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This article examines trends in the average area covered by sea ice during the summer in Canada's north for a 43 year period and is the fourth in an ongoing series of short analytical articles featuring climate related data. This and future articles in the series are the product of ongoing collaboration among Statistics Canada, Environment Canada and Natural Resources Canada.

Consumption-related greenhouse gas emissions in Canada, the United States and China

Although the location of greenhouse gas (GHG) emissions is not important as far as their contribution to global warming is concerned, it can be useful to know how final domestic expenditures on products and services in Canada cause emissions in other countries and conversely, how final expenditures elsewhere cause emissions in Canada. This article uses a novel multi-regional input-output (MRIO) model to trace the connections between domestic final expenditures on goods and services in one country and the resulting GHG emissions in another.

Use and disposal of compact fluorescent lights by Canadian households

This study looks at the use and disposal of compact fluorescent lights (CFLs) in 2009, using data from the Households and the Environment Survey. In 2009, more than 7 out of 10 households in Canadian census metropolitan areas had CFLs.

Statistics Canada Statistique Canada

Canada

Selected Canadian environment, economic and social indicators

This table highlights a few environment, economic and social indicators. Setting them side-by-side starts to illuminate the relationships that exist among these three areas. More indicators can be found in the section "Canadian environment, economic and social indicators."

Table 1
Selected Canadian environment, economic and social indicators

	Period	Percentage change
		percent
Population	2010 to 2011	1.0
Gross domestic product, monthly	September 2011	0.2
Greenhouse gas emissions	2008 to 2009	-5.7
Particulate matter ($PM_{2.5}$) [1]	2000 to 2009	..
Ground-level ozone (median percentage change per year)	1990 to 2009	0.5
Natural resource wealth	2009 to 2010	23.4

1. Trend not statistically significant.

Source(s): Statistics Canada, CANSIM tables 051-0001 and 378-0005 (accessed November 8, 2011). Statistics Canada, 2011, *Gross Domestic Product by Industry*, Catalogue no. 15-001-X. Environment Canada, 2011, *National Inventory Report 1990-2009: Greenhouse Gas Sources and Sinks in Canada - Executive Summary,* Catalogue no. En81-4/1-2009E-PDF. Environment Canada, 2011, *Environmental Indicators*, *www.ec.gc.ca/indicateurs-indicators/default.asp?lang=EnXXn=ED311E59-1&offset=6&toc=show* (accessed November 8, 2011).

Sea ice trends in Canada

Mark Henry, Environment Accounts and Statistics Division

This article examines trends in the average area covered by sea ice during the summer in Canada's north over a 43 year period (1968 to 2010). Trends of total (all) and multi-year (older than one year) sea ice are reported. Time series data were analysed for nine sea ice regions and three shipping route regions for total ice cover and five sea ice regions and two shipping route regions for multi-year ice cover (Maps 1 and 2).

Total ice cover represents the area covered by all sea ice and multi-year ice cover is the area covered by older ice which has survived at least one summer's melt.[1] Multi-year ice poses a particular threat to ships and navigation.

The summer season is defined as the period from June 25 to October 15 for those sea ice regions found in the Canadian Arctic domain and from June 19 to November 19 for the regions in the Hudson Bay domain (Textbox "**Background and methodology**" and Map 1).

An ongoing data collaboration

This article is the fourth of an ongoing series in *EnviroStats* showcasing data related to Canada's climate and the impacts of climate change. The series focuses on short statistical analyses of climate-related data. To date, the series has included trend analysis on glacier mass balance, temperature and precipitation. Previous articles can be found at *www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-002-X&chropg=1&lang=eng*.

The articles in the series are the product of an ongoing collaboration between Statistics Canada, Environment Canada and Natural Resources Canada.

Data featured in the articles will be made available through the Statistics Canada website, both in free CANSIM data tables and through new articles re-examining trends in the data every few years.

Sea ice is considered by the World Meteorological Organization-Global Climate Observing System to be an Essential Climate Variable.[2] Sea ice is also one of several variables used to support the work of the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC).[3]

1. Environment Canada, Canadian Ice Service, 2011, *Ice Glossary*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=501D72C1-1* (accessed in May 2011).
2. Global Climate Observing System, 2011, *Global Climate Observing System*, *www.wmo.int/pages/prog/gcos/index.php?name=EssentialClimateVariable* (accessed June 1, 2011).
3. Global Observing Systems Information Center, 2011, *GCOS Essential Climate Variables (ECV) Data & Information Access Matrix*, *http://gosic.org/ios/MATRICES/ECV/ecv-matrix.htm* (accessed June 20, 2011).

Background and methodology

Time series data used for this article were derived from weekly sea ice charts produced by the Canadian Ice Service (CIS) and disseminated through their Canadian Ice Service Digital Archive.[4] The sea ice charts were produced using a combination of aerial surveys, surface observations, airborne and ship reports, and remotely sensed (satellite) data.[5] The ice charts were then compiled into a time series by the Climate Processes Section of the Climate Research Division at Environment Canada, with minor corrections made to the early years in the data record to improve quality and ensure homogeneity through the time series.[6,7]

The average area covered by sea ice is expressed in square kilometres and the rate of change is expressed as the absolute change in sea ice coverage per decade and as a percentage relative to the first year of the time series (1968). The rate of change is based on the overall decline in the linear trend.

The nine sea ice regions reflect geographies delineated and used by the CIS and are based upon the type of ice as well as climate, bathymetric, current and ocean temperature conditions. The regions are spread across two domains, the Arctic Domain and the Hudson Bay Domain. In addition, three regions are included that cover northern shipping routes.

The summer season was chosen for the time series as data are more extensive during this time period. Historically, sea ice charts have been generated to support the shipping season, which is mainly focussed on the summer and not the winter. Winter charts have been produced for some areas and periods of time, most notably after 1980, but are less comprehensive in temporal and geographic coverage.[8]

The time series data were tested for the presence of serial correlation and for anomalous observations (outliers). A Statistical Analysis Software (SAS) procedure, PROC ARIMA, was used to compute the overall trend. The PROC ARIMA process produces a linear trend and the associated significance level adjusted for any existing serial correlation and anomalous observations.[9] All of the linear trends shown are statistically significant.[10]

Results

Sea ice regions

Total (all) sea ice

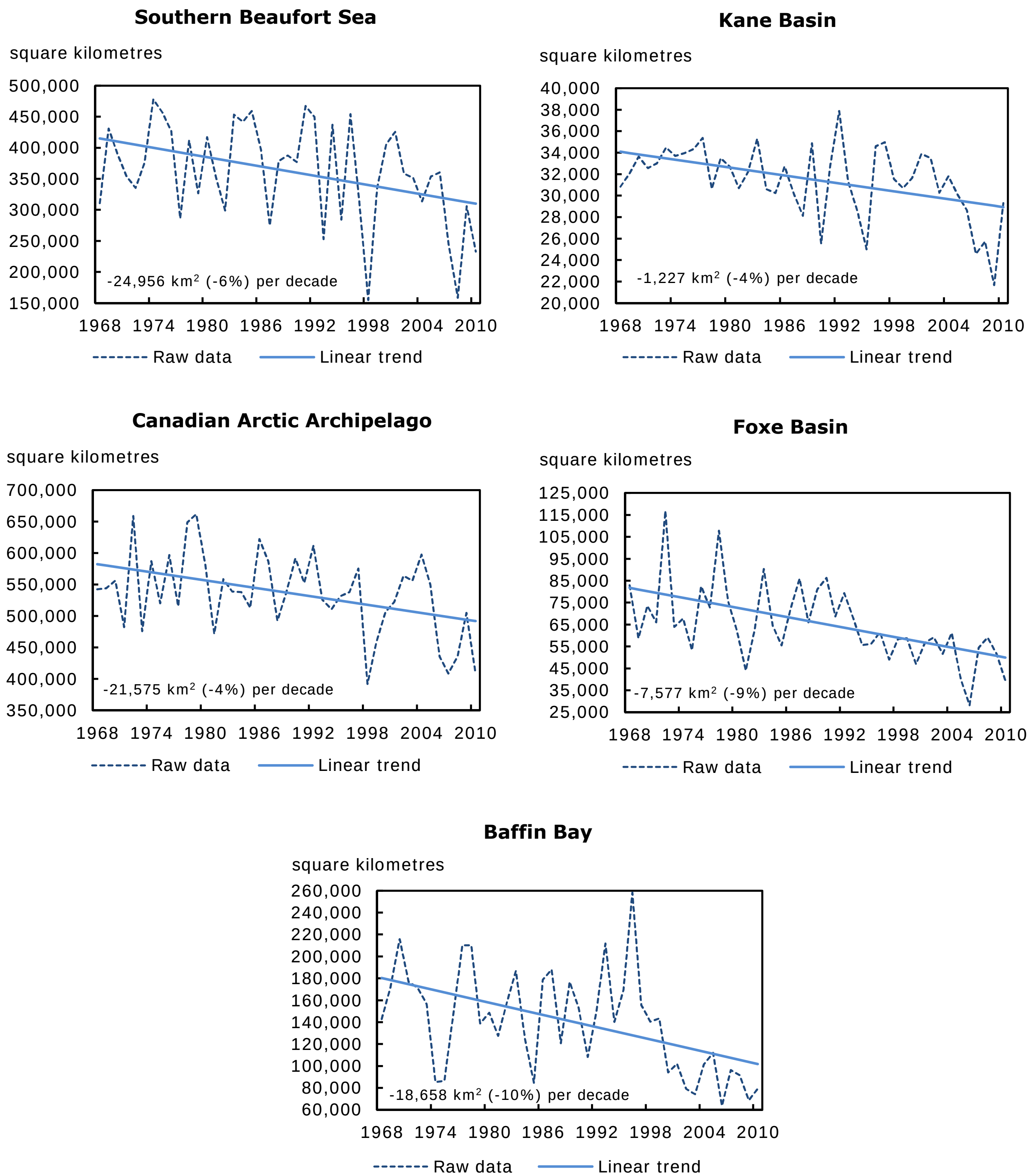
All regions showed decreases in summer coverage over the study period for total sea ice (Charts 1 and 2, and Table 2). The largest rates of decline were seen in the five southern and eastern regions: Northern Labrador Sea (1,536 km^2, or 17%, per decade), Hudson Strait (4,947 km^2, or 16%, per decade), Davis Strait (6,581 km^2, or 14%, per decade), Hudson Bay (16,605 km^2, or 11%, per decade) and Baffin Bay (18,658 km^2, or 10%, per decade).

