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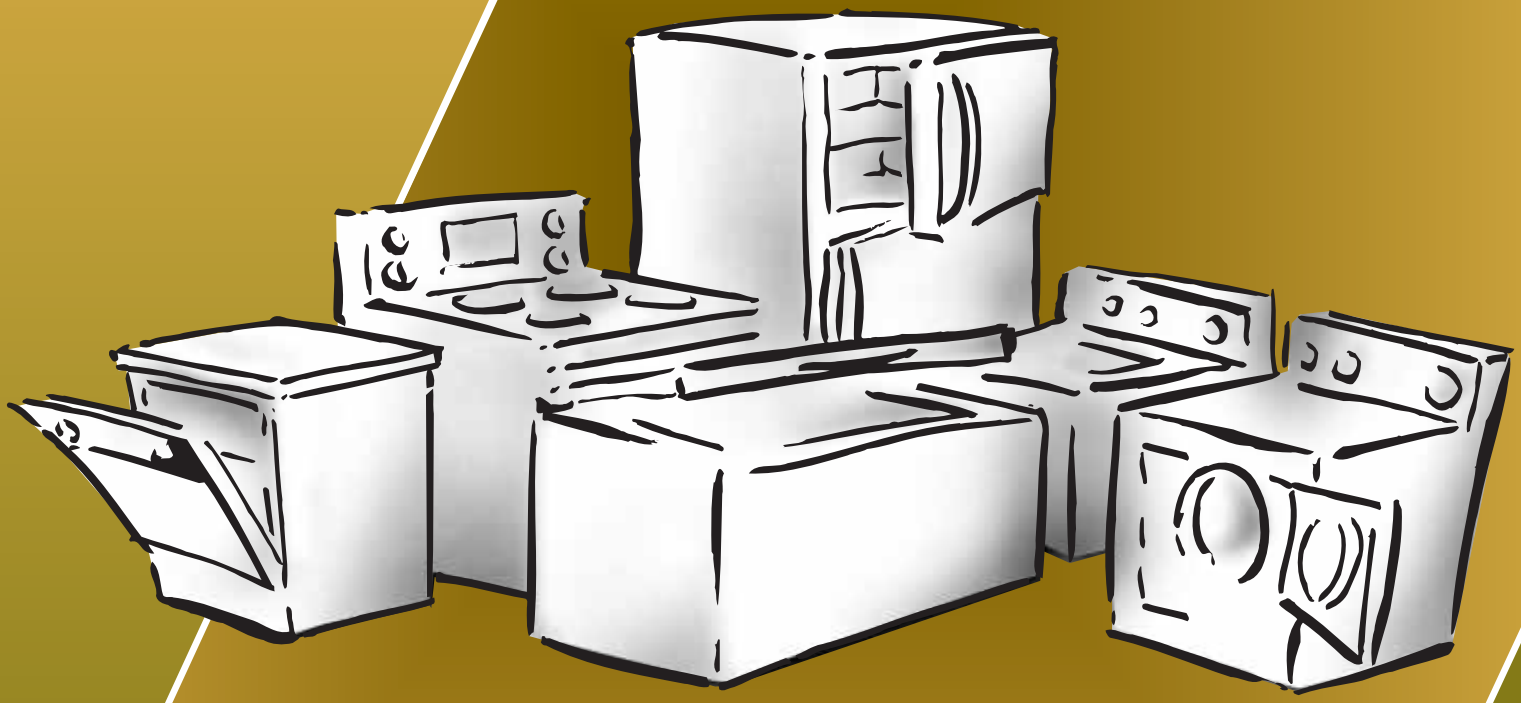
Energy Consumption of Major Household Appliances Shipped in Canada



Trends for 1990–2005

December 2007

Canada

The digital mosaic of Canada which appears on the cover of this publication is produced by Natural Resources Canada (Canada Centre for Remote Sensing), and 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 Arctic regions.

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

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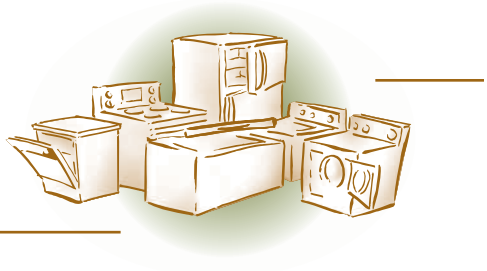
FOREWORD



Since 1996, as part of the National Energy Use Database initiative, Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) has been receiving from members of the Canadian Appliance Manufacturers Association (CAMA) their annual Canadian appliance shipment data, by model, for the six major household appliance categories – refrigerators, freezers, dishwashers, electric ranges, clothes washers and electric clothes dryers. According to CAMA, the manufacturers represent more than 90 percent of the Canadian market for five of the appliance groups.[1] To keep each appliance manufacturer's data confidential, appliance manufacturers suggested that a third party receive and prepare the database in a format in which no one (other than the third party) could determine the shipment data for an individual model or manufacturer. NRCan retained the services of Electro-Federation Canada, chosen by CAMA, as the third party to receive the data.

Each model's shipments, provided by CAMA, were matched to their associated unit energy consumption (UEC) ratings found in the *EnerGuide Appliance Directory* database (oee.nrcan.gc.ca/publications/infosource/pub/appliances/2007). The average annual shipment-weighted UEC was then calculated for each appliance category. This report details the results of the analysis of the estimated shipment-weighted average UEC, in kilowatt hours per year, of the six major household appliance categories shipped in Canada between 1990 and 2005. It also provides data on the annual distribution of shipments by UEC range for the six types of appliances during the same period.

This is the sixth report of this type published by the OEE.[2] You may notice differences between this report and the previous ones. The differences are due to updates, changes in the number of data contributors, new appliance categories/types and a change in the methodology (described in Appendix A, "Methodology"). Also, since 2004, participating manufacturers have provided their shipment data broken down by region/province and by channel (retail versus builder), allowing regional analysis, thereby assisting in monitoring the success of regional programs.

To further improve the quality and representation of new appliance energy efficiency data in Canada, the OEE is exploring options to improve the coverage of the Canadian market through ongoing discussions with CAMA and other appliance manufacturers.

The OEE would like to thank the participating manufacturers and CAMA for their co-operation in this project.

The data gathered through this report will deepen your knowledge of the various aspects of energy consumption with respect to appliances. The data will also enable NRCan to develop and fine-tune its ecoENERGY programs, designed to support Canadians as they seek to achieve greater energy efficiency and reduce their greenhouse gas emissions.

This report was prepared by Diane Lindia of the Demand Policy and Analysis Division of the OEE. Indrani Hulan supervised the project, Glen Ewaschuk provided assistance, and David McNabb provided project leadership.

If you would like to learn more about the OEE's services and programs, contact it by e-mail at euc.cec@nrcan.gc.ca.

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[1] Information about market share for freezers is not available.
[2] The first report was based on 1990–1997 data; the second report, 1990–1999 data; the third report, 1990–2001 data; the fourth report, 1990–2003 data; the fifth report, 1990–2004 data.

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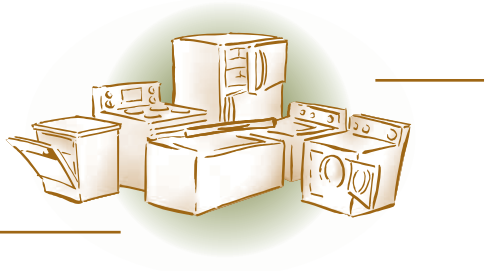
HIGHLIGHTS



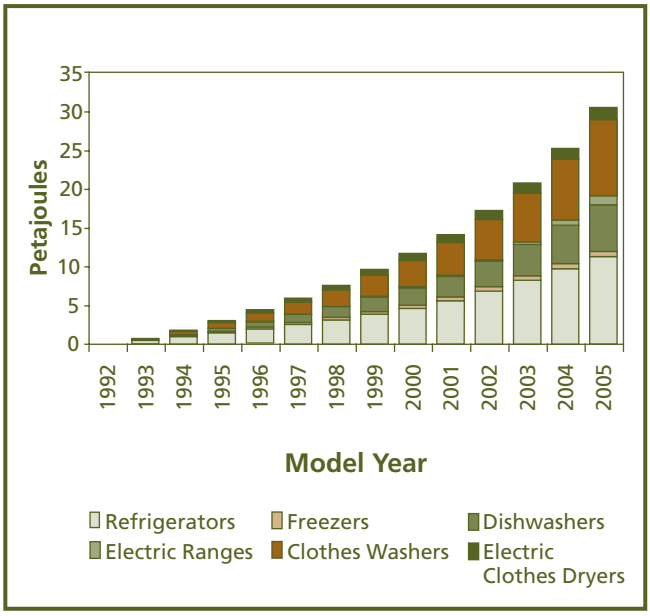
Appliances have become an increasingly fundamental part of modern lifestyles. The average Canadian household contains at least six major appliances, including a refrigerator, freezer, dishwasher, range, clothes washer and clothes dryer. The percentage of ownership of most appliances in Canada has steadily increased during the past 20 years.

Future energy demand of appliances is driven by the efficiency of the equipment, market penetrations, population growth, and changes in individual behaviour and usage patterns. Although the penetration of most "white goods"[3] is already relatively high in Canada, population growth and the shift to smaller, more numerous households will likely increase the appliance energy use over the coming decade.[4]

The energy efficiency of major household appliances on the market improved significantly between 1990 and 2005. Largely responsible for the improvement were the significant research and development activities carried out by appliance manufacturers and three initiatives authorized under the 1992 *Energy Efficiency Act*: the minimum energy performance standards (MEPS) contained in the *Energy Efficiency Regulations*, the EnerGuide for Equipment program and the ENERGY STAR® Initiative in Canada. Also responsible for the improvement were an increase in consumer awareness and various incentives and rebates offered by the federal, provincial and municipal governments and utilities. Details of the latter can be found in the Directory of Energy Efficiency and Alternative Energy Programs in Canada (oee.nrcan.gc.ca/programs-directory) or on the ENERGY STAR Web site (oee.nrcan.gc.ca/energystar/english/consumers/rebate.cfm).

Figure 1 depicts the cumulative energy savings, measured in petajoules (PJ),[5] of major household appliances from 1992 to 2005.

FIGURE 1
Cumulative Energy Savings for All Major Household Appliances, 1992–2005



[3] Large, durable consumer goods usually finished in white, such as refrigerators, clothes washers and dryers.

[4] Source: *E Source Residential Appliances Atlas*, (E Source TA-RA-01: November 2001).

[5] One petajoule (PJ) (1 PJ = 1 × 10^{15} joules) is equivalent to the amount of energy consumed by about 9000 households in one year – assuming each household uses 111 gigajoules (GJ) (1 GJ = 1 × 10^{9} joules) annually (according to the *Energy Use Data Handbook* table that can be found on the OEE Web site at oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_5_e_2.cfm). A joule is the international unit of measure of energy – the energy produced by the power of one watt flowing for one second. There are 3.6 million joules in one kilowatt hour (kWh).

