group, or by the number of available beds in the same group.

ENERGY SOURCE: Type of energy source or fuel used by a campus or complex. For the purposes of this survey, data was collected on the use of electricity, natural gas, heavy fuel oil, diesel, other middle distillates, propane, steam and wood.

FLOOR AREA: Total gross floor area excluding indoor parking and mechanical areas of all buildings within a campus or complex, indicated in square metres.

GIGAJOULE (GJ): A measurement unit equal to 10^9 joules. The joule is the international unit for measuring energy and corresponds to the energy produced by a power of one watt flowing for one second.

GREENHOUSE GASES (GHGS): Gases that absorb and radiate heat in the lower atmosphere that otherwise would be lost in space. The greenhouse effect is essential for life on Earth since it keeps the average temperatures of the planet high enough to support plant and animal growth. The main GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Carbon dioxide is by far the most abundant greenhouse gas and accounts for 70 percent of GHG emissions.

HEAVY FUEL OIL: All grades of residual type fuels, including low-sulphur fuels, used mainly for steam and electric power generation and diesel motors. Includes fuel oil grade nos. 4, 5 and 6.

HOSPITAL: The hospital survey population covered by the CES was defined using the following NAICS codes: 622111 General (except paediatric) Hospitals, 622210 Psychiatric and Substance Abuse Hospitals and 622112 Paediatric Hospitals. Only complexes with 50 or more employees were surveyed.

HOUSEHOLD: A person or a group of people occupying one dwelling unit.

NATURAL GAS: A mixture of hydrocarbons containing mainly methane with small quantities of various gaseous hydrocarbons or hydrocarbons dissolved in crude oil, found in underground deposits.

NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS): A classification system that categorizes establishments into groups with similar economic activities. The structure of NAICS, adopted by Statistics Canada in 1997 to replace the 1980 Standard Industrial Classification (SIC) system, was developed by the statistical agencies of Canada, Mexico and the United States.

OTHER MIDDLE DISTILLATES: Includes light fuel oil (nos. 1, 2 and 3), kerosene, mineral lamp oil, stove oil, furnace fuel oil, gas oils and light industrial fuel.

PRIVATE DWELLING: A structurally separate set of living premises with a private entrance from outside the building or from a common hallway or stairway inside, such as a single-family house or apartment.

PROPANE: A normally gaseous straight-chain hydrocarbon extracted from natural gas or refinery gas streams. It can also take a liquid form.

STEAM: A gas resulting from the vaporization of a liquid or the sublimation of a solid, generated by condensing or non-condensing turbines.

TOTAL NUMBER OF STUDENTS OR BEDS: For campuses or colleges, the total number of part-time and full-time students enrolled in 2003. For hospital complexes, the total number of acute-care and long-term beds available in 2003.

UNIVERSITY: The university survey population covered by the CES was defined using NAICS code 611310.

WOOD: Wood and wood energy used as fuel, including roundwood (cord wood), lignin, wood scraps (chips) from furniture and window frame manufacturing, bark, sawdust, forestry residues, charcoal and pulp waste.

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