Smaller decreases were seen in the trends for the western and central portions of the north, an area that includes the Foxe Basin, Southern Beaufort Sea, the most northern region of Kane Basin and the Canadian Arctic Archipelago (Table 2).

During the study period, six of the nine regions experienced their maximum average summer ice extent in the 1970s and seven of the nine regions experienced their minimum extents during the last five years of the study period (2005 to 2010).

4. Environment Canada, Canadian Ice Service, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).
5. A. Tivy, S.E.L. Howell, B. Alt, S. McCourt, R. Chagnon, G. Crocker, T. Carrieres, and J.J. Yackel, 2011, "Trends and variability in summer sea ice cover in the Canadian Arctic based on the Canadian Ice Service Digital Archive, 1960-2008 and 1968-2008," *Journal of Geophysical Research*, Vol. 116, C03007.
6. A. Tivy, S.E.L. Howell, B. Alt, S. McCourt, R. Chagnon, G. Crocker, T. Carrieres, and J.J. Yackel, 2011, "Trends and variability in summer sea ice cover in the Canadian Arctic based on the Canadian Ice Service Digital Archive, 1960-2008 and 1968-2008," *Journal of Geophysical Research*, Vol. 116, C03007.
7. Time series data for this article were produced by Dr. Stephen Howell of the Climate Research Division of Environment Canada.
8. A. Tivy, S.E.L. Howell, B. Alt, S. McCourt, R. Chagnon, G. Crocker, T. Carrieres, and J.J. Yackel, 2011, "Trends and variability in summer sea ice cover in the Canadian Arctic based on the Canadian Ice Service Digital Archive, 1960-2008 and 1968-2008," *Journal of Geophysical Research*, Vol. 116, C03007.
9. To enquire about the statistical analysis used in this article, contact the Information Officer (613-951-0297; *environ@statcan.gc.ca*), Environment Accounts and Statistics Division.
10. Statistically significant linear trends at the 95% confidence level or above.

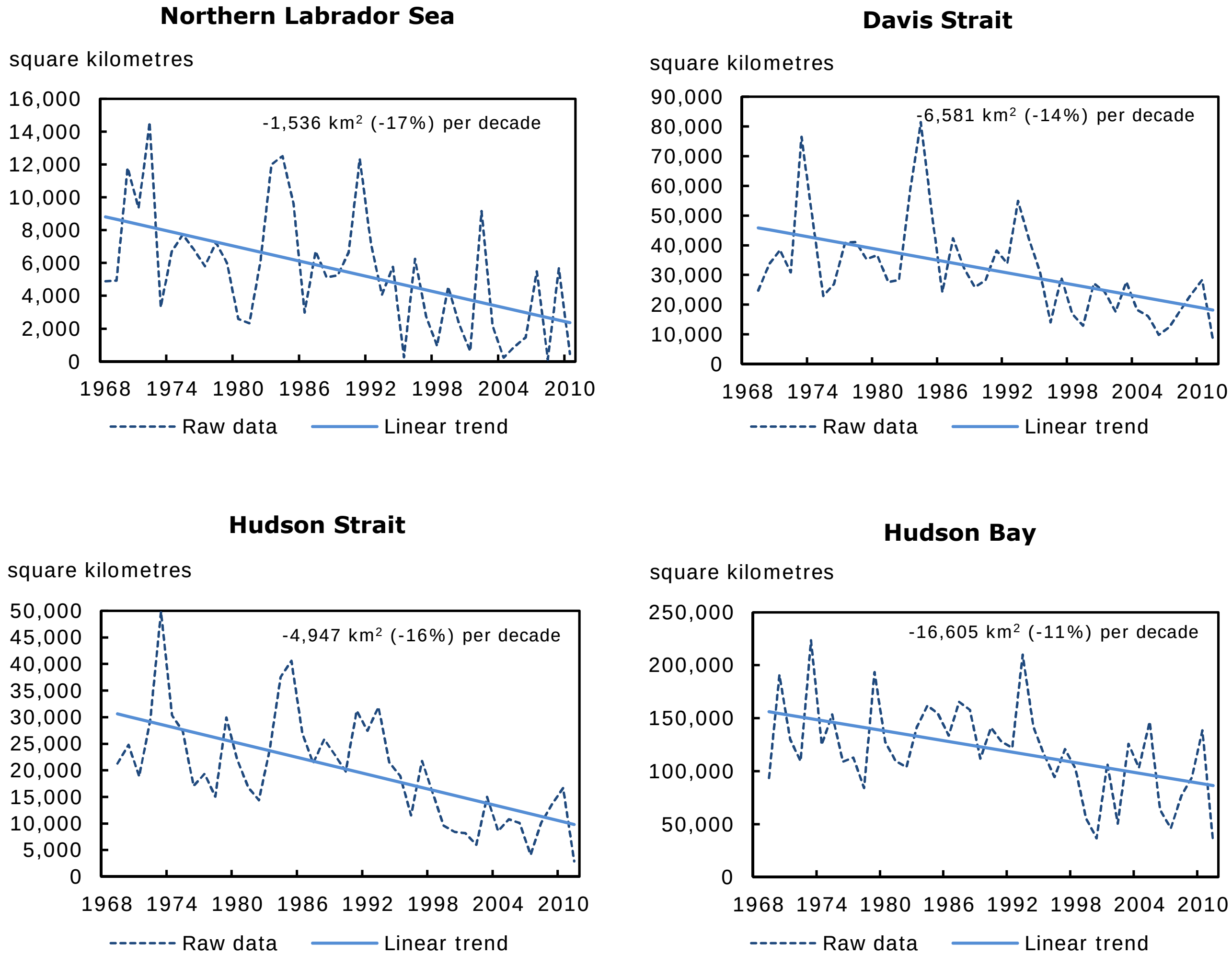
Chart 1
Average area covered by total (all) sea ice during summer from 1968 to 2010 for sea ice regions of Arctic Domain



Note(s): Note different scales on y-axis.
Source(s): Environment Canada, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).

Chart 2

Average area covered by total (all) sea ice during summer from 1968 to 2010 for sea ice regions of Hudson Bay Domain



Note(s): Note different scales on y-axis.
Source(s): Environment Canada, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).

Table 2
Change in area covered by sea ice during summer from 1968 to 2010

	Sea ice					
	Total (all)			Multi-year (older than one year)		
	Absolute change per decade	Change per decade relative to 1968	Overall change (1968 to 2010)	Absolute change per decade	Change per decade relative to 1968	Overall change (1968 to 2010)
	square kilometres	percent		square kilometres	percent	
Sea ice region						
Arctic Domain						
Southern Beaufort Sea	-24,956	-6	-25	NS	NS	NS
Canadian Arctic Archipelago	-21,575	-4	-16	NS	NS	NS
Baffin Bay	-18,658	-10	-43	-385	-21 [1]	-89 [1]
Kane Basin	-1,227	-4	-15	NS	NS	NS
Foxe Basin	-7,577	-9	-39	NS	NS	NS
Hudson Domain						
Hudson Bay	-16,605	-11	-45	...	...	...
Hudson Strait	-4,947	-16	-68	...	...	...
Davis Strait	-6,581	-14	-60	...	...	...
Northern Labrador Sea	-1,536	-17	-73	...	...	...
Shipping route region						
Northwest Passage - North Route	NS	NS	NS	NS	NS	NS
Northwest Passage - South Route	-6,986	-6	-25	NS	NS	NS
Arctic Bridge	-14,147	-15	-61	...	...	...

NS Linear trend is not statistically significant at the 95% confidence level.
1. Multi-year ice only covers a very small part of this region.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

Multi-year ice

A decrease of 385 km^2 (21%) per decade was seen in summer coverage of multi-year sea ice in the Baffin Bay region (Chart 3). This represents the largest decline of all time series in the study but it should be noted that multi-year ice only covers a very small part of this region.

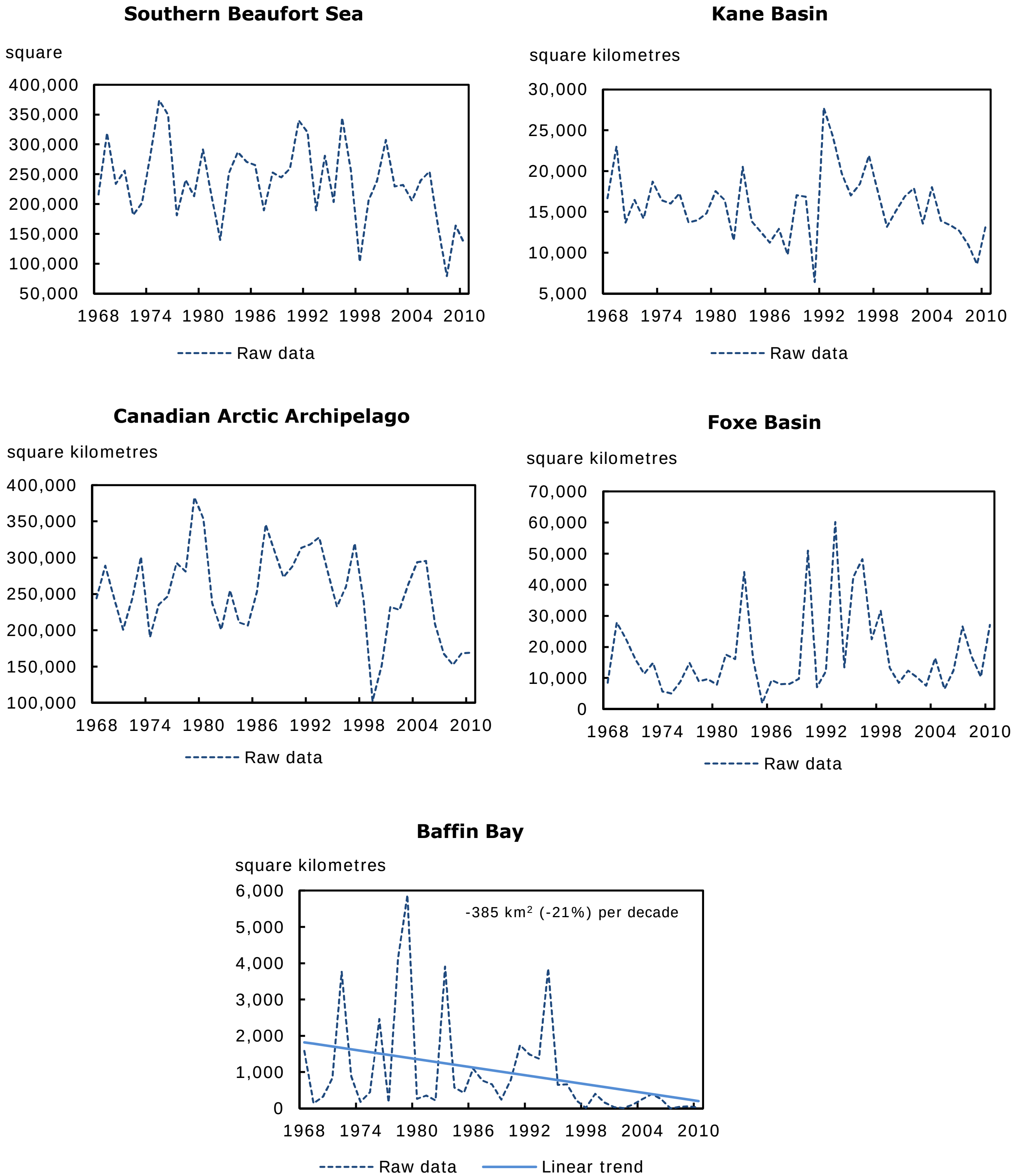
Results did not indicate statistically significant trends for the Canadian Arctic Archipelago, Beaufort Sea, Foxe or Kane Basin regions and multi-year ice is not present in the other four regions.