Highlights

Here are some interesting findings as a result of the analysis of the shipment data:

- Total energy savings for the six major appliances shipped in 2005 were calculated at 5.60 PJ[6] (or 1.56 billion kWh[7]). This saved consumers an estimated $143 million in energy costs in 2005, based on an approximate national average of 9.2 cents/kWh.[8]
- The cumulative energy savings for all major household appliances between 1992 and 2005 were 30.48 PJ (or 8.47 billion kWh) – the equivalent of a year's energy for about 274 000 households.
- Among major appliances, refrigerators produced the largest cumulative energy savings, 11.13 PJ (or 3.09 billion kWh) from 1992 to 2005.
- This is the second year for which data were available to perform an analysis for retail versus builder shipments by region/province. In both years, it was found that, for all major household appliances, shipments to builders in British Columbia and the Territories were higher and shipments to builders in Quebec were lower than shipments to other regions. This finding will be monitored in future reports.

Energy-efficient products will have a significant impact on consumers' energy bills and energy savings only upon the disposal of older appliances, such as the "old" second refrigerator in the basement.[9] According to the *2003 Survey of Household Energy Use*,[10] about 765 000 Canadian households did not dispose of their previous refrigerator when they acquired a new one in 2003. If consumers keep using the older models as a second appliance in the home, the maximum amount of energy savings and greenhouse gas emission reductions will not be realized.

6 One petajoule (PJ) equals 277 777 777.78 kWh.
7 The commercial unit of electricity energy equivalent to 1000 watt hours. A kilowatt hour can best be visualized as the amount of electricity consumed by ten 100-watt bulbs burning for one hour.
8 Source: *Energy Use Data Handbook* table that can be found on the OEE Web site at oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_18_e_2.cfm. Note that this is a national average.
9 Be sure to choose an environmentally friendly option when disposing of an appliance. Appliance recycling programs are available in many Canadian communities. Consult your Yellow Pages or call your municipality to find out what programs exist and how appliances are collected in your area. Or consult the Canadian Metals Recycling Database at www.recycle.nrcan.gc.ca to find Canadian companies involved in the recycling of appliances or "white goods."
10 Natural Resources Canada, *2003 Survey of Household Energy Use, Detailed Statistical Report* (Ottawa: 2006), p. 59. Available: oee.nrcan.gc.ca/Publications/statistics/sheu03/pdf/sheu03.pdf.

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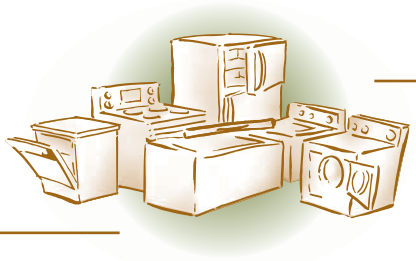

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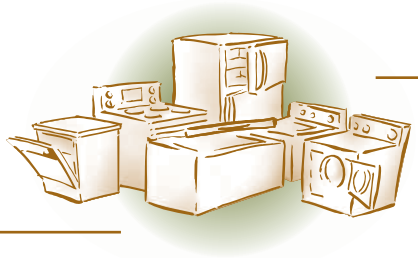

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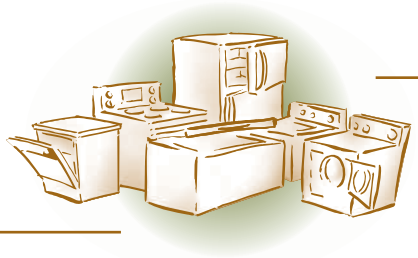
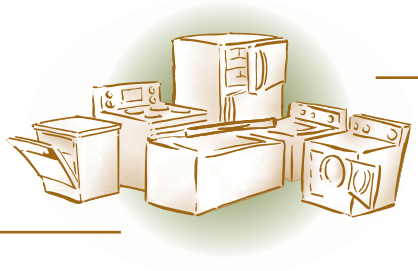


INTRODUCTION



This report outlines changes in the energy use and distribution of major household appliances from 1990 to 2005. It is based on the shipments for that period of the six major household appliance categories in Canada: refrigerators, freezers, dishwashers, electric ranges, clothes washers and electric clothes dryers. The data are collected through the co-operation of the Canadian Appliance Manufacturers Association (CAMA).

Note that the quantity and profile of appliance shipments closely reflect Canadian purchases. Most retailers rely on a distribution strategy called just-in-time inventory, which responds quickly to consumer demand. In fact, retailers keep inventory as low as possible. For this reason, the Office of Energy Efficiency (OEE) believes that the shipment data in this report closely reflect the purchasing behaviour of consumers.

While this report deals exclusively with shipment data, the OEE also has reports that provide additional information about appliances, such as the *2003 Survey of Household Energy Use* (SHEU–2003). This national survey collected data on energy consumption and factors affecting energy consumption, such as the age of household appliances and their use. Some of the findings of SHEU–2003 are related to the analysis and discussions in this report.

Each of the following chapters in this report covers a specific type of appliance:

- refrigerators (Chapter 1)
- freezers (Chapter 2)
- dishwashers (Chapter 3)
- electric ranges (Chapter 4)
- clothes washers (Chapter 5)
- electric clothes dryers (Chapter 6)

Chapter 7, "Summary of Major Household Appliances," discusses the overall energy savings achieved from improvements to these appliances.

Chapter 1, "Refrigerators," contains more information than the other chapters. Although there is much diversity in the types and sizes of refrigerators, they have been grouped to calculate the average annual unit energy consumption (UEC) for all refrigerators by model year. However, because both size and energy consumption are so important in such analysis, you are advised to also look further at the analysis of refrigerators by UEC per cubic foot in Section 1.2.5.

Because of restrictions in the market information available, the freezer shipment data are not as comprehensive as data for the other appliances and should be used with caution.

Appendix A, "Methodology," describes the database preparation process conducted by Electro-Federation Canada and the methodology used by the analysts to summarize the data.

Appendix B, "Definitions," contains definitions of the types of appliances in this report.

Appendix C, "Questions and Answers About Changes to ENERGY STAR®," provides questions and answers about changes to the ENERGY STAR Initiative in Canada.

Appendix D, "Detailed Tables," provides detailed data supporting the various charts and figures in this report.

This report also provides regional/provincial shipment data, as well as "channel" data, which compare retail shipments and builder shipments described as follows:

- Retail shipments include shipments from Canadian manufacturers to Canadian retailers and other consumers.
- Builder shipments include shipments to Canadian home builders, motels, governments, trailer manufacturers and property management.

Note that these data show the region/province to which the appliances were originally shipped. It is possible that some appliances were eventually sold in a different province. The extent of this redistribution is unknown but believed to be small.

This trend analysis is associated with the implementation of the *Energy Efficiency Regulations* authorized under the 1992 *Energy Efficiency Act*. The Regulations ensure that new appliances imported into Canada, or manufactured in Canada and shipped from one province or territory to another, comply with federal minimum energy performance standards (MEPS). Additionally, this trend analysis is also associated with the ENERGY STAR Initiative in Canada, which was officially introduced in 2001.

ENERGY STAR is the international symbol for energy efficiency for some major household appliances. It is a voluntary labelling program that helps consumers identify products that are among the most energy efficient on the market. For more information about the *Energy Efficiency Regulations*, consult the *Guide to Canada's Energy Efficiency Regulations* found on the Web site at oee.nrcan.gc.ca/regulations. For more information about ENERGY STAR qualified products, visit energystar.gc.ca.

Note that the baseline year used for all estimates of energy savings was 1992 even though the MEPS did not come into effect until 1995. This practice is followed because energy efficiency began to improve almost immediately after the *Energy Efficiency Act* came into force in 1992, thanks to market forces such as the regulations expected from the Act and United States (U.S.) regulations. Because 1992 was the baseline year used in this report's calculations, and to ensure that cumulative energy savings were not over-estimated, a retirement factor was included in the past two years' analysis. This factor takes into account the aging of appliances based on the life expectancies set out in the *EnerGuide Appliance Directory*.[11] See Appendix A, "Methodology," for more information about this retirement factor.

As previously mentioned, the improvement in the energy efficiency of the major household appliances can be attributed to

- the significant research and development carried out by the members of CAMA
- the MEPS contained in the *Energy Efficiency Regulations*
- the amendments to the MEPS
- the initiative authorized under the 1992 *Energy Efficiency Act*, namely, the EnerGuide for Equipment program
- the ENERGY STAR Initiative in Canada

"Market transformation" programs were designed to cause lasting change in the market by increasing the availability of and demand for high-efficiency appliances. The goal of these activities is to develop sustainable markets for more efficient products. For more information about the ecoENERGY Efficiency initiatives of the OEE, visit the Web site at oee.nrcan.gc.ca.

[11] Natural Resources Canada, *EnerGuide Appliance Directory 2005* (Ottawa: February 2005), p. 13.

How Appliances Work[12]

Refrigerators and Freezers

Refrigerators and freezers keep food cold by removing heat from the air in the refrigerator or freezer cabinet. This is accomplished by using a fluid – called the refrigerant – that absorbs heat as it circulates through coils in cabinet walls. The heat is pumped away and rejected outside the cabinet.

The cooling system in a refrigerator or freezer relies on the vapour compression cycle, in which the refrigerant changes from liquid to vapour and back to liquid again while circulating in a closed system, absorbing or discharging heat as it changes phase. In a typical refrigerator, the compressor circulates the refrigerant through two sets of coils in one continuous loop. One set, the evaporator coils, cools the refrigerator as the working fluid absorbs heat and vaporizes. The other set, the condenser coils, is typically located under or in back of the unit and gives off absorbed heat as the working fluid condenses.

An insulated cabinet with well-sealed doors is critical to maintaining the temperature difference between the cool refrigerator interior and ambient air.

Increases in energy efficiency mean less energy required per unit volume, but total energy use will also depend on other factors, particularly the size of the unit. All other things being equal, the bigger the refrigerator, the more energy it will use. Each cubic foot of additional refrigerated space adds about 20 to 30 kilowatt hours to annual energy use. Configuration of the refrigerator and the ratio of freezer to fresh food storage space are also important. For example, models with side-by-side refrigerator and freezer compartments generally use more energy than units with top freezers.

Other features or uses can also impact energy use. Making ice, either in trays in the freezer or with automatic ice makers, can increase energy use by 15 to 20 percent. Through-the-door ice and water dispensers can increase energy consumption by about 10 percent.

Antisweat heaters that prevent condensation on the outside of the refrigerator cabinet in humid weather boost consumption as well. However, in many models, a power-saver switch is available. This switch controls the warming coils that prevent condensation.

Installation can also play a role in energy use. An older refrigerator that is surrounded by cabinets or has little clearance will use more energy because there is less air flow to carry heat away from the condenser coils. Most newer models employ fan-cooled condensers, which are less affected by air circulation around the product. Installation next to a heat source may also cause the unit to use more energy.

The great strides in the energy efficiency of refrigerators have been accomplished by a combination of fairly straightforward technical improvements – primarily more efficient compressors, thicker insulation, better door seals, and improved condensers and evaporators – and more sophisticated technologies, including microprocessor controls and sensors. There are, however, many promising options for improving efficiency even further.