Shipping route regions

Two of the shipping route regions cover the north and south routes of the Northwest Passage that link the Atlantic and Pacific oceans. The third region is the Arctic Bridge, which covers the Canadian portion of a route linking North American markets to Eurasian markets via the ports of Churchill, Manitoba and Murmansk, Russia.

The presence of sea ice significantly limits navigation through these northern channels. When navigable the Arctic Bridge shipping route can save days over a St. Lawrence Seaway passage. If it were commercially navigable, the Northwest Passage could cut thousands of kilometres off the journey from Europe to Asia via the Panama Canal. The Northwest Passage shipping routes are usually blocked by sea ice during all seasons, though both were navigable in late summer and early fall of 2007.

Chart 3
Average area covered by multi-year sea ice during summer from 1968 to 2010 for sea ice regions of Arctic Domain



Note(s): Note different scales on y-axis. For charts with no linear trend line indicated the trend is not statistically significant at the 95% confidence level.
Source(s): Environment Canada, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).

Total (all) ice

Two of the shipping route regions saw decreases in total sea ice cover during summer, with the Arctic Bridge (Canadian portion) declining at a rate of 14,147 km^2 (15%) per decade and the southern route of the Northwest Passage declining by 6,986 km^2 (6%) per decade (Chart 4 and Table 2).

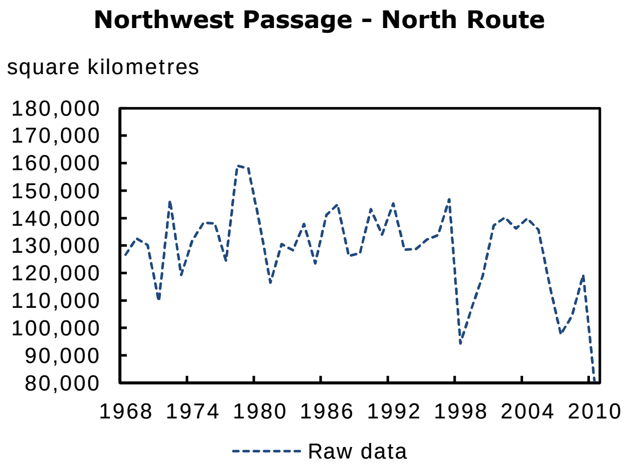
The results did not indicate a statistically significant trend for the northern region of the Northwest Passage.

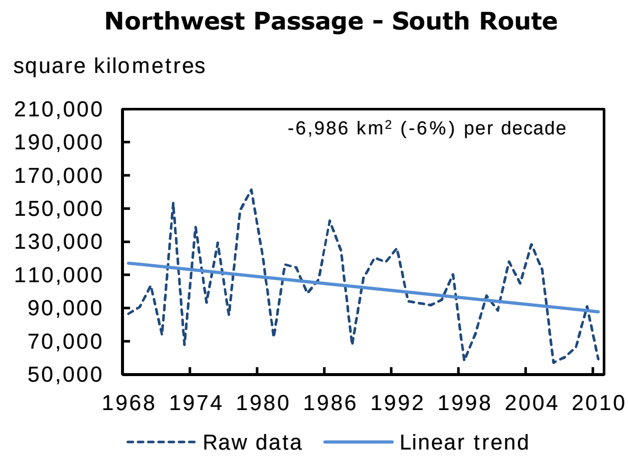
A comparison of total ice cover during the summer of 2007, a year of light ice conditions when routes were navigable in late summer and early fall, to the average for the study period indicates that the Arctic Bridge region and the southern region of the Northwest Passage had 47% and 41% less summer coverage in that year. Total sea ice cover in the northern region of the Northwest Passage was also lower than average (-24%) in 2007.

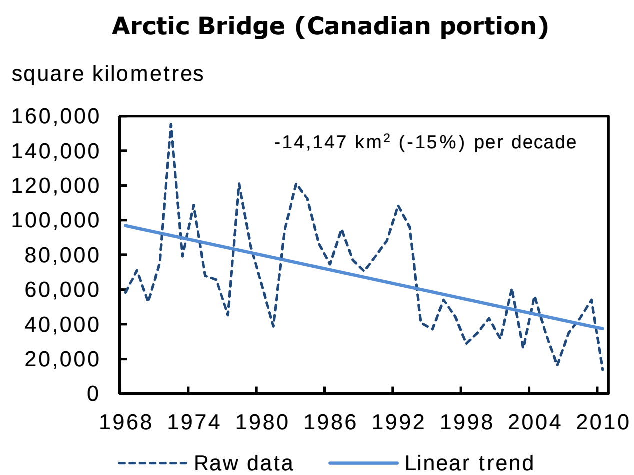
Multi-year ice

Results did not indicate statistically significant trends for the northern or southern regions of the Northwest Passage and multi-year ice is not present in the Arctic Bridge region (Chart 5).

Chart 4
Average area covered by total (all) sea ice during summer from 1968 to 2010 for shipping route regions

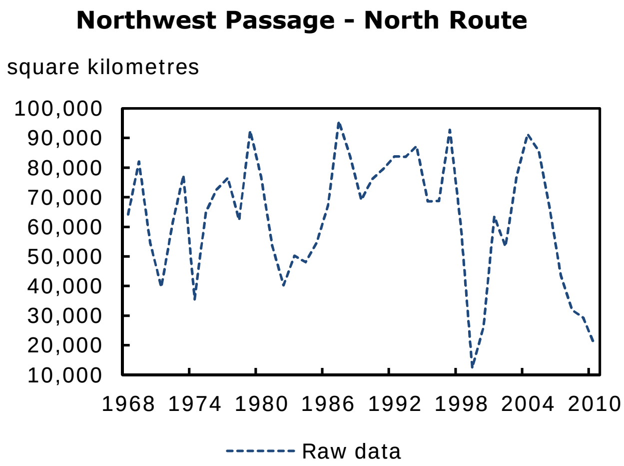


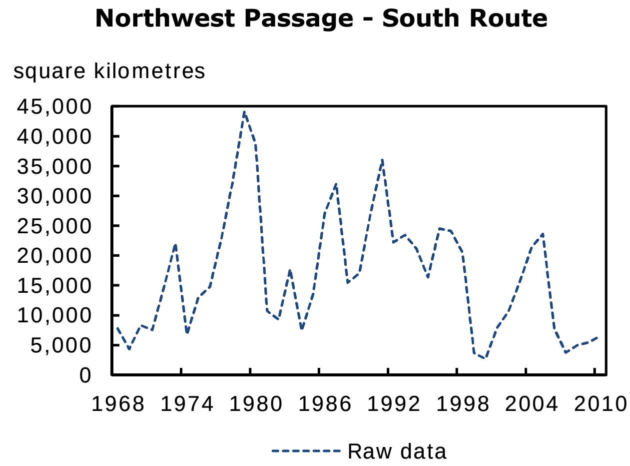




Note(s): Note different scales on y-axis. For charts with no linear trend line indicated the trend is not statistically significant at the 95% confidence level.
Source(s): Environment Canada, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).

Chart 5
Average area covered by multi-year sea ice during summer from 1968 to 2010 for shipping route regions





Note(s): Note different scales on y-axis. For charts with no linear trend line indicated the trend is not statistically significant at the 95% confidence level.
Source(s): Environment Canada, 2011, *Ice and Iceberg Charts*, *www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=B6C654BB-1* (accessed in May 2011).

Map 1
Canada's sea ice regions and domains

Source(s): Environment Canada, Canadian Ice Service.

Map 2
Canada's shipping route regions

Source(s): Environment Canada, Canadian Ice Service.
Statistics Canada, Environment Accounts and Statistics Division, 2011.

Consumption-related greenhouse gas emissions in Canada, the United States and China

Craig Gaston, Environment Accounts and Statistics Division

Although the location of greenhouse gas (GHG) emissions is not important as far as their contribution to global warming is concerned, it can be useful to know how final domestic expenditures on products and services in Canada cause emissions in other countries and conversely, how final expenditures elsewhere cause emissions in Canada. This is a "consumption perspective" on GHG emissions as opposed to the production perspective by which countries normally present their GHG emissions.

GHG emissions statistics are generally compiled according to the various sources of emissions within the geographical boundaries of a country. Emissions in other countries related to Canadian expenditures are not directly observable but can be approximated using input-output models that describe the flows of goods between industries and countries.[11] Input-output models have a long tradition at Statistics Canada and have been used with environmental extensions to estimate the energy and GHG effects of expenditures by Canadian households.[12]

This article uses a novel multi-regional input-output (MRIO) model to trace the connections between domestic final expenditures on goods and services in one country and the resulting GHG emissions in another. The model represents the economies of Canada, the United States and China. The rest of the world is not specified explicitly; only the trade flows with the rest of the world are articulated.

The model was built for the year 2002 because that is the most recent year for which detailed input-output tables are available for all three countries. There has been rapid growth of China's economy since then and additional analysis has been done here to provide some insight into the effect of increased Canadian expenditures on Chinese goods since 2002. A more recent MRIO model would be necessary to capture the fine-grained changes in the world economy over the last decade.

When using a single-country input-output model (unlike the MRIO model that has been used here), the simplifying assumption that imports have the same embodied emissions as similar goods produced in Canada is required. The Canada-U.S.-China MRIO model addresses this shortcoming. While a substantial improvement on single-country models for this reason, constructing the MRIO model requires a number of assumptions and considerable manipulation of the individual countries' input-output tables. The results presented here should, therefore, be considered experimental and taken as illustrative rather than final (see the textbox below for further details).[13]

11. Statistics Canada, 2008, *Guide to the Income and Expenditure Accounts*, Catalogue no. 13-017-X.
12. A. Clark Milito and G. Gagnon, 2008, "Greenhouse gas emissions—a focus on Canadian households," *EnviroStats*, Vol. 2, no. 4, Statistics Canada Catalogue no. 16-002-X200800410749.
13. Documentation on the MRIO model used in this study can be obtained by contacting the Information Officer, Environment Accounts and Statistics Division (613-951-0297; *environ@statcan.gc.ca*).

Some notes on terminology and data quality

"Direct" emissions refer in this study to the quantity of GHGs required to produce a good or service purchased by a final consumer and to GHGs emitted by household fuel consumption. "Indirect" emissions are those resulting from the production of intermediate goods and services required to make the final products.

For convenience, we refer to "emissions embodied in imports" as GHGs generated in a foreign country in order to produce goods and services imported into Canada. The purpose of a MRIO model is to translate final expenditures in one country into production in the countries distinguished in the model. Emissions can then be calculated by applying country-specific intensities (emissions per unit of production) to the outputs of each industry in each region.

Multi-regional models present difficult conceptual and practical problems. To keep the model manageable, we have focused only on the United States and China as they are Canada's two most important suppliers. China's volume of trade with Canada has been increasing steadily over the last decade.

The United States and China together accounted for about two-thirds of Canada's imports in 2002. China's share of Canada's imports almost doubled from 4.6% in 2002 to 8.8% in 2006, partly at the expense of the United States. It cannot be assumed that by modelling two-thirds of Canada's trade, two-thirds of our imported emissions have been modelled, but a crude estimate of the missing emissions can be made by using the U.S. model as a proxy for the rest of the world.

Even combining only three countries in a single model requires a considerable amount of data. Input-output tables of a sufficient size and quality are not available for each country every year. Although annual Canadian tables exist up to 2008, the most recent U.S. and Chinese benchmark input-output tables are for 2002. There are more recent tables available but they are smaller and of lower data quality. The MRIO model is thus based on 2002 data.

A uniform valuation of goods and services that maintains a consistent relationship between currencies and physical production is ideal, but this becomes difficult with respect to China because of the uncertainty of the exchange rates. Although market exchange rates are appropriate to convert dollars into Chinese currency, these are not necessarily compatible with the relationship between production and emissions in China. Some adjustments for purchasing power parity to take account of this problem have been made, with the assumption that the problem is inversely proportional to the export intensity of each industry.

This paper provides a consumption perspective on GHG emissions, or a consumption "footprint." From this point of view, the focus is on emissions related to *final* domestic expenditures.

It is important to note how emissions associated with trade between countries are treated in this study. The foreign emissions attributed to Canadian imports are those emissions generated in producing the goods and services purchased by *final* Canadian consumers (for example, imported food sold in supermarkets). The foreign emissions associated with *intermediate* imports[14] are excluded from the analysis except insofar as those imports end up incorporated into goods and services ultimately sold to final Canadian consumers. Similarly, the foreign emissions associated with intermediate imports that are incorporated into goods and services ultimately sold to final consumers in other countries are attributed to those other countries. This means, for example, that the emissions in the United States from producing auto parts that are imported into Canada to make a vehicle that is then exported to the United States belong to the United States in this study; these emissions appear in the U.S.-U.S. cell of Table 3. For this reason, one cannot determine the emissions related to a country's total imports from the results in this study.

It is also important to note that the MRIO used in this study is not the only model possible for estimating the GHG emissions footprint of consumption. There are a number of different approaches that can be used in doing so. Another approach that has been taken is to create an input-output model using data from the Global Trade Analysis Project (GTAP) database of the University of Purdue.[15,16] Depending on what input-output model is used and the data underlying the model, the results obtained will differ. This is unavoidable due to differences in the degree of detail with which national economies are described in the models.

The geography of greenhouse gas (GHG) emissions

Table 3 shows the geographical distribution of 2002 emissions for Canada and its two largest suppliers of goods and services. The first row shows emissions resulting from the domestic final expenditures in each region on Canadian

14. Intermediate imports are those purchased by businesses and then further processed into domestic goods and services.
15. Purdue University, 2011, *GTAP Data Bases: GTAP 7 Data Base*, *www.gtap.agecon.purdue.edu/databases/v7/* (accessed October 30, 2011).
16. R. Andrew, G. Peters and J. Lennox, 2009, "Approximation and Regional Aggregation In Multi-Regional Input-Output Analysis For National Carbon Footprint Accounting," *Economic Systems Research*, Vol. 21, no. 3, pages 311 to 335.

goods and services. In total, 689 million tonnes (Mt) of carbon dioxide equivalent (CO_2 eq) were emitted in Canada in 2002 in the process of satisfying Canadian domestic demand and demand from other countries.[17,18] Of this total, 217 Mt resulted from the production of Canadian goods and services destined for final consumers in the United States. Only 3 Mt resulted from Chinese demand for Canadian products.

The first column of Table 3 shows emissions in each region resulting from domestic final expenditures. In total, 530 Mt of GHG were emitted globally to satisfy Canadian domestic final expenditures. Of this, 401 Mt were emitted in Canada[19] while 58 Mt and 14 Mt were embodied in Canadian imports from the United States and China respectively. Only emissions embodied in imports used to satisfy final domestic expenditures are shown explicitly in Table 3. There are also foreign emissions related to Canadian exports, which are not shown explicitly, as these do not result from Canadian final expenditures. For example, the production in Canada of motor vehicles destined for U.S. consumers requires parts that are produced in the United States and then imported into Canada. The emissions resulting from producing these motor vehicle parts are included in the 6,232 Mt shown in the U.S.-U.S. cell of the table. This is appropriate because the United States is the ultimate consumer of the parts, which return in the completed vehicles, whereas Canada is only the proximate consumer.[20]

The first row of Table 3 can be broken out by the industries in Canada that contributed the most to GHG emissions and assigned to the origin of the final expenditure (Chart 6). Of note is the fact that the U.S. purchases resulted in a relatively large quantity of GHG emissions from coal-generated electricity in Canada (23.8 Mt of CO_2 eq). These are mostly indirect emissions resulting from the production in Canada of goods and services destined for export to the United States. Direct U.S. purchases of Canadian electricity generated from coal account for less than 10% of these emissions. In contrast, the real estate industry's emissions, most caused by providing heat and electricity to buildings, are dominated by Canadian purchases. (Canada's exports to China were small compared to Chinese imports so China barely appears in Chart 6.)

Table 3
Greenhouse gas (GHG) emissions related to domestic final expenditures, by region, 2002

	To				**Total**
	Canada	United States	China	Rest of World	
	megatonnes of carbon dioxide equivalent				
From					
Canada	401	217	3	68	**689**
United States	58	6,232	19	448	**6,757**
China	14	178	4,120	665	**4,977**
Rest of World	57	731	198	21,922	**22,908**
Total	**530**	**7,359**	**4,340**	**23,103**	**35,331** [1]

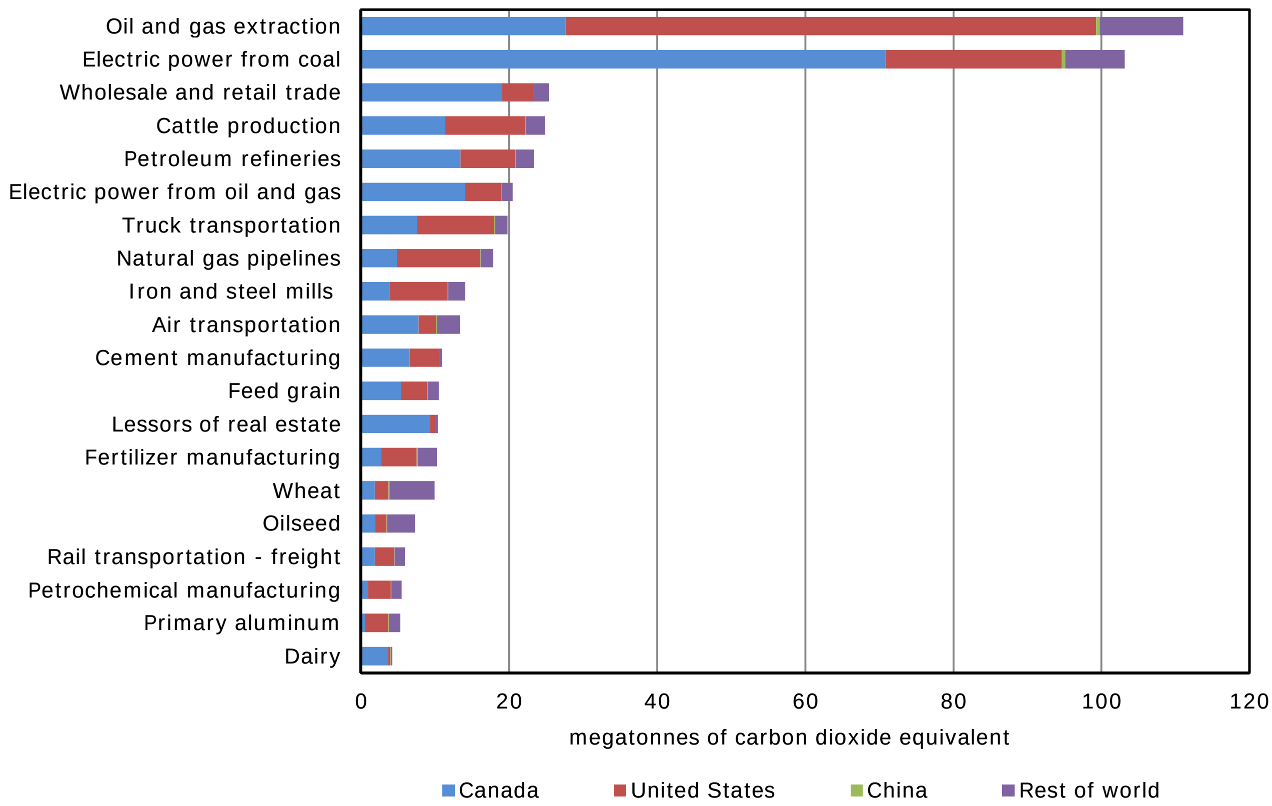
1. There is no official global CO_2 eq estimate for 2002. It was estimated based on Canada's share of 2000 global CO_2 eq emissions as cited in World Resources Institute, 2010, *Climate Analysis Indicators Tool (CAIT)*, *http://cait.wri.org* (accessed July 20, 2011). This share was assumed to be unchanged for 2002 and applied to Canada's 2002 emissions to estimate the global figure.