Several advanced insulation concepts are pushing the envelope beyond conventional levels. An additional benefit to these insulation materials is that they allow appliance manufacturers to reduce energy consumption without reducing internal volume or changing the outer dimensions of the appliance. In some cases, usable volume in the refrigerator or freezer compartments can be increased.

The use of separate compressors to cool the fresh food and freezer compartments may reduce overall compressor energy use because each compressor can be optimized to the conditions of the compartment it serves. While the compressor is the heart of a refrigeration system, it must be linked to other improvements in performance. The use of better insulation and door gaskets, for example, reduces the cooling load of the compressor.

[12] Source: *E Source Residential Appliances Atlas*, (E Source TA-RA-01: November 2001).

With respect to stand-alone freezers, smaller units use less energy, and chest freezers are more energy efficient than uprights because little cold air escapes when you open the top-mounted door. While chest freezers take up more floor space than uprights, experts say they are 10 to 25 percent more efficient because they are better insulated and air does not spill out when the door is opened. Also, the weight of the door helps seal the unit. Upright freezers are available in two types: manual-defrost and self-defrost. Manual-defrost freezers are slightly cheaper to buy and operate. However, self-defrost freezers eliminate the need for you to defrost them. Also, they contain interior shelves and shelves on the door.

Dishwashers

There are several design and technology options available to increase the efficiency of conventional dishwashers, including hot water conservation, motor efficiency improvements and drying efficiency improvements.

Close to 60 percent of all energy used by dishwashers is used to heat the water. Dishwashers require the highest temperature of any household appliance – an average recommended operating temperature of 60˚C (140˚F). For most dishwashers sold in North America, hot water supplied from the household water heater is heated an additional 15 to 20 degrees by an electric booster heater of 500 to 1000 watts. Booster heaters help ensure wash quality and facilitate heated drying. Dishwashers with advanced sensors and fuzzy-logic control can automatically select the type of cycle needed, the water level and the time required to get dishes clean, potentially reducing energy use.

Designing a dishwasher with a lower recommended water temperature is one way to reduce energy consumption. Another way is to reduce the amount of hot water used, which can be accomplished by reducing the level of fill and decreasing wash and rinse times.

About 8 percent of the energy consumed by a typical dishwasher is used to run the motor in the pump. Typically, split-phase motors are used, which have an efficiency of about 50 percent. The heated drying mode in dishwashers uses an electric heating element and sometimes a fan to accelerate the drying of the load. This function consumes about 9 percent of the total energy used by an average dishwasher.

Much of the energy-conservation potential related to dishwashers relies on the user. No matter how efficiently a dishwasher is designed to function, its performance depends on proper installation and operation. For example, a dishwasher uses the same amount of water and energy whether it is empty or full. Using alternate wash cycles, such as energy-saving, low-temperature or shorter cycles, whenever appropriate helps conserve energy.

Electric Ranges

Consumer behaviour has more impact on energy use in cooking than in most other areas of appliance use. Efficiency options are limited in most cooking technologies. Educating the consumer to choose wisely holds more potential for cooking efficiency improvements than do most technological advancements.

Consumer cooking habits can dramatically improve cooking efficiency – more than most technological advances can. Cooking energy can be reduced by using smaller appliances, by choosing cookware wisely and by heating the minimum amount necessary for the minimum time necessary. From the users' preferences for appliances to how often they peek in the oven, the users' actions do impact cooking energy. Cookware choice also impacts energy use. Choosing flat-bottom cookware instead of warped-bottom cookware saves a significant amount of energy on electric elements. Further energy can be saved by using insulated cookware, while the most efficient choice is a pressure cooker.

Most of the trends in electric ranges are not being driven by energy efficiency. Instead, manufacturers are seeking to make their appliances easier to clean, more elegantly styled, and simpler and quicker to use.

Ovens are inherently inefficient because the heat takes a circuitous path from the heating element to the food. The coil or burner radiates energy, which is absorbed partly by the cooking vessel but mostly by the oven walls. The walls then conduct heat to the air, which finally cooks the food. Self-cleaning ovens generally

have extra insulation built into the walls to resist the 450˚C (850˚F) temperatures generated during self cleaning.

Clothes Washers

Clothes washers clean clothes by using mechanical, chemical and thermal energy. When placed in water, soil is dislodged from fibres by motion and friction and is carried away by the water. Laundry detergent chemicals, many of which are activated by heat, help emulsify oil and grease and the dirt they bind. In some products, enzymes break down proteins and other materials so they can be removed by water.

The most significant improvement in the energy efficiency of clothes washers is occurring through a shift to horizontal-axis washers and advanced vertical-axis machines. Many of the advanced horizontal- and vertical-axis machines now use a high spin speed to reduce the remaining moisture content of laundry, thereby reducing the amount of dryer energy needed. In horizontal-axis machines, clothes are tumbled in a rotating tub so that the clothes are plunged into a shallow pool of water and then pulled out again. Some machines recirculate water through the washer by pumping water to the top of the washer tub and spraying it over the clothes, thus reducing water consumption by 20 percent.

Washing-machine motors and controls account for only a small portion of the overall energy required to launder clothes. A larger portion of energy goes into heating the water used in the wash and rinse cycles and drying the washed clothes. Efficiency gains come from reducing the water needed to clean clothes effectively and increasing the speed of the spin cycle so that less energy is needed for drying.

Increasingly, clothes washers are equipped with automatic controls that determine water level and temperature based on electronic sensors located within the machine. Additional research will be needed to determine how these controls affect consumer behaviour and, as a result, water and energy consumption.

Electric Clothes Dryers

Most residential electric clothes dryers in North America are evaporative dryers. These dryers operate by circulating air, drawn from the household living space and heated by electricity, through a rotating drum containing wet clothes, then venting the moist exhaust air, usually to the outdoors. The level of heat is regulated by a thermostat – all dryers have a temperature sensor in the exhaust that cycles the heat off and on to prevent overheating. Dryer shut-off at the end of a cycle is controlled by a timer, temperature sensor or moisture sensor.

In conventional dryers, the most direct way to save energy is through shorter drying cycles – the less time the dryer is on, the less energy it uses.

How a dryer is operated and maintained makes a difference in how much energy it uses. For example, a dryer filled to one third of its capacity requires about 25 percent more energy than when fully loaded to dry each pound of clothes. With small loads, heated air can bypass the clothes and leave the drum without contributing to the drying process. Also, drying several loads consecutively prevents losing the heat. Most complaints concerning poor drying performance can be traced to clogged lint filters and exhaust systems.

Minimum Energy Performance Standards and the *Energy Efficiency Regulations*

Natural Resources Canada's (NRCan's) wide range of energy efficiency initiatives includes Canada's *Energy Efficiency Regulations*, standards and labelling programs.[13]

The *Energy Efficiency Act*, which came into force in 1992, gives the Government of Canada the authority to make and enforce regulations on performance and labelling requirements for energy-using products, including major household appliances, imported into Canada or shipped across provincial or territorial borders.

[13] Source: Natural Resources Canada, *Improving Energy Performance in Canada, Report to Parliament Under the* Energy Efficiency Act *for the Fiscal Year 2005–2006* (Ottawa: 2006), p. 9. Available: oee.nrcan.gc.ca/Publications/statistics/parliament05-06/pdf/parliament05-06.pdf.

The first *Energy Efficiency Regulations* came into effect in February 1995, following extensive consultations with provincial/territorial governments, affected industries, utilities, environmental groups and others. The Regulations refer to national consensus performance standards developed by accredited standards-writing organizations, such as the Canadian Standards Association. Such standards include testing procedures that must be used to determine a product's energy performance. Regulated products that fail to meet the MEPS identified by the Regulations cannot be imported into Canada or traded interprovincially. The U.S., Canada and some European countries are developing a harmonization process to simplify the centrally based administration of standards programs and to reduce the regulatory burden on equipment manufacturers.[14]

NRCan regularly amends the Regulations to strengthen the MEPS for prescribed products where the market has been transformed to a higher level of efficiency.[15] It is estimated that the amendments will have an impact equivalent to eliminating the energy use of all households for one year in a city the size of Barrie, Ontario, or Abbotsford, British Columbia, both with an approximate population of 131 000.[16]

Amendments to the Regulations also include labelling improvements so consumers have the latest information about the most energy-efficient products on the market. This way, Canadians can tap into huge potential savings in energy and money, and they will benefit from the improved air quality that results when emissions are reduced. In preparing amendments to the Regulations, NRCan analyses the impact of the proposed amendment on society, the economy and the environment. For more information about the *Energy Efficiency Regulations*, visit the Web site at oee.nrcan.gc.ca/regulations.

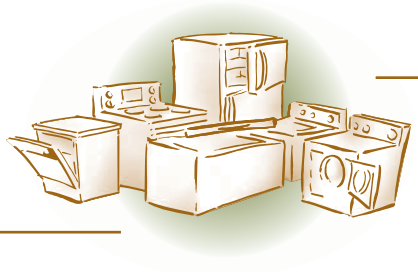
Canada's *Energy Efficiency Act* and *Energy Efficiency Regulations* support a number of labelling initiatives. These initiatives require that an EnerGuide label be displayed on major electrical household appliances, showing the consumer the estimated annual energy consumption of the product in kilowatt hours and comparing it with the most efficient and least efficient models of the same class and size.

EnerGuide directories with energy ratings for major appliances are published each year and distributed to consumers, retailers and appliance salespeople. Up-to-date searchable lists of models are also available on the NRCan Web site.

Responding to a desire by Canadians to have a labelling system designed to identify the best performers, Canada officially introduced, in 2001, ENERGY STAR, the international symbol for energy efficiency. The ENERGY STAR program began in the U.S., through the Environmental Protection Agency (EPA), and has expanded internationally. NRCan's OEE signed an administrative arrangement with the U.S. EPA and the U.S. Department of Energy to become the official custodian of the program for Canada. Canada became the fifth country to join the ENERGY STAR program, with Australia, New Zealand, Japan and Taiwan. The European Union is now also a signatory of ENERGY STAR.

[14] Source: *E Source Residential Appliances Atlas*, (E Source TA-RA-01: November 2001).
[15] For more information about the MEPS relating to major household appliances, visit the OEE Web site *Guide to Canada's* Energy Efficiency Regulations at oee.nrcan.gc.ca/regulations/guide.cfm. Part Two of this guide deals with appliances.
[16] Source: Natural Resources Canada's News Source, Backgrounder on *Energy Efficiency Regulations*, www.nrcan-rncan.gc.ca/media/newsreleases/2007/200704b_e.htm.

THE ENERGY STAR® INITIATIVE



The ENERGY STAR symbol is a simple way for consumers to identify products that are among the most energy efficient on the market. Only appliance manufacturers and retailers whose products meet the ENERGY STAR criteria can label their appliances with this symbol. The ENERGY STAR specifications get revised as federally regulated minimum energy performance standards (MEPS) increase in stringency.[17]

Refrigerators

Standard-size refrigerators must be at least 15 percent more efficient than the MEPS in Canada's *Energy Efficiency Regulations* to qualify for the ENERGY STAR registered mark.

Qualified compact refrigerators will continue to exceed the MEPS by at least 20 percent.

ENERGY STAR qualified refrigerators typically have a more energy-efficient compressor and better insulation than conventional models. They may also have an "Energy Saver" switch that allows consumers to adjust how much energy the refrigerator uses to keep food fresh.

Freezers

ENERGY STAR qualified standard-size freezers must exceed the MEPS by at least 10 percent. Compact freezer models must exceed the MEPS by at least 20 percent.

Dishwashers

Dishwashers must exceed the MEPS by at least 25 percent to qualify for the ENERGY STAR registered mark. This eligibility criterion became more stringent on January 1, 2007.

Many ENERGY STAR dishwashers use "smart" sensors that adjust the wash cycle and the amount of water used to match the load. They may also have an internal heater to boost the temperature of incoming water.

Clothes Washers

Standard-size clothes washers must be at least 36 percent more efficient than the MEPS and must have a modified energy factor (MEF) of at least 40.21 litres per kilowatt hour per cycle to qualify for the ENERGY STAR registered mark. These eligibility criteria became more stringent on January 1, 2007.

An MEF means that the calculation takes into account the amount of dryer energy used to remove the remaining moisture content. ENERGY STAR qualified clothes washers must have advanced design features that deliver cleaning performance while using less energy and 30 to 50 percent less water. The washer extracts more water from clothes during the spin cycle, thereby reducing the drying time and saving energy and wear and tear on your laundered items.

The ENERGY STAR symbol is becoming increasingly recognized by the Canadian appliance purchaser. The next section analyses trends in ENERGY STAR shipments.

[17] Natural Resources Canada, *EnerGuide Appliance Directory 2005* (Ottawa: February 2005).

Penetration Rate of ENERGY STAR Qualified Appliances

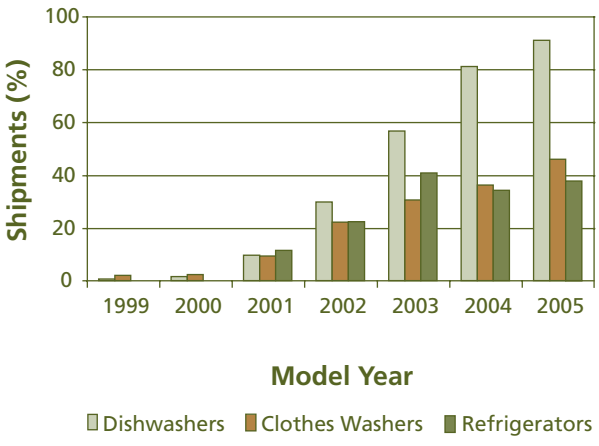
Figure 2 demonstrates the penetration rate[18] of ENERGY STAR qualified appliances since they began appearing on the market in early 1999 (influenced by United States activity spilling into Canada). In 2001, Canada officially adopted the ENERGY STAR registered mark to designate the most energy-efficient appliances. By 2005, 91 percent of all dishwashers, 38 percent of all refrigerators and 46 percent of all clothes washers shipped in Canada were ENERGY STAR qualified products.[19]

Possible reasons for the higher penetration rate of ENERGY STAR qualified dishwashers – compared with those for clothes washers and refrigerators – are that many of them were made available to the consumer and they were being offered at affordable prices. Dishwasher manufacturers met the specifications quickly, and the incremental cost to meet ENERGY STAR levels was eventually eliminated. Also, the dishwasher specifications had not changed in some time, whereas specifications for refrigerators and clothes washers had. A revision to increase the stringency of the ENERGY STAR specification for dishwashers came into effect in January 2007.

Note that the penetration rate of ENERGY STAR refrigerators decreased from 2003 to 2004 (from 40.7 percent to 34.2 percent) as a result of the more stringent ENERGY STAR level introduced in 2004.

Because the ENERGY STAR Initiative included freezers only recently, they have not been included in the analysis at this time.

FIGURE 2
ENERGY STAR Qualified Appliances as a Percentage of Total Shipments in Canada, 1999–2005*



*For more information, see Table D.A.1 in Appendix D, "Detailed Tables."

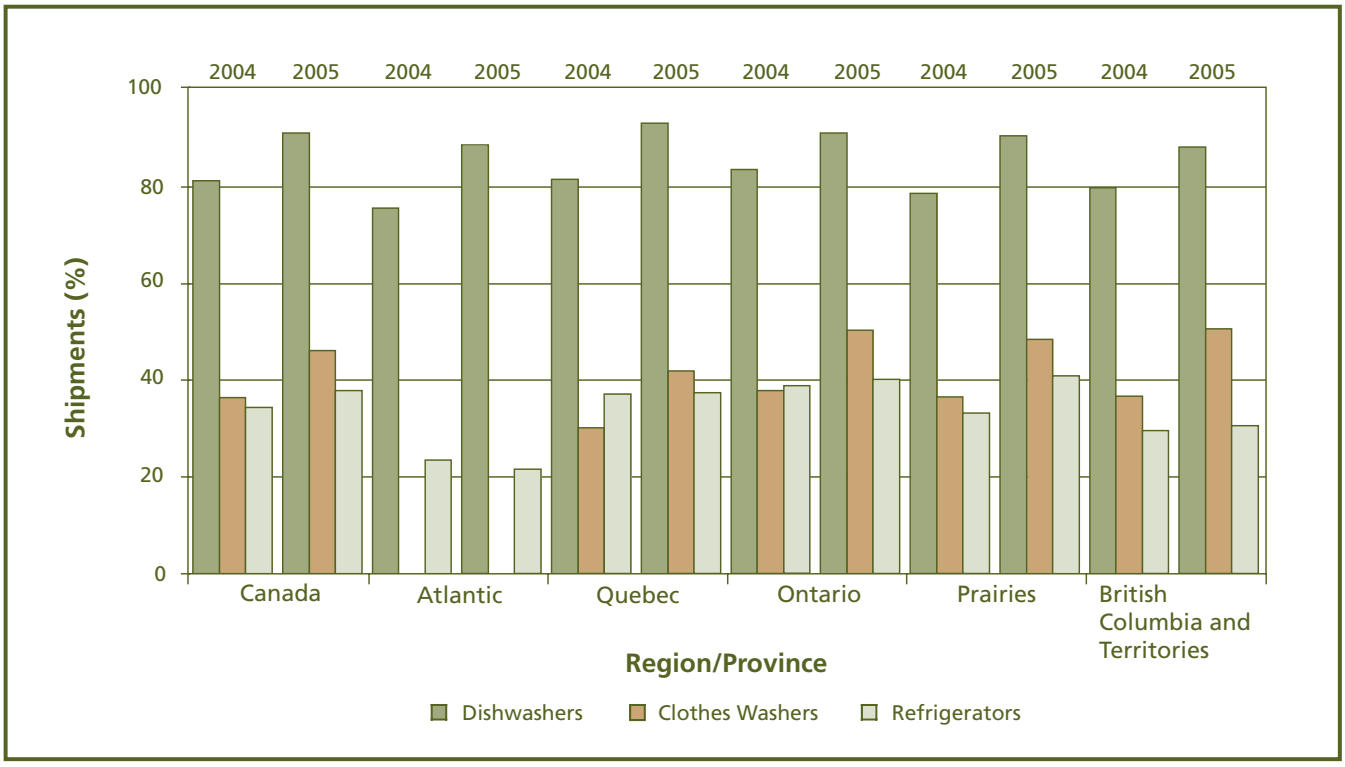
[18] For each appliance, the penetration rate is the total number of ENERGY STAR qualified appliances shipped divided by the total number of appliances shipped of that particular appliance.

[19] These percentages are based on actual figures reported by the Canadian Appliance Manufacturers Association members to the third-party contractor referred to in Appendix A, "Methodology." They differ slightly from those reported in the *2006 Major Appliance Industry Trends & Forecast* statistical reference tool published by Electro-Federation Canada. Refer to the section entitled "Reporting Methodology – Expansion Factors" (p. 11) in that publication for more details.

Penetration Rate by Region/Province, 2004 and 2005

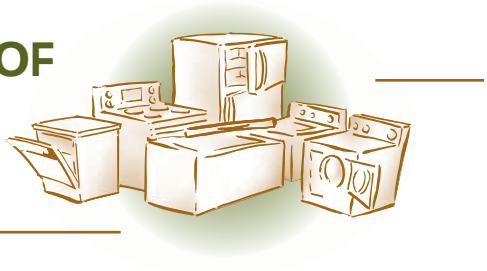
Figure 3 shows the breakdown by region/province for each appliance category covered by the ENERGY STAR Initiative in 2004 and 2005 (excluding freezers). The tendencies remained constant throughout the country, with the penetration rate of all three ENERGY STAR appliances being slightly higher in 2005, with the exception of refrigerators in the Atlantic provinces. Note that, for confidentiality reasons, the rate for clothes washers in the Atlantic provinces is not shown.

FIGURE 3
ENERGY STAR Qualified Appliances as a Percentage of Total Shipments, by Region/Province, 2004 and 2005*



*For more information, see Table D.A.2 in Appendix D, "Detailed Tables."

THE ROLE OF THE MEMBERS OF THE CANADIAN APPLIANCE MANUFACTURERS ASSOCIATION



Canadian Appliance Manufacturers Association (CAMA) members understand the important roles they must play in minimizing the effects that household appliances have on the environment.[20] Developing, producing and marketing more energy-efficient products to aid in reducing consumer energy use and harmful greenhouse gas emissions is one of these roles. They also acknowledge the importance of recycling and properly disposing of white goods and their packaging.

The recycling rate for end-of-life appliances in Canada is considered to be high due to the number of municipal recycling initiatives and the significant level of valuable materials that comprise most household appliances, such as steel, aluminum, copper, zinc and plastics. However, it is difficult to put a number on overall national or regional recovery rates because there is no national mechanism for tracking the recovery and recycling of white goods. As previously noted, according to the 2003 *Survey of Household Energy Use,*[21] in 2003, about 765 000 Canadians did not dispose of their previous refrigerator when they acquired a new one. As the issue is truly a North American concern, CAMA has formed a joint working group with the United States Association of Home Appliance Manufacturers to develop new solutions to a growing issue.

The significant reduction in appliance energy consumption over the years has resulted from the combined efforts of the appliance industry, governments, retailers and consumers. The minimum efficiency standards have contributed to a decrease in peak electricity demand and an increase in cost savings to consumers. The benefit to society of more efficient appliances will increase as the existing stock of major appliances in Canadian homes is replaced.

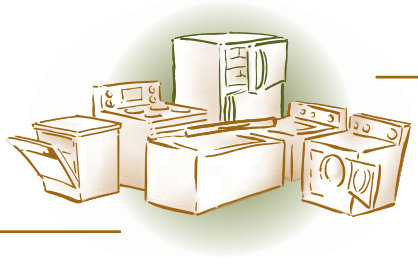
CAMA and its member companies take environmental issues seriously. They have taken significant steps to minimize the impact household appliances have on the environment while meeting consumer needs. Examples of improvements by the appliance manufacturers, in conjunction with their material and component suppliers, are as follows:

- **Refrigerators and freezers** – improved condensers, compressors, evaporators, fan motors, door seals and foam insulation
- **Dishwashers** – better insulation, spray arms and filtering systems; and the availability of an air-dry cycle
- **Electric ranges** – improvements in insulation and venting
- **Clothes washers** – upgraded sensors, motors and mixing valves; the promotion of a cold water wash; and the addition of front-loading clothes washers to manufacturers' product lines
- **Electric clothes dryers** – automatic termination controls eliminating excessive drying and more effective water extraction in the washing machine, resulting in a shorter drying time.