Note(s): Diagonal cells include emissions from direct household fuel consumption so that the sum of each row equals the country total.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

17. Statistics Canada, CANSIM table 153-0034 (accessed July 25, 2011).
18. Statistics Canada's Material and Energy Flow Accounts (MEFA) emissions estimates differ from the totals that appear in the official Environment Canada submission to the United Nations Framework Convention on Climate Change. This is due to adjustments that have to be made to *National Inventory Report* (NIR) sectoring and definitions in order to ensure consistency with the requirements of the Canadian System of National Accounts. The MEFA include only the three main GHGs, namely carbon dioxide, methane, and nitrous oxide, and do not include emissions from the decomposition or incineration of waste. The Environment Canada NIR also reports on emissions from hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Canada's total GHG emissions including these other gases were 717 Mt in 2002.
19. Note that this amount includes the direct emissions due to household use of fossil fuels.
20. The amount of U.S. GHG emissions related to U.S. purchases of Canadian automobiles is shown in Table 4 (7.5 Mt).

Chart 6
Greenhouse gas (GHG) emissions in Canada by industry and source of demand, 2002



Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

Greenhouse gas (GHG) emissions related to motor vehicle production

The purchase of motor vehicles provides a good example of how consumption in one country leads to GHG emissions in other countries. In 2002, Canadians spent $12.8 billion[21] to purchase motor vehicles produced in Canada (Table 4). This resulted in emissions of 1.7 Mt of CO_2 eq in Canada, and 1.7 Mt of CO_2 eq in the United States. In contrast, we see that U.S. purchases of their own vehicles had a relatively small impact in Canada (8.4 Mt) compared to the United States (102.7 Mt). The explanation for this is that the Canadian auto industry relied much more heavily on U.S. producers for inputs than the converse. Amongst these U.S. inputs to Canadian auto manufacturing are metal stampings, most of which were imported. The emissions from the U.S. primary metal sector required to produce those stampings are considerable. In neither Canada nor the United States did Chinese production contribute more than 10% of total emissions associated with motor vehicle purchases.

21. Producers' value, which excludes transport and trade margins.

Table 4
Greenhouse gas (GHG) emissions related to the purchase of motor vehicles, 2002

	Final demand	Emissions by country				Total
		Canada	United States	China	Rest of world	
	billions of Canadian dollars	megatonnes of carbon dioxide equivalent				
Canadian purchases of:						
Canadian motor vehicles	12.8	1.7	1.7	0.2	1.6	**5.2**
U.S. motor vehicles	23.7	0.5	5.9	0.4	8.1	**14.9**
U.S. purchases of:						
Canadian motor vehicles	51.0	7.5	6.8	0.8	4.9	**20.0**
U.S. motor vehicles	413.3	8.4	102.7	7.1	91.1	**209.3**

Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

Greenhouse gas (GHG) emissions intensities

Table 5 shows selected direct and total emissions intensities underlying the GHG calculations in the MRIO model (total emissions are defined as direct plus indirect). Not all of these industries' products are significant in Canada's imports but they all contribute, directly or indirectly, to the emissions resulting from Canadian expenditures on goods and services.

Differences in emissions intensity of electric power generation largely reflect the mix of energy sources in each country. Hydro electricity accounted for about 60% of Canada's electricity generation whereas fossil fuels accounted for only 25%.[22] In China, coal and other fossil fuels accounted for 80% of electricity generation, with coal being the dominant energy source.[23] Fossil fuels accounted for 70% of U.S. generation, but one quarter of this was from natural gas, which has much lower GHG emissions than coal per unit of electricity produced.[24]

22. Statistics Canada, 2009, *Electric Power Generation, Transmission and Distribution, 2007*, Catalogue no. 57-202-X, Table 2.
23. National Bureau of Statistics of the Peoples Republic of China, 2006, *Electricity Balance Sheet*, *www.allcountries.org/china_statistics/7_6_electricity_balance_sheet.html* (accessed August 22, 2011).
24. U.S. Energy Information Administration, 2011, *Electric Power Annual - Summary Statistics for the United States*, *www.eia.gov/cneaf/electricity/epa/epates.html* (accessed August 22, 2011).

Table 5
Greenhouse gas (GHG) emissions per dollar of production, 2002

	Direct emissions			Total emissions [1]		
	Canada	United States	China	Canada	United States	China
	kilograms of carbon dioxide equivalent per Canadian dollar					
Selected industries						
Cement manufacturing	7.2	6.2	11.2	7.9	7.1	13.5
Electric power generation	3.6	5.5	9.6	3.9	5.8	10.9
Grain farming	3.2	1.9	2.3	4.6	2.6	3.4
Cattle farming	3.1	2.5	...	4.9	4.7	...
Oil and gas extraction	1.8	0.9	0.7	2.1	1.2	1.5
Iron and steel production	1.3	1.7	5.4	2.0	2.5	8.8
Coal mining	1.2	2.1	2.0	1.5	2.5	3.3
Petroleum refining	0.6	0.6	0.3	1.7	1.4	1.5
Truck transportation	0.6	0.5	0.5	1.1	0.8	1.1
Chemical manufacturing	0.5	0.3	0.5	1.8	0.8	2.1
Textile manufacturing	0.0	0.0	0.1	0.4	0.5	1.7
Motor vehicle and parts manufacturing	0.0	0.0	0.0	0.3	0.2	1.2
Computer and electronic products	0.0	0.0	0.0	0.1	0.1	0.7

1. Includes direct and indirect emissions in Canada, the United States and China.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

China's relatively higher emissions intensities in textiles, motor vehicles and computer manufacturing reflect the higher emissions intensity of its largely coal-based electric power industry. Also, its relatively higher intensity for iron and steel production contributes to higher emissions in manufactured products.

Canada's emissions intensity for oil and gas extraction reflects the different mix of crude oil grades extracted in this country compared to the United States and China. Crude oil accounted for 20% of the rest of world's Canadian imports of GHG emissions in 2002.

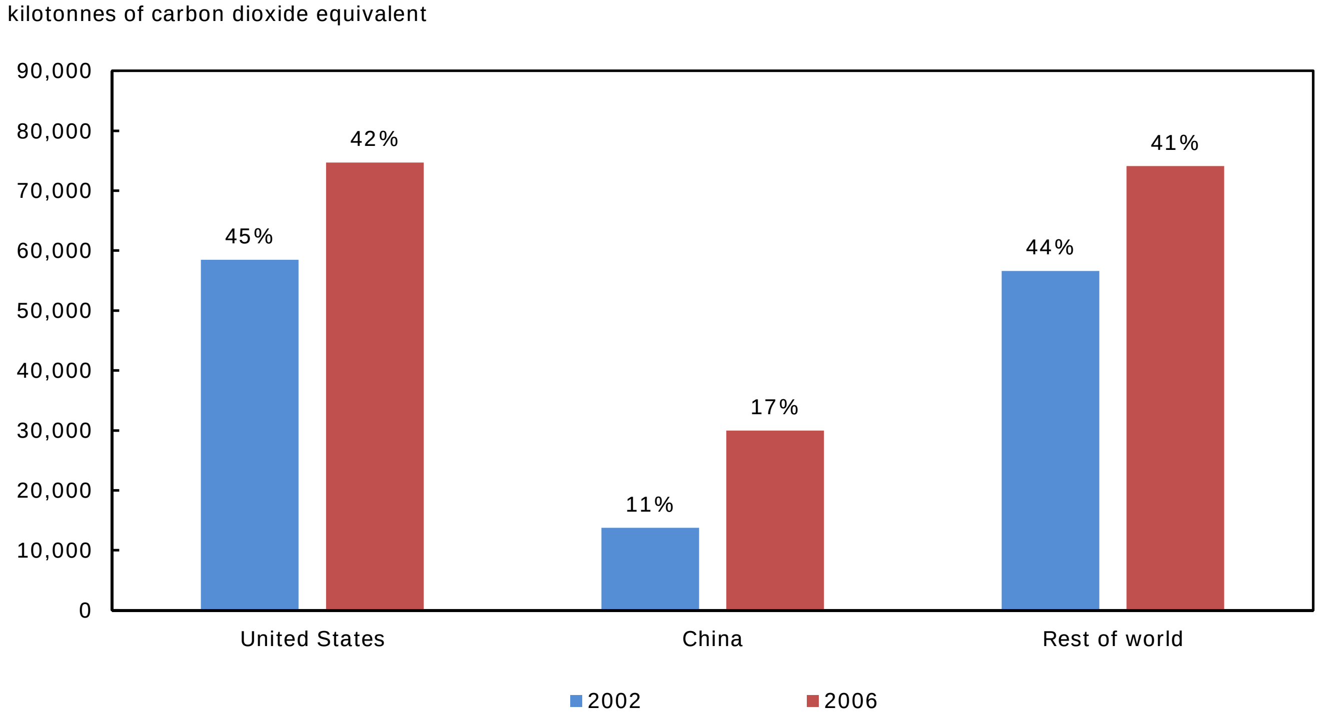
The total emissions intensities for each county reported in Table 5 reflect similar relative levels as the direct intensities. One striking exception is the ratio of Canada's total-to-direct intensity for computer and electronic products, which is considerably higher than that of the United States and China. The Canadian industry is more oriented towards assembly of components than are its two trading partners, resulting in a lower direct intensity.