[20] Source: Canadian Appliance Manufacturers Association, a division of Electro-Federation Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 (www.electrofed.com).

[21] Natural Resources Canada, *2003 Survey of Household Energy Use, Detailed Statistical Report* (Ottawa: 2006), p. 59. Available: oee.nrcan.gc.ca/Publications/statistics/sheu03/pdf/sheu03.pdf.

1 REFRIGERATORS



Refrigerators are available in various sizes and with a variety of features, all of which affect energy consumption. Consequently, EnerGuide groups refrigerators according to type and size, thereby enabling you to compare the energy consumption of similar models. Table 1.1 compares the market share of the various types of refrigerators in 2005.

The following are the definitions of the various types of refrigerators:

Refrigerators without automatic defrost

Type 1 Refrigerators and refrigerator-freezers with manual defrost

Type 2 Refrigerator-freezers with partial automatic defrost

Refrigerators with automatic defrost

Type 3 Refrigerator-freezers with automatic defrost and top-mounted freezer, but without through-the-door ice service; also all-refrigerators[22] with automatic defrost

Type 4 Refrigerator-freezers with automatic defrost and side-mounted freezer, but without through-the-door ice service

Type 5 Refrigerator-freezers with automatic defrost and bottom-mounted freezer, but without through-the-door ice service

Type 6 Refrigerator-freezers with automatic defrost, top-mounted freezer and through-the-door ice service

Type 7 Refrigerator-freezers with automatic defrost, side-mounted freezer and through-the-door ice service

Refrigerators – compact

Type 11 Compact refrigerators and refrigerator-freezers with manual defrost

Type 12 Compact refrigerators and refrigerator-freezers with partial automatic defrost

Type 13 Compact refrigerator-freezers with automatic defrost and top-mounted freezer; also compact all-refrigerators with automatic defrost

Type 14 Compact refrigerator-freezers with automatic defrost and side-mounted freezer

Type 15 Compact refrigerator-freezers with automatic defrost and bottom-mounted freezer

TABLE 1.1
Refrigerator Market, 2005

Type of Refrigerator	Market Share (%)
1	0.0
2	0.0
3	64.8
4	1.1
5	17.9
6	0.0
7	9.6
11	6.3
12	0.0
13	0.1
14	0.0
15	0.0
	100.0
Through-the-Door Ice Service	9.6
Type of Freezer*	
Top-mounted	64.9
Side-mounted	11.3
Bottom-mounted	17.9
Without freezer	5.8
	100.0

*Due to rounding, the numbers may not add up to 100.

[22] The term "all-refrigerators" refers to models that have no freezer compartment.

1.1 2005 Market Snapshot

The shipment-weighted average annual unit energy consumption (UEC) of all refrigerators shipped in 2005 was 469 kilowatt hours (kWh). In 2005, as in all years studied since 1990, Type 3 refrigerators (those with a top-mounted freezer and automatic defrost) were the most popular type in Canada, accounting for 64.8 percent of all refrigerators shipped on the Canadian market. The shipment-weighted average annual UEC of Type 3, and all other refrigerator types, is outlined in Table D.1 in Appendix D, "Detailed Tables." The most popular size category, 16.5 to 18.4 cubic feet (cu. ft.), accounted for 41.6 percent of the market in 2005.

In 2005, 37.6 percent of the refrigerator models on the market qualified as ENERGY STAR® products, exceeding the minimum energy performance standards (MEPS) by at least 15 percent (refer to Table D.A.1 in Appendix D, "Detailed Tables").

There has been a substantial improvement in the energy efficiency of refrigerators since 1990. By 2005, 86.7 percent of refrigerators consumed less than 30 kWh/cu. ft. per year, even though a trend toward larger refrigerators had emerged.

- *In 2005, refrigerators with a volume between 16.5 and 18.4 cu. ft. remained the most popular, on average accounting for 41.6 percent of the market.*
- *From 1990 to 2005, the largest refrigerators (those with a volume of at least 20.5 cu. ft.) more than quadrupled in market share – rising from 5.1 to 21.7 percent.*
- *In 1990, refrigerators larger than 16.4 cu. ft. consumed on average more than 1000 kWh of electricity per year. By 2005, refrigerators that size consumed less than half as much energy, and some of the largest units (28.5 to 30.4 cu. ft.) consumed, on average, only 628 kWh of electricity per year.*

1.2 Distribution of Shipments

1.2.1 Distribution by Type

TABLE 1.2
Distribution of Refrigerators by Type

Model Year	Type 1 (%)	Type 2 (%)	Type 3 (%)	Type 4 (%)	Type 5 (%)	Type 6 (%)	Type 7 (%)	Type 11 (%)	Type 13 (%)
1990	3.5	2.0	84.9	7.6	0.6	0.0	0.0	0.1	1.2
1991	3.1	0.3	84.3	9.0	0.8	0.0	0.3	0.3	2.0
1992	2.1	0.4	85.4	7.5	0.3	0.0	3.5	0.1	0.6
1993	1.1	0.6	85.5	6.8	0.7	0.0	4.2	0.1	0.9
1994	0.6	0.7	85.1	4.9	2.0	0.1	4.3	1.3	1.0
1995	0.2	0.6	84.8	4.6	1.6	0.1	5.2	1.9	1.0
1996	0.2	0.5	84.8	4.4	2.2	0.1	6.6	0.8	0.4
1997	0.4	0.1	83.8	3.8	3.2	0.0	8.3	0.4	0.0
1998	0.4	0.0	76.5	3.3	8.5	0.3	7.3	3.6	0.0
1999	0.1	0.0	76.6	2.4	8.4	0.4	7.5	4.6	0.0
2000	0.0	0.0	72.9	2.2	11.1	0.5	7.9	5.3	0.0
2001	0.0	0.0	71.1	2.1	11.1	0.4	9.1	6.1	0.1
2002	0.0	0.0	70.2	2.2	10.6	0.2	11.0	5.8	0.1
2003	0.0	0.0	68.2	2.4	13.9	0.1	11.2	2.0	2.2
2004	0.0	0.0	66.4	1.9	15.5	0.1	11.0	4.5	0.5
2005	0.0	0.0	64.8	1.1	17.9	0.0	9.6	6.3	0.1
Total Change	3.5%	2.0%	20.1%	6.5%	17.3%	0.0%	9.6%	6.2%	1.1%

Although Type 3 refrigerators were consistently the most shipped model between 1990 and 2005, their market share declined from 84.9 to 64.8 percent of all refrigerators shipped, as demonstrated in Table 1.2 and Figure 1.1.

There seems to be an increasing trend toward refrigerators with a bottom-mounted freezer (Type 5). These refrigerators did not have a significant market share in 1990; but with a steady increase in popularity, they accounted for 17.9 percent of the market in 2005. Also, refrigerators with a side-mounted freezer, automatic defrost and through-the-door ice service (Type 7) remained popular, accounting for 9.6 percent of the market in 2005. Out of these two increasingly popular refrigerator types (5 and 7), Type 5 is generally more energy efficient (see Figure 1.2 and Table D.1 in Appendix D, "Detailed Tables"). Types 1, 2, 4, 6 and 13 had almost disappeared from the market by 2005. Data on Types 12, 14 and 15 refrigerators are available, but because the values are so low, they were not included in the analysis.

FIGURE 1.1
Distribution of Refrigerators by Type, 1990 and 2005

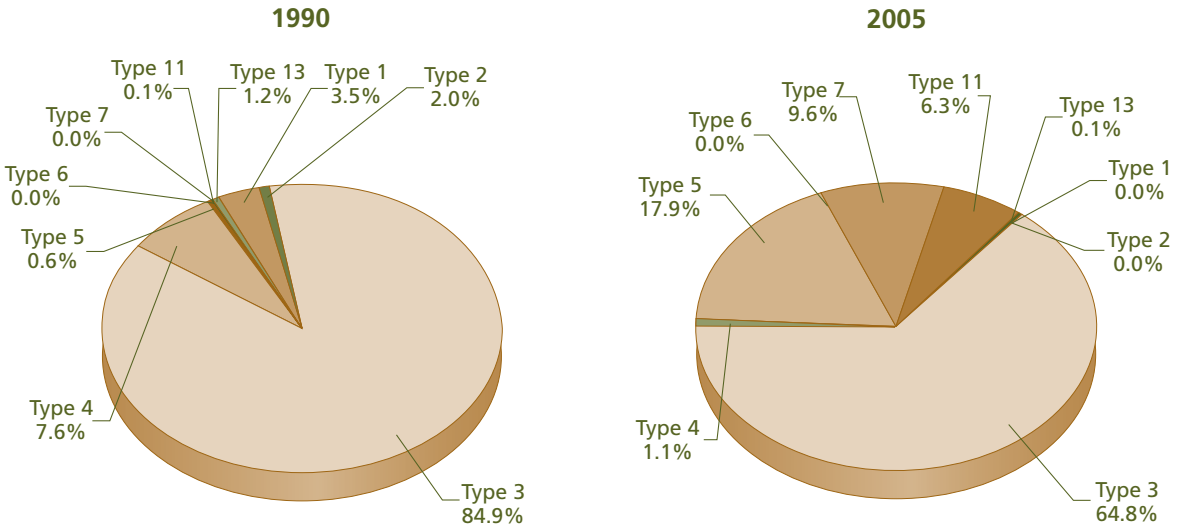
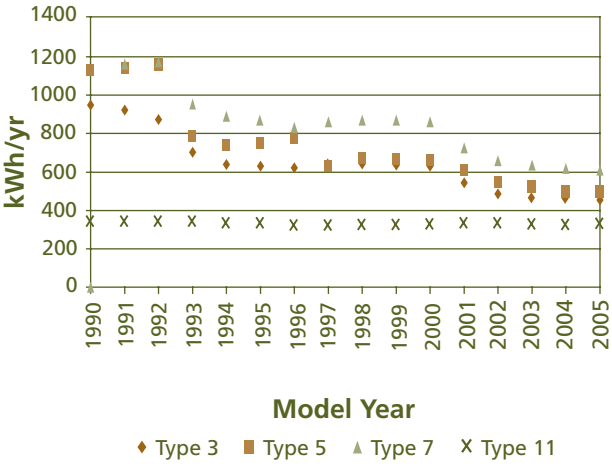


FIGURE 1.2
Average Annual Unit Energy Consumption of Refrigerators by Type, by Model Year*