A more recent perspective

A more recent perspective on Canada's imported GHG emissions resulting from domestic final expenditures can be gained by running the 2002 MRIO model using Canada's 2006 import data and domestic final expenditures. The validity of this rests on the simplifying assumption that 2002 GHG emissions intensities and industrial technologies for all regions prevailed in 2006. Of course, updating the data for all variables in the model would yield more accurate results but it is the large relative shift in the source of Canada's imports from other countries to China that stands out during this period. In the absence of more recent data, the estimates produced using this simplified approach give a good indication of the trends in Canada's embodied emissions.

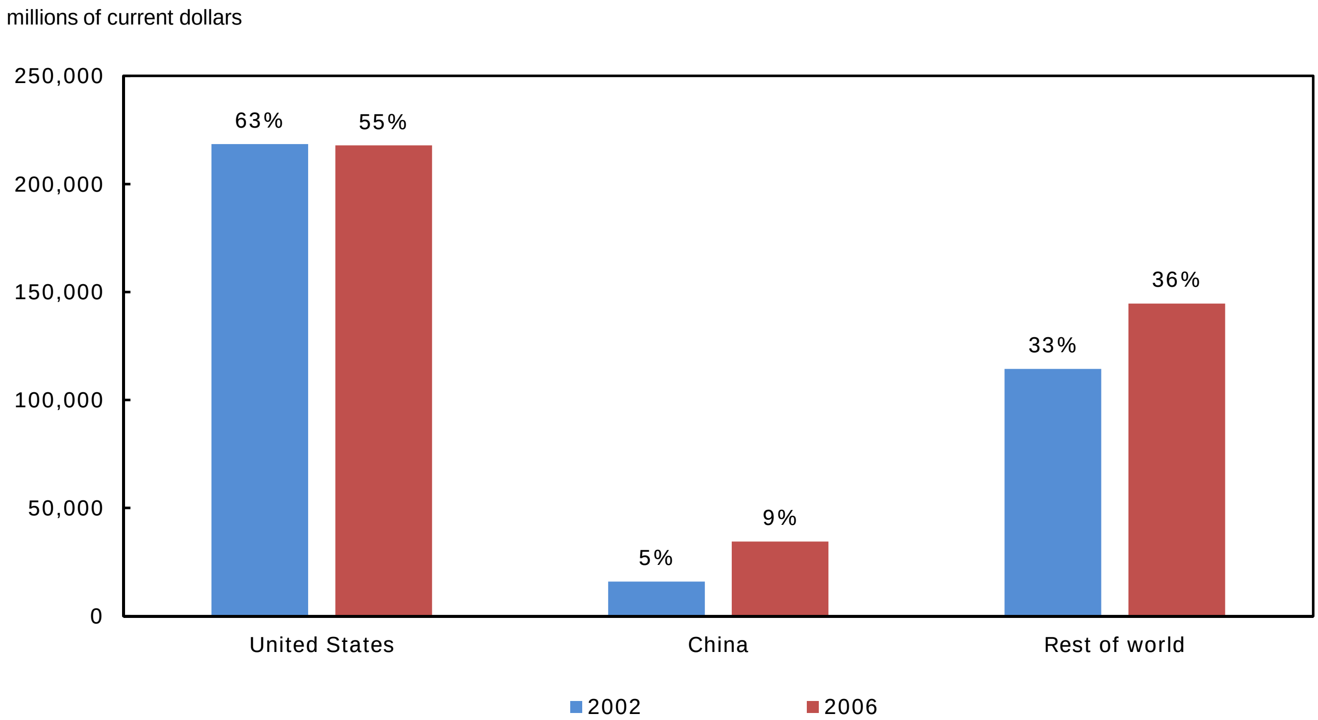
Canada's imports of embodied GHG emissions from each region increased by about the same amount, 17 Mt, between 2002 and 2006 for a total of 50 Mt. This was an increase of 39% over 2002 levels (129 Mt). China's share of the total increased from 11% to 17% at the expense of the United States and the rest of the world (Chart 7). China's share of the dollar value of Canada's merchandise imports almost doubled over the same period. The U.S. share declined by 8% due to the relative increase from other countries as well as from China (Chart 8). The relatively lower share of the value of merchandise imports from China compared to China's share of embodied GHG emissions reflects the higher GHG intensity per dollar for that country's imports compared to those from the United States and the rest of the world.

Chart 7
Canada's imported greenhouse gas (GHG) emissions related to domestic final demand



Note(s): Percentages indicate contribution of imports from each country to total imported GHG emissions.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2011, special tabulation.

Chart 8
Canada's merchandise imports



Note(s): Percentages indicate contribution of imports from each country to Canada's total merchandise imports.
Source(s): Statistics Canada, 2011, *Canadian International Merchandise Trade Database*, Catalogue no. 65F0013X.

Use and disposal of compact fluorescent lights by Canadian households

Gordon Dewis, Environment Accounts and Statistics Division

Canadian households used 520,250 terajoules (TJ) of electricity in 2007, which works out to 40 gigajoules (GJ) per household.[25] Of this, 324,993 TJ of electricity (62%) was consumed by households in census metropolitan areas (CMAs).[26,27] Using more energy-efficient lights is one way households can reduce the amount of electricity they consume and their energy costs.[28] Reductions in energy consumption can, depending on how the electricity was generated, also lead to lower greenhouse gas emissions, which play a role in global warming.

What you should know about this study

This study is based on data from the 2009 Households and the Environment Survey (HES), which was conducted as part of the Canadian Environmental Sustainability Indicators initiative. Respondents were asked to indicate whether they had any compact fluorescent lights (CFLs), fluorescent tubes, halogen lights or light-emitting diode (LED) lights. As well, they were asked if they had had any dead or unwanted CFLs to dispose of in the past year and how they disposed of them if they did.

Not all CMAs are represented in the analysis of all variables in this study as some results were suppressed for data quality reasons. The criteria for inclusion of a given CMA were that the result had to have a coefficient of variation (CV) no higher than 33.3 and at least 20 records had to have contributed to the result. In cases where fewer than 20 records contributed to a result, the value was deemed "too unreliable to be published," regardless of the CV and indicated as F in the data table. Values that had a CV between 16.5 and 33.3 (and at least 20 records contributing) are to be used with caution, which is indicated with an E in the data table.

About energy-saving lights

Conventional incandescent light bulbs are among the least energy-efficient light bulbs in use today.[29] However, there are a variety of alternative types of lights that can be used that require less energy to produce the same amount of light compared to an incandescent bulb. Compact fluorescent lights (CFLs), fluorescent tube lights, halogen lights and light-emitting diode (LED) lights are common types of energy-efficient lights.

To put things in perspective, a 100 watt (W) incandescent light will consume 0.36 GJ[30] of energy for every thousand hours it runs. A 30 W CFL generates a similar amount of light to a 100 W incandescent light, however it will only consume 0.108 GJ of energy in one thousand hours of operation. Similarly, a 13 W LED light emits a similar amount of light to a 100 W incandescent light while consuming just 0.047 GJ of energy over the course of one thousand hours.

Use of energy-saving lights

In 2009, almost 9 out of 10 households in Canadian census metropolitan areas (CMAs) (88%) had at least one type of energy-saving light (Table 6). The majority of CMA households (74%) had compact fluorescent lights (CFLs). Households in Barrie were most likely (91%) to report having had at least one CFL. Kelowna households were least likely to have CFLs, with less than 7 out of 10 (65%) reporting having one. In the province of Quebec, where the cost per kilowatt-hour (kWh) tends to be the lowest in Canada,[31] every CMA, with the exception of Sherbrooke (80%), reported uptake rates for CFLs lower than the national rate of 74%.

25. Statistics Canada, 2010, *Households and the Environment: Energy Use (2007)*, Catalogue no. 11-526-S.
26. Statistics Canada, Households and the Environment Survey: Energy Use Supplement (2007), special tabulation.
27. Census metropolitain areas (CMAs) consist of one or more municipalities situated around a major urban core. A CMA must have a total population of at least 100,000 of which 50,000 or more live in the urban core. (See: Statistics Canada, 2007, *2006 Census Dictionary*, Catalogue no. 92-566-X for more information).
28. The residential price of electricity in Canada has risen by approximately 20% between 2002 and 2010, with some provinces seeing an increase of more than 30% during this time period. See: Statistics Canada, CANSIM table 326-0020 (accessed September 1, 2011).
29. Natural Resources Canada, 2009, *Choosing Lighting Fixtures – Determine Your Needs*, *http://oee.nrcan.gc.ca/residential/personal/lighting/needs.cfm?attr=4* (accessed October 20, 2010).
30. 1 kilowatt-hour (kWh) = 0.0036 GJ
31. Statistics Canada, Consumer Prices Division, 2011, special tabulation.