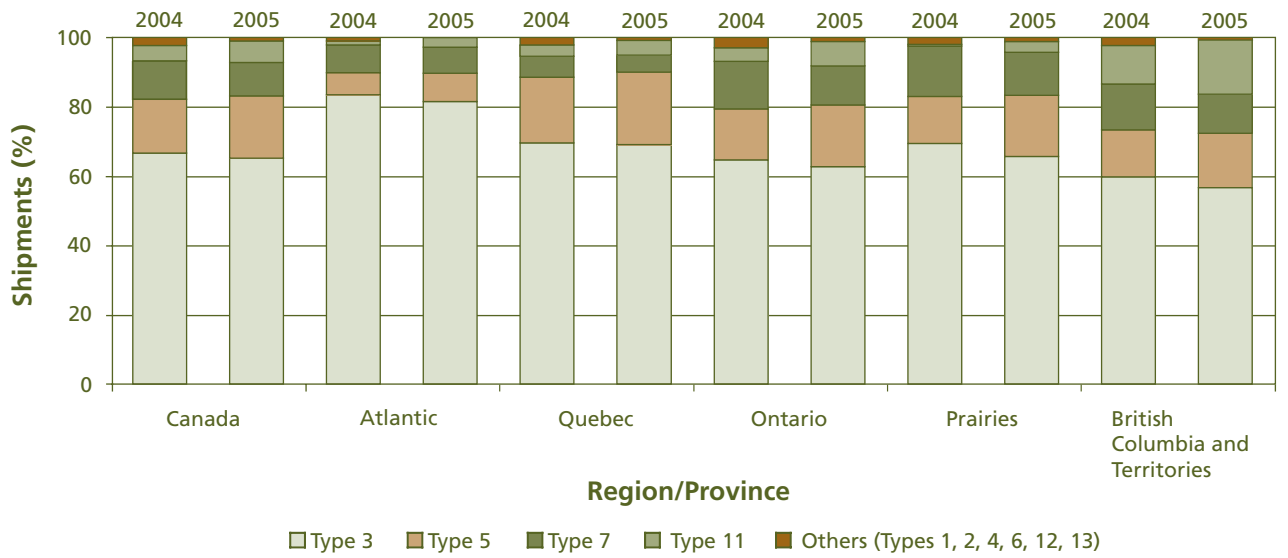


*For more information, see Table D.1 in Appendix D, "Detailed Tables."

Figure 1.2 demonstrates the average annual UEC of the four most popular refrigerator types during the study period. Type 11 and Type 3 refrigerators remained the most energy efficient, followed by Types 5 and 7.

1.2.2 Distribution by Type, by Region/Province

FIGURE 1.3
Distribution of Refrigerators by Type, by Region/Province, 2004 and 2005*



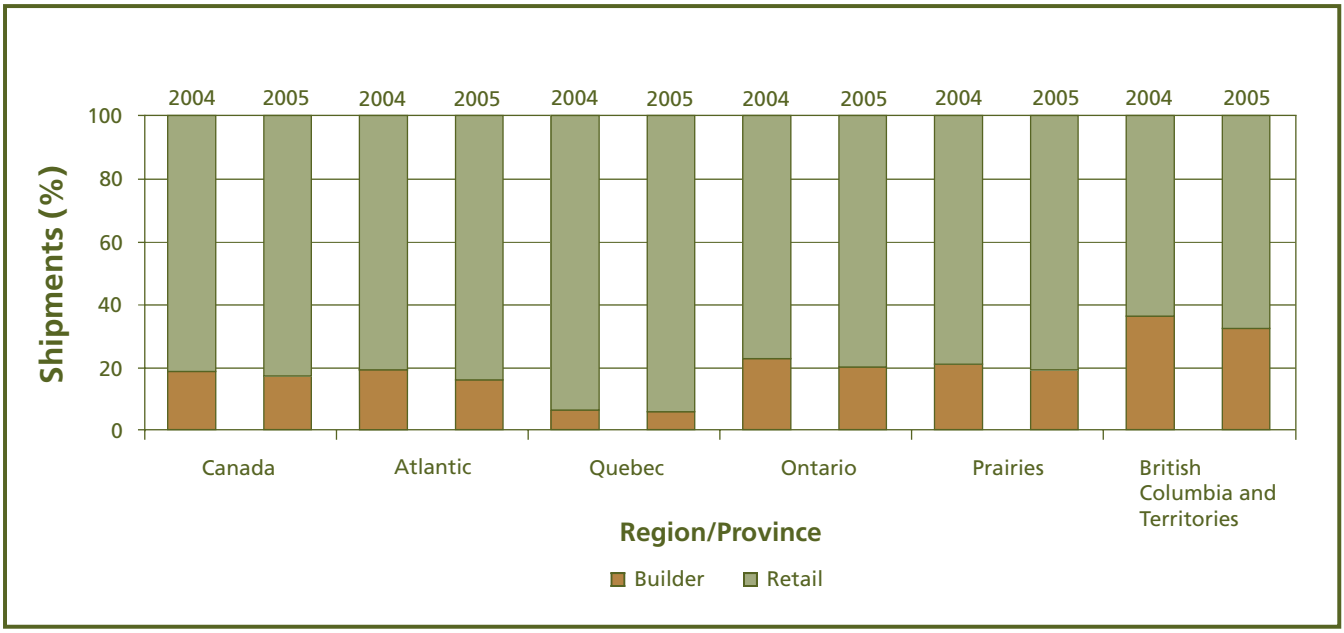
*For more information, see Table D.2 in Appendix D, "Detailed Tables."

As previously mentioned, Type 3 refrigerators (those with a top-mounted freezer and automatic defrost) remained the most shipped model in 2005, with a national average of 64.8 percent. Figure 1.3 illustrates the distribution of the various types of refrigerators throughout the regions/provinces, in 2004 and 2005.

Type 3 refrigerators remained the most popular in the Atlantic provinces, whereas Type 5 (those with a bottom-mounted freezer and automatic defrost) remained more popular in Quebec (19 percent in 2004 and 21 percent in 2005), followed by Ontario and the Western provinces (13 to 14 percent in 2004 and 16 to 18 percent in 2005). Type 7 (those with a side-mounted freezer, automatic defrost and through-the-door ice service) were more popular in Ontario and the Western provinces (13 to 14 percent in 2004 and 11 to 12 percent in 2005). The popularity of Type 11 refrigerators (compact refrigerators with manual defrost) grew in British Columbia and the Territories (from 11 percent in 2004 to 16 percent in 2005).

1.2.3 Distribution by Channel, by Region/Province

FIGURE 1.4
Distribution of Refrigerators by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.3 in Appendix D, "Detailed Tables."

Figure 1.4 demonstrates the proportion of refrigerators shipped for retail sales[23] versus those shipped for builder sales,[24] for 2004 and 2005. It shows slight decreases in builder shipments for all regions of the country. Once again, British Columbia and the Territories had a substantially larger builder representation than the other regions; shipments of refrigerators to builders in Quebec were again relatively low.

[23] Retail sales include those by Canadian manufacturers and importers and/or their branches and distributors to Canadian retailers and other consumers, but do not include sales to branches or to other Canadian Appliance Manufacturers Association member companies.
[24] Builder sales include those to home, row house or apartment builders; motels; governments; trailer manufacturers; and property management.

1.2.4 Distribution by Volume

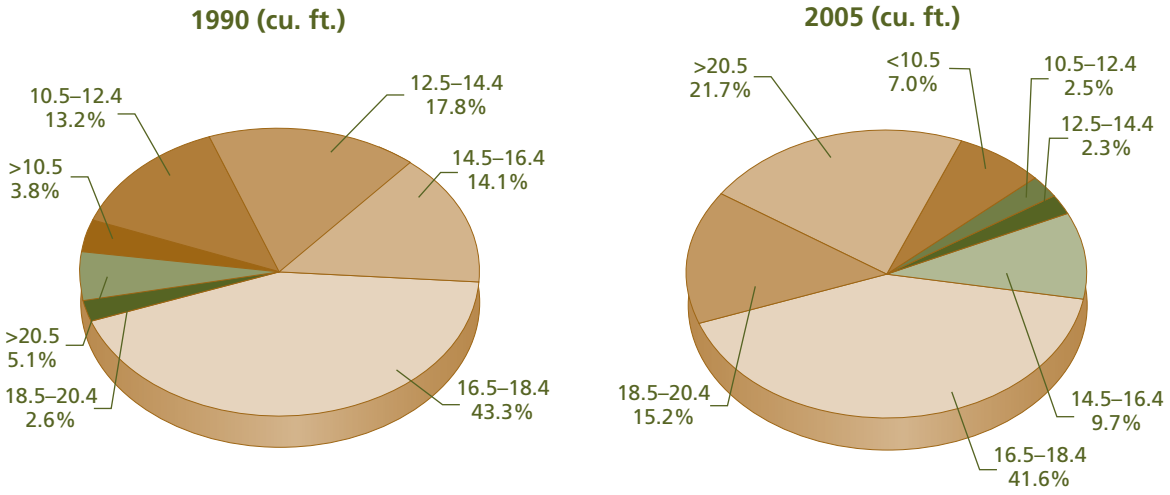
TABLE 1.3
Distribution of Refrigerators by Volume

Model Year	Volume (cu. ft.) <10.5 (%)	10.5–12.4 (%)	12.5–14.4 (%)	14.4–16.4 (%)	16.5–18.4 (%)	18.5–20.4 (%)	>20.5 (%)
1990	3.8	13.2	17.8	14.1	43.3	2.6	5.1
1991	2.6	14.2	11.0	14.2	47.9	5.4	4.7
1992	1.6	10.9	10.0	19.6	42.0	8.3	7.6
1993	2.2	8.0	7.1	16.6	45.3	12.2	8.7
1994	3.4	9.5	6.9	16.5	45.8	8.7	9.3
1995	3.7	14.1	6.7	15.0	39.5	10.8	10.2
1996	1.9	13.5	6.7	13.4	38.6	12.5	13.4
1997	0.9	11.1	6.9	12.2	39.2	12.7	16.9
1998	4.0	9.3	7.0	10.6	42.7	11.1	15.2
1999	5.3	7.6	6.9	9.9	43.5	10.0	16.8
2000	6.5	6.6	7.7	9.0	41.2	9.3	19.7
2001	8.1	5.6	6.7	8.7	36.4	11.4	23.2
2002	6.3	5.5	7.4	6.8	34.6	15.3	24.2
2003	4.9	3.9	6.1	8.6	37.0	15.7	23.9
2004	5.6	3.0	3.3	11.0	39.2	14.3	23.5
2005	7.0	2.5	2.3	9.7	41.6	15.2	21.7
Total Change	▲ 3.5%	▼ 10.7%	▼ 15.5%	▼ 4.4%	▼ 1.7%	▲ 12.6%	▲ 16.6%

Refrigerators with a volume between 16.5 and 18.4 cu. ft. remained the most popular, on average accounting for 41.6 percent of the market in 2005, as outlined in Table 1.3 and Figure 1.5. However, a trend toward larger refrigerators had emerged. The market share of refrigerators with a capacity greater than 16.5 cu. ft. increased steadily during the study period – rising from 51.0 percent to 78.6 percent. This increase is also evidenced in the findings of the *2003 Survey of Household Energy Use*[25] where, in 2003, more than 61 percent of households possessed a main refrigerator larger than 16.5 cu. ft.

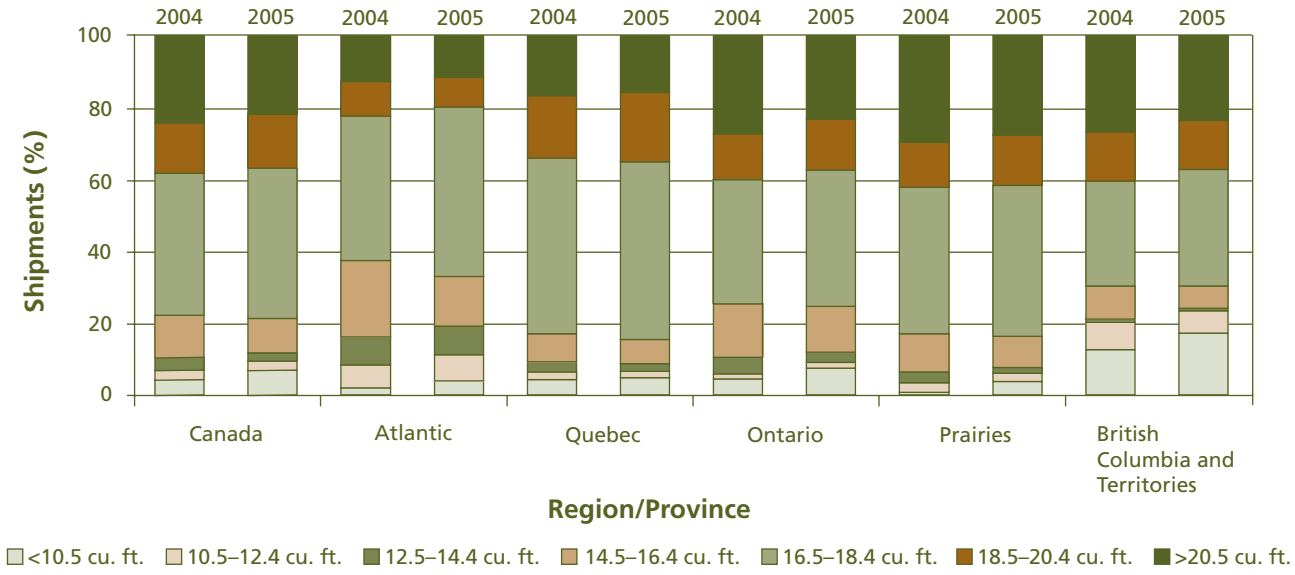
[25] Natural Resources Canada, *2003 Survey of Household Energy Use, Detailed Statistical Report* (Ottawa: 2006), Table 5.1, p. 57. Available: oee.nrcan.gc.ca/Publications/statistics/sheu03/pdf/sheu03.pdf.

FIGURE 1.5
Distribution of Refrigerators by Volume, 1990 and 2005



1.2.5 Distribution by Volume, by Region/Province

FIGURE 1.6
Distribution of Refrigerators by Volume, by Region/Province, 2004 and 2005*



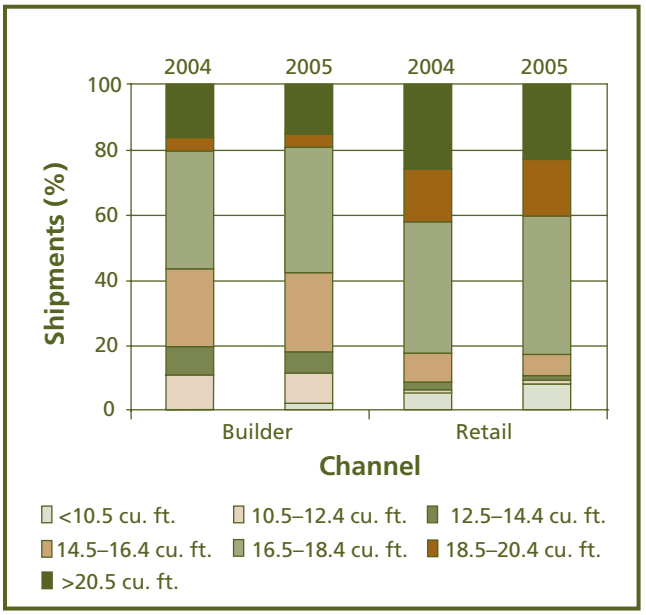
*For more information, see Table D.4 in Appendix D, "Detailed Tables."

Figure 1.6 demonstrates that refrigerators between 16.5 and 18.4 cu. ft. were the most popular nationally in 2004 and 2005. This chart shows that consumers in the Atlantic provinces purchased slightly larger refrigerators in 2005, where demand for refrigerators between 16.5 and 18.4 cu. ft. grew from 40.3 percent in 2004 to 47.1 percent in 2005. This chart also shows that British Columbia and the Territories received more shipments of small refrigerators (those smaller than 10.5 cu. ft.) in 2005 (17.3 percent in 2005 compared with 12.7 percent in 2004).

Figure 1.7 compares the national breakdown of the distribution of refrigerators for retail sales and builder sales in 2004 and 2005. Although the most popular size of refrigerator in both cases for both years was between 16.5 and 18.4 cu. ft., retail shipments of refrigerators larger than 18.5 cu. ft. remained higher in 2005 than those shipped for the builder trade. This chart also shows that shipments of refrigerators between 14.5 and 16.4 cu. ft. to builders remained higher in 2005 than those shipped for retail sales.

The channel (retail versus builder) data also show that retail shipments of refrigerators smaller than 10.5 cu. ft. remained quite high in British Columbia and the Territories. Similarly, retail shipments of those between 14.5 and 16.4 cu. ft. remained higher in the Atlantic provinces. Builder shipments of refrigerators between 10.5 and 12.4 cu. ft. remained higher in the Atlantic provinces and Quebec. Similarly, builder shipments of the largest refrigerators (those larger than 20.5 cu. ft.) remained highest in the Prairies and in British Columbia and the Territories. For more information, see Tables D.5 and D.6 in Appendix D, "Detailed Tables."

FIGURE 1.7
Distribution of Refrigerators by Volume, by Channel, 2004 and 2005*



*For more information, see Tables D.5 and D.6 in Appendix D, "Detailed Tables."

1.2.6 Distribution by Average Annual Unit Energy Consumption per Cubic Foot

TABLE 1.4
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot

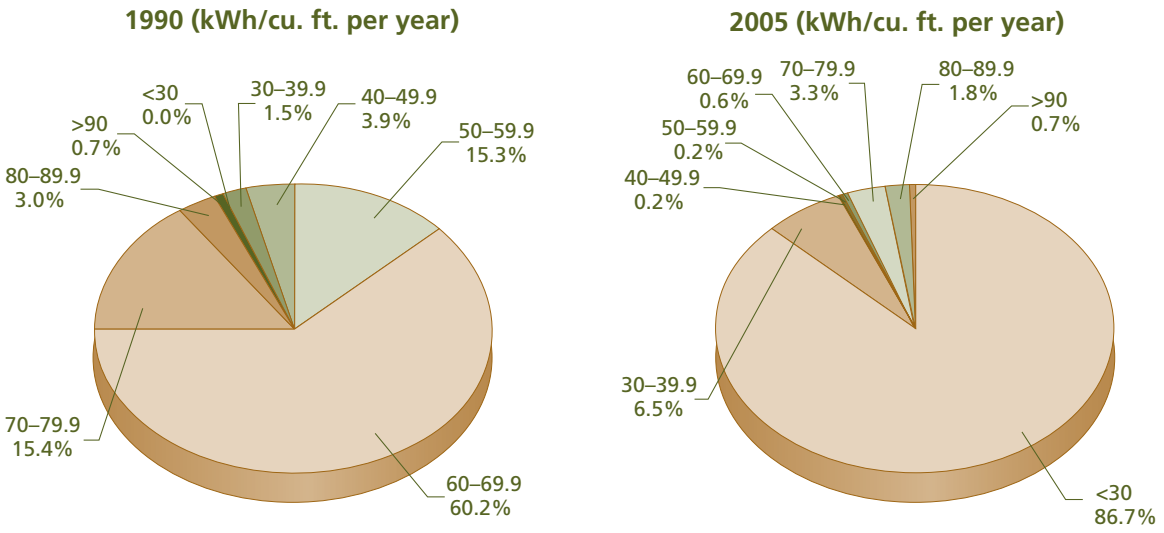
Model Year	kWh/cu. ft. per year							
	<30 (%)	30–39.9 (%)	40–49.9 (%)	50–59.9 (%)	60–69.9 (%)	70–79.9 (%)	80-89.9 (%)	>90 (%)
1990	0.0	1.5	3.9	15.3	60.2	15.4	3.0	0.7
1991	0.0	2.9	10.7	26.9	41.3	12.2	3.6	2.4
1992	0.0	4.8	26.9	33.2	16.0	10.4	4.0	4.8
1993	0.1	51.0	29.7	9.1	1.4	4.2	1.9	2.6
1994	0.4	70.9	22.4	4.0	0.0	0.0	1.7	0.6
1995	2.8	63.3	29.3	1.6	0.0	0.1	2.5	0.5
1996	6.6	60.0	31.2	0.9	0.1	0.0	0.7	0.4
1997	6.9	60.4	31.4	0.9	0.1	0.0	0.2	0.1
1998	5.9	62.4	27.1	0.8	0.0	0.6	2.9	0.2
1999	8.4	61.2	25.0	0.6	0.2	0.7	3.4	0.6
2000	12.2	57.4	23.6	0.9	0.4	0.7	3.6	1.2
2001	44.5	34.5	12.7	1.3	0.8	4.0	0.7	1.5
2002	64.3	26.6	3.1	0.2	0.0	3.9	0.2	1.7
2003	78.4	15.5	1.6	0.2	0.2	2.8	0.2	1.0
2004	82.6	11.0	1.3	0.2	0.2	1.2	3.0	0.7
2005	86.7	6.5	0.2	0.2	0.6	3.3	1.8	0.7
Total Change	86.7%	5.0%	3.7%	15.1%	59.6%	12.1%	1.2%	0.0%

Refrigerators are becoming more efficient, thanks largely to the ongoing efforts of manufacturers, the MEPS and the amendment to the MEPS. Note in Table 1.4 and Figure 1.8 that, since this 2001 amendment to the MEPS, there has been a substantial improvement in the energy efficiency of refrigerators.[26] By 2005, 86.7 percent of refrigerators consumed less than 30 kWh per cu. ft. per year, even though there was a definite trend toward larger ones, as illustrated in Table 1.3.

Also responsible for the trend toward the purchase of more energy-efficient refrigerators are the various initiatives and incentives offered by the federal, provincial and municipal governments and utilities.

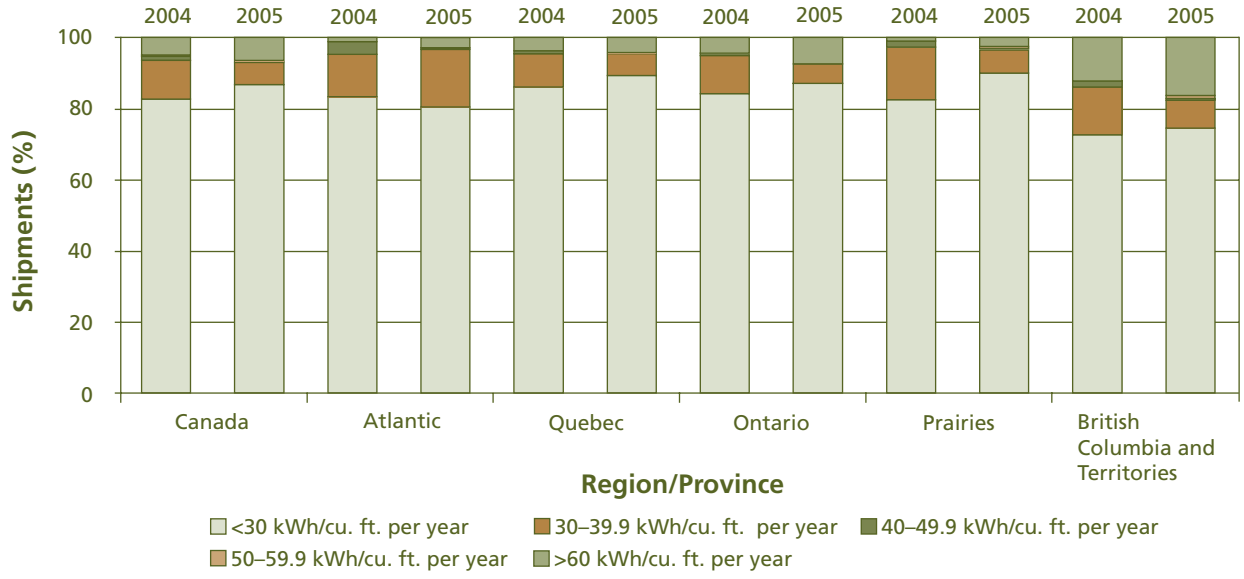
[26] For more information about the 2001 amendment to the MEPS for refrigerators, visit the following Web site: oee.nrcan.gc.ca/regulations/refrigerators.cfm.

FIGURE 1.8
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot, 1990 and 2005



1.2.7 Distribution by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province

FIGURE 1.9
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004 and 2005*



*For more information, see Table D.7 in Appendix D, "Detailed Tables."

In 2005, 86.7 percent of all refrigerators shipped in Canada consumed less than 30 kWh/cu. ft. Figure 1.9 shows that, in 2005, consumers in British Columbia and the Territories continued to have a slight preference towards more energy-intensive refrigerators, compared with the rest of the country; 25.6 percent of refrigerators shipped there consumed more than 30 kWh/cu. ft. This could be attributed to the fact that they have a higher percentage of compact refrigerator shipments than other regions, which have been found to be less energy efficient (see Figure 1.12 and Table D.9 in Appendix D, "Detailed Tables").

1.3 Energy Consumption

1.3.1 Average Annual Unit Energy Consumption by Model Year

As mentioned previously, even though there is diversity in types and sizes of refrigerators, they have all been grouped to calculate the average UEC for all refrigerators by model year (see Figure 1.10). Overall, the UEC decreased by 487 kWh during the study period. Note the significant decrease in UEC from 2000 to 2005 (170.3 kWh per year), which coincides with the 2001 amendment to the MEPS. For analysis of the distribution of refrigerators by average annual UEC by type, see Table D.1 in Appendix D, "Detailed Tables." Because size is so important in such analysis, you are advised to also look further at the distribution of refrigerators by average annual UEC per cubic foot by volume (Table D.9 in Appendix D, "Detailed Tables").

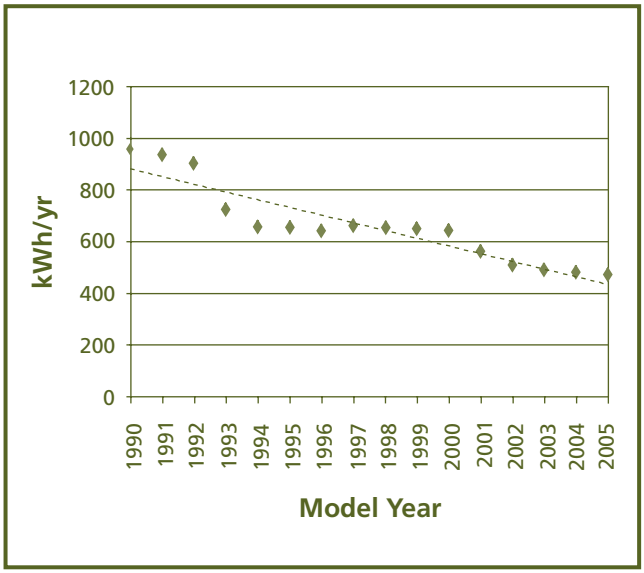
1.3.2 Average Annual Unit Energy Consumption by Volume

The energy performance of refrigerators improved remarkably between 1990 and 2005. As illustrated in Figure 1.11, the larger the volume, the greater the decrease in average annual UEC. The average annual UEC of refrigerators with volumes smaller than 5 cu. ft. remained relatively unchanged during the period.

In 1990, refrigerators larger than 16.5 cu. ft. consumed on average more than 1000 kWh of electricity per year. By 2005, refrigerators that size consumed less than half as much energy, and some of the largest units (28.5 to 30.4 cu. ft.) consumed, on average, only 628 kWh of electricity per year.

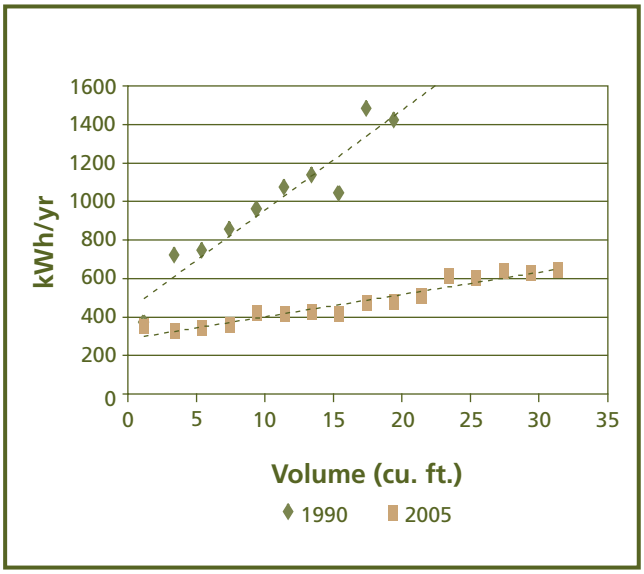
The gap between the average annual UEC of the largest and smallest units narrowed between 1990 and 2005. At the beginning of this period, the difference between the average annual UEC of the largest and smallest units was more than 1000 kWh. By 2005, with manufacturers improving the energy efficiency of larger models, the difference had shrunk to about 292 kWh. This trend demonstrates that there is less of a deterrent for purchasing larger units.

FIGURE 1.10
Average Annual Unit Energy Consumption of Refrigerators by Model Year*



*For more information, see Table D.1 in Appendix D, "Detailed Tables."

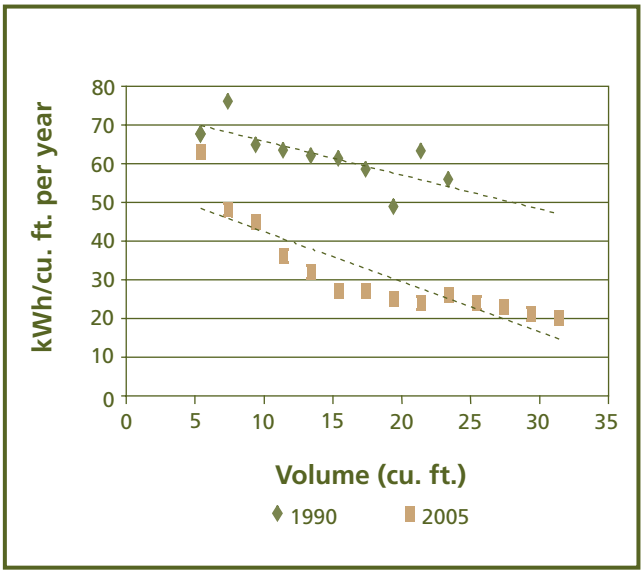
FIGURE 1.11
Average Annual Unit Energy Consumption of Refrigerators by Volume*



*For more information, see Table D.8 in Appendix D, "Detailed Tables."

The trend in the average annual UEC of refrigerators, on a per-cubic-foot basis, is consistent with the previous findings. Figure 1.12 shows that larger models consume less energy per cubic foot than smaller ones.

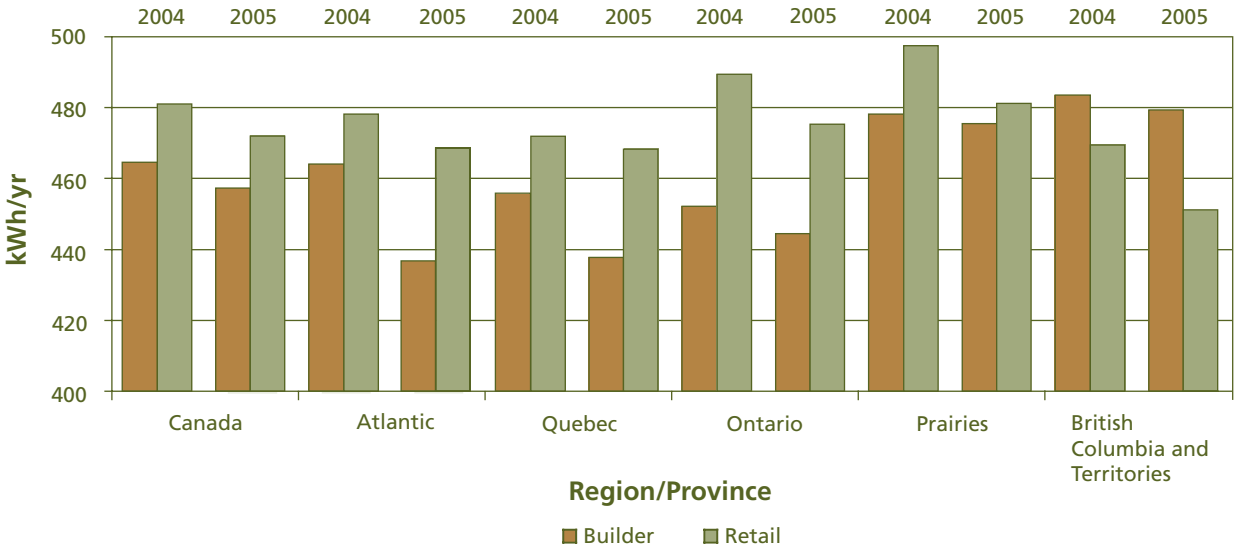
FIGURE 1.12
Average Annual Unit Energy Consumption per Cubic Foot of Refrigerators by Volume*



*For more information, see Table D.9 in Appendix D, "Detailed Tables."

1.3.3 Average Annual Unit Energy Consumption by Channel, by Region/Province