Table 6
Energy-saving lights, 2009

	At least one type of energy-saving light	Compact fluorescent lights	Fluorescent tubes	Halogen lights	LED lights (excluding holiday lights)	Had dead or unwanted compact fluorescent lights (CFLs) to dispose of	Had dead or unwanted compact fluorescent lights (CFLs) to dispose of	
							Put them in the garbage [1]	Took or sent them to a depot or drop-off centre [1]
	percent							
All CMA households	**88**	**74**	**47**	**37**	**7**	**22**	**55**	**24**
St. John's	79	68	24	22	12E	19	73	F
Halifax	90	84	51	18E	13E	21E	61E	F
Moncton	85	71	37E	F	F	F	F	F
Saint John	94	82	62	26E	F	22E	F	F
Saguenay	82	71	39	45	F	24	78	F
Québec	92	68	50	59	6E	22	81	F
Sherbrooke	89	80	35	45	F	28E	F	F
Trois-Rivières	88	74	37	49	F	17E	78	F
Montréal	85	67	39	50	5E	23	57	13E
Ottawa - Gatineau	91	78	54	40	5E	26	59	21E
Ottawa - Gatineau (Quebec part)	87	70	39	48	F	23E	49E	F
Ottawa - Gatineau (Ontario part)	92	81	60	37	5E	28	62	F
Kingston	96	82	53	24	F	28	58	F
Peterborough	95	88	53	35	F	20E	F	F
Oshawa	88	78	46	30	6E	18	50	F
Toronto	86	74	50	32	6	23	48	34
Hamilton	87	79	48	29	9E	23	50E	24E
St. Catharines	94	85	57	28	9E	17	F	F
Kitchener	93	81	52	29	7E	20	59	F
Brantford	93	80	51	28E	F	15E	F	F
Guelph	94	86	38	25E	F	25E	F	51E
London	91	84	50	35	8E	23	60	F
Windsor	89	80	50	35	F	20E	53	F
Barrie	95	91	44	28	F	23E	69	F
Greater Sudbury	94	86	55	21E	F	26	F	F
Thunder Bay	93	87	55	27E	12E	28	41E	39E
Winnipeg	87	68	50	32	7E	15E	64	F
Regina	95	83	53	34	12E	22	77	F
Saskatoon	93	77	44	31	F	15E	68	F
Calgary	92	81	47	35	8E	21	65	F
Edmonton	88	75	55	29	6E	20E	32E	53E
Kelowna	71	65	34E	27E	F	F	F	F
Abbotsford	90	81	44	33E	F	15E	F	F
Vancouver	90	68	45	39	11	21	50	31E
Victoria	94	76	46	41	20E	20	74	F

1. As a percentage of CMA households that had dead or unwanted compact fluoresent lights (CFLs) to dispose of.
Note(s): As a percentage of all CMA households.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey (survey number 3881), 2009.

Fluorescent tubes were the second most common type of energy-saving light found in Canadian homes in 2009, with 47% of households reporting having had one. Households in Saint John reported the highest use in the country (62% having at least one fluorescent tube), while those in St. John's had the lowest use, with just under a quarter of households (24%) reporting having one.

Halogen lights are a type of incandescent light bulb that contain a halogen gas and consume about 40% less electricity than that of a traditional incandescent light bulb for a given amount of light.[32] Halogen lights were used by 37% of households in large municipalities. LED lights, the most energy-efficient of all, were used by 7% of all households in CMAs.

32. Natural Resources Canada, 2009, *Choosing Light Fixtures – Tungsten-Halogen Incandescent Lamps*, *http://oee.nrcan.gc.ca/residential/personal/lighting/halogen.cfm?attr=4* (accessed August 23, 2011).

Disposal of compact fluorescent lights (CFLs)

Unlike incandescent lights, which can be disposed of safely in the regular garbage, CFLs contain mercury, which can have significant impacts on both human health and the environment if not disposed of properly.[33] Consequently, these lights are generally not accepted in the regular garbage stream and need to be disposed of using a hazardous waste program. 'Take back' programs exist in some areas to help consumers dispose of CFLs in a proper manner. While some programs are run on a provincial basis,[34] others are operated by retailers.[35] Households' access to take back programs can therefore vary significantly, even within the same CMA.

In 2009, 22% of households in CMAs reported having dead or unwanted CFLs for disposal. Households in the Ontario part of the Ottawa-Gatineau CMA and in Kingston, Thunder Bay and Sherbrooke were the most likely to have reported having dead or unwanted CFLs for disposal (all 28%) (Table 6). Households in Brantford, Winnipeg, Saskatoon and Abbotsford were the least likely to have had a dead or unwanted CFL to dispose of (all 15%).

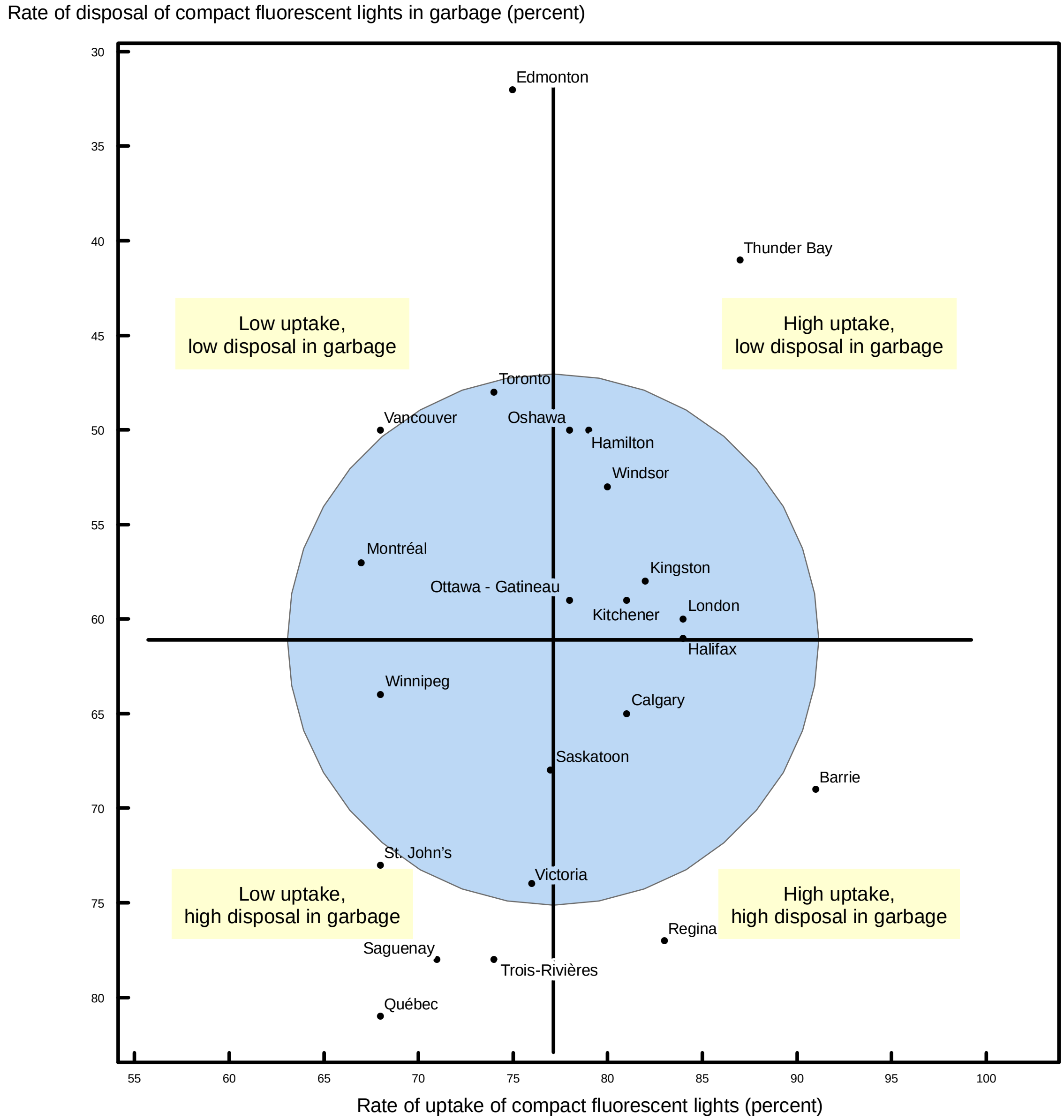
Of the households that reported having dead or unwanted CFLs to dispose of, just under one-quarter (24%) reported they took them to a depot or drop-off centre, however most households (55%) reported that they put them in the regular garbage, while 13% indicated they still had them. At the CMA level, households in Québec City were most likely to have disposed of them in the garbage (81%).

Most CMAs fell into one of two categories: those that had relatively high rates of uptake of CFLs and relatively low rates of disposal of CFLs in the garbage (the top right quadrant of Figure 1); or those that had relatively low rates of uptake of CFLs and relatively high rates of disposal of CFLs in the garbage (the bottom left quadrant of Figure 1). With the exception of Thunder Bay, all of the CMAs in the former group display behaviour that is close to the norm for all CMAs, while half of those in the latter group display less typical behaviour (that is, they fall outside of 1 standard distance of the mean centre of the CMAs in the figure).

33. Environment Canada, 2010, *Disposing of Mercury Products*, *www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=F111AAC6-1#Fluo* (accessed August 23, 2011).
34. B.C. Fluorescent Light Recycling Program Product Care Association, 2011, *LightRecycle*, *www.productcare.org/lights* (accessed October 28, 2010).
35. Project Porchilght, n.d. (no date), *CFL Recycling*, *www.projectporchlight.com/content/cfl-recyclers* (accessed October 19, 2011).

Figure 1

Uptake of compact fluorescent lights (CFLs) versus disposal of CFLs in garbage



Note(s): The intersection of the internal X-Y axis is the mean centre of all plotted CMAs. The blue circle depicts 1 standard distance, centred on the mean centre of all plotted CMAs. Standard distance is the spatial equivalent of standard deviation. It measures the amount of absolute dispersion in a point pattern.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey (survey number 3881), 2009.

There were a few CMAs that had both relatively high rates of uptake of CFLs combined with a relatively high proportion of households that threw their dead or unwanted CFLs in the garbage. For example, more than 8 out of 10 households in Regina and Barrie used CFLs, but they also had among the highest rates for disposal of CFLs in the garbage. Conversely, Oshawa, Hamilton and Thunder Bay had low rates for disposal of CFLs combined with relatively high rates of use.

Quick fact

Light-emitting diode (LED) holiday lights

Light-emitting diodes (LEDs) are very energy-efficient lights that are becoming increasingly popular alternatives to traditional incandescent bulbs in strings of holiday lights. Between 2007 and 2009, there was a 10% increase in the number of Canadian households reporting their use to almost one-third (32%) of households. All provinces showed an increase in their use, except for Ontario, with households in Atlantic Canada and Saskatchewan having the greatest increases in their uptake.

Table 7
Use of light-emitting diode (LED) holiday lights, by province, 2007 and 2009

	2007	2009
	percent	
Canada	**29**	**32**
Newfoundland and Labrador	22	35
Prince Edward Island	32	41
Nova Scotia	29	39
New Brunswick	27	38
Quebec	25	28
Ontario	31	31
Manitoba	33	35
Saskatchewan	26	36
Alberta	31	34
British Columbia	34	36

Note(s): As a percentage of all households.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey (survey number 3881), 2007 and 2009.

Canadian environment, economic and social indicators

Table 8
Population indicators

	2005	2006	2007	2008	2009	2010
Population [1]						
Persons	32,245,209	32,576,074	32,929,733	33,319,098	33,729,690	34,126,181
Percent change from previous year	1.0	1.0	1.1	1.2	1.2	1.2
Aged 65 and over (percent of total)	13.1	13.3	13.5	13.7	13.9	14.1
Density (per square kilometre)	3.6	3.6	3.7	3.7	3.7	3.8

1. Population data is based on the Estimates of Population program.

Source(s): Statistics Canada, CANSIM table 051-0001 (accessed November 8, 2011). Statistics Canada, 2007, *Population and Dwelling Count Highlight Tables, 2006 Census*, Catalogue no. 97-550-X2006002.

Table 9
Economy indicators

	2005	2006	2007	2008	2009	2010
Gross Domestic Product (GDP)						
GDP (millions of chained 2002 dollars)	1,247,807	1,283,033	1,311,260	1,320,291	1,283,722	1,324,993
Percent change from previous year	3.0	2.8	2.2	0.7	-2.8	3.2
Per capita (chained 2002 dollars)	38,697	39,386	39,820	39,626	38,059	38,826
Consumer Price Index (2002 = 100)	**107.0**	**109.1**	**111.5**	**114.1**	**114.4**	**116.5**
Unemployment rate (percent)	**6.8**	**6.3**	**6.0**	**6.1**	**8.3**	**8.0**

Source(s): Statistics Canada, CANSIM tables 380-0017, 051-0001, 326-0021 and 282-0002 (accessed November 7, 2011).

Table 10
Social indicators

	2005	2006	2007	2008	2009	2010
Average household spending [1]						
Total (current dollars)	65,575	67,736	69,946	71,364	71,117	..
Water and sewage (current dollars)	211	221	253	251	259	..
Electricity (current dollars)	1,070	1,111	1,147	1,162	1,183	..
Food (current dollars)	6,978	7,046	7,305	7,435	7,262	..
Gasoline and other motor fuels (current dollars)	2,024	2,079	2,223	2,233	2,218	..
Personal expenditure on consumer goods and services (millions of chained 2002 dollars)	**723,146**	**753,263**	**787,765**	**811,157**	**814,215**	**841,466**
Residential waste						
Production [2] (tonnes)	..	12,616,337	..	12,897,396	..	..
Production per capita (kilograms)	..	387	..	387	..	..
Disposal (tonnes)	..	8,893,494	..	8,536,891	..	..
Disposal per capita (kilograms)	..	273	..	256	..	..
Diversion (tonnes)	..	3,722,843	..	4,360,505	..	..
Diversion per capita (kilograms)	..	114	..	131	..	..
Diversion rate (percent of waste production)	..	30	..	34	..	..
Distance driven by light vehicles [3] (millions of kilometres)	**289,717**	**296,871**	**300,203**	**294,361**	**303,576**	**..**

1. Data on average household spending is based on the Survey of Household Spending (SHS). For information on the difference between the SHS and personal expenditure data please see: Statistics Canada, 2008, *Guide to the Income and Expenditure Accounts*, Catalogue no. 13-017-X.
2. The estimates presented in this table refer only to material entering the waste stream and do not cover any waste that may be managed on-site by a household. In addition, these data do not include materials that were processed for reuse and resale, (for example, whole sale of scrap metal or used clothing), nor those materials that are collected through deposit-return systems and therefore not processed at a material recovery facility.
3. Distance driven for vehicles weighing less than 4.5 tonnes, excluding the territories.

Source(s): Statistics Canada, CANSIM tables 203-0001, 203-0003, 203-0002, 203-0007, 380-0017, 153-0041, 153-0042, 051-0001 and 405-0063 (accessed November 7, 2011).

Table 11
Energy indicators

	2005	2006	2007	2008	2009	2010
Primary energy availability (terajoules)	**11,307,113**	**11,176,879**	**11,969,050**	**11,179,124**	**10,962,914**	**..**
Primary and secondary energy						
Exports (terajoules)	9,641,137	9,833,549	10,308,635	10,265,704	8,816,828	..
Residential consumption (terajoules)	1,296,644	1,243,425	1,336,452	1,356,259	1,316,207	..
Established reserve						
Crude bitumen (closing stock,[1] millions of cubic metres)	1,620	3,340	3,500	4,300	4,216	4,130
Crude oil (closing stock,[1] millions of cubic metres)	752.3	712.6	721.8	688.8	622.5	..
Natural gas (closing stock,[1] billions of cubic metres)	1,553.7	1,577.7	1,534.3	1,671.2	1,700.9	..
Recoverable reserves						
Coal (closing stock,[1] millions of tonnes)	4,560.4	4,468.8	4,395.2	4,322.0	4,347.1	..
Uranium (closing stock,[1] tonnes)	431,000	423,400	482,000	447,000	383,000	..
Electricity generation						
Total (megawatt hours)	597,810,875	585,097,531	603,572,420	601,278,688	577,500,520	566,746,484
Hydro-electric (percent of total)	60.1	60.0	60.6	62.0	62.8	61.3
Nuclear (percent of total)	14.5	15.8	14.6	14.7	14.8	15.0
Fossil fuel and other fuel combustion (percent of total)	25.4	24.2	24.8	23.3	22.4	23.7

1. The size of the reserve at year-end.

Source(s): Statistics Canada, CANSIM tables 128-0009, 153-0012, 153-0013, 153-0014, 153-0017, 153-0018, 153-0019, 127-0001 and 127-0002 (accessed November 7, 2011).

Table 12
Environment and natural resources indicators

	2005	2006	2007	2008	2009	2010
Greenhouse gas (GHG) emissions (megatonnes of carbon dioxide equivalent (CO_2 eq))	**731**	**719**	**748**	**732**	**690**	**..**
GHG emissions per capita (tonnes of CO_2 eq)	**22.7**	**22.1**	**22.7**	**22.0**	**20.5**	**..**
GHG emissions by final demand						
Total household[1] (megatonnes of CO_2 eq)	415	412	432	..	..	..
Total household per capita (tonnes of CO_2 eq)	12.9	12.6	13.1	..	..	..
Direct household[2] (megatonnes of CO_2 eq)	111	109	115	..	..	..
Indirect household[3] (megatonnes of CO_2 eq)	305	303	317	..	..	..
Exports (megatonnes of CO_2 eq)	275	263	271	..	..	..
Value of selected natural resources						
Land (millions of current dollars)	1,367,002	1,532,193	1,708,196	1,832,780	1,905,946	2,004,683
Timber (millions of current dollars)	283,572	265,747	245,187	232,562	191,317	170,892
Subsoil resource stocks (millions of current dollars)	805,761	931,530	944,379	1,551,785	747,185	987,342
Average farm pesticide expenditures (current dollars)	**7,792**	**8,268**	**9,147**	**11,361**	**11,647**	**..**
Air quality[4]						
Ozone (population weighted, parts per billion)	40	38	39	38	37	..
$PM_{2.5}$ (population weighted, micrograms per cubic metre)	10	8	8	8	7	..

1. Total household greenhouse gas emissions are the sum of direct plus indirect household greenhouse gas emissions.
2. Direct household greenhouse gas emissions include all greenhouse gas emissions due to energy use in the home and for private motor vehicles.
3. Indirect household greenhouse gas emissions are those business-sector emissions due to the production of the goods and services purchased by households. An estimate of the greenhouse gas emissions from foreign companies due to the production of the imported goods purchased by Canadian households is included.
4. Ground level ozone and fine particulate matter ($PM_{2.5}$) are two key components of smog that have been linked to health impacts ranging from minor respiratory problems to hospitalizations and premature death. Exposure studies indicate that adverse health effects can occur even with low concentrations of these pollutants in the air. Annual data are revised, based on the latest release of the Canadian Environmental Sustainability Indicators report.

Source(s): Statistics Canada, CANSIM tables 051-0001, 153-0046, 378-0005 and 002-0044 (accessed November 8, 2011). Environment Canada, 2011, *National Inventory Report 1990-2009: Greenhouse Gas Sources and Sinks in Canada - Executive Summary*, Catalogue no. En81-4/1-2009E-PDF. Environment Canada, 2011, *Environmental Indicators*, *www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=B1385495-1#air1_en* (accessed November 8, 2011). Statistics Canada, Environment Accounts and Statistics Division, Material and Energy Flow Accounts.

Updates

Upcoming releases

Gasoline evaporative losses from retail gasoline outlets across Canada, 2009

The survey of industrial processes (SIP) is a pilot survey conducted to assess the feasibility of collecting data on operational activities and engineering processes of small and medium enterprises (SME) across Canada. For the 2009 reference period, the *SIP pilot survey results* presented general statistics for all retail gasoline outlets, including marinas with gas docks, across Canada.

Statistics Canada has completed assessing the utility of the data collected from this pilot survey for estimating gasoline evaporative losses from retail gasoline outlets. Mathematical models were applied to the survey data to calculate losses of gasoline due to evaporation. The estimates addressed evaporative losses associated with gasoline truck deliveries, storage tanks, vehicle refuelling, and other operational activities.

To be released January 23, 2012 (Statistics Canada Catalogue no. 16-001-M).

Industrial Water Use, 2009

The information collected for the Industrial Water Survey measures, by volume, the sources of water used, the purposes of water use, whether or not water was re-circulated or re-used, where the water was discharged, the types of treatments applied to intake water prior to use and the types of treatments applied to wastewater prior to discharge. Water acquisition costs, treatment costs and operating and maintenance expenses related to water intake and discharge are also collected.

The results of this survey are used in the development of environmental accounts, aid in tracking the state of stocks of water and contribute to national indicators of water quality.

To be released in the spring of 2012 (Statistics Canada Catalogue no. 16-401-X).

CANSIM tables and updates

CANSIM is Statistics Canada's key socio-economic database.

The following table has been added to CANSIM:

CANSIM table 153-0101, Water use in Canada, by sector

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Release date: December 2011

Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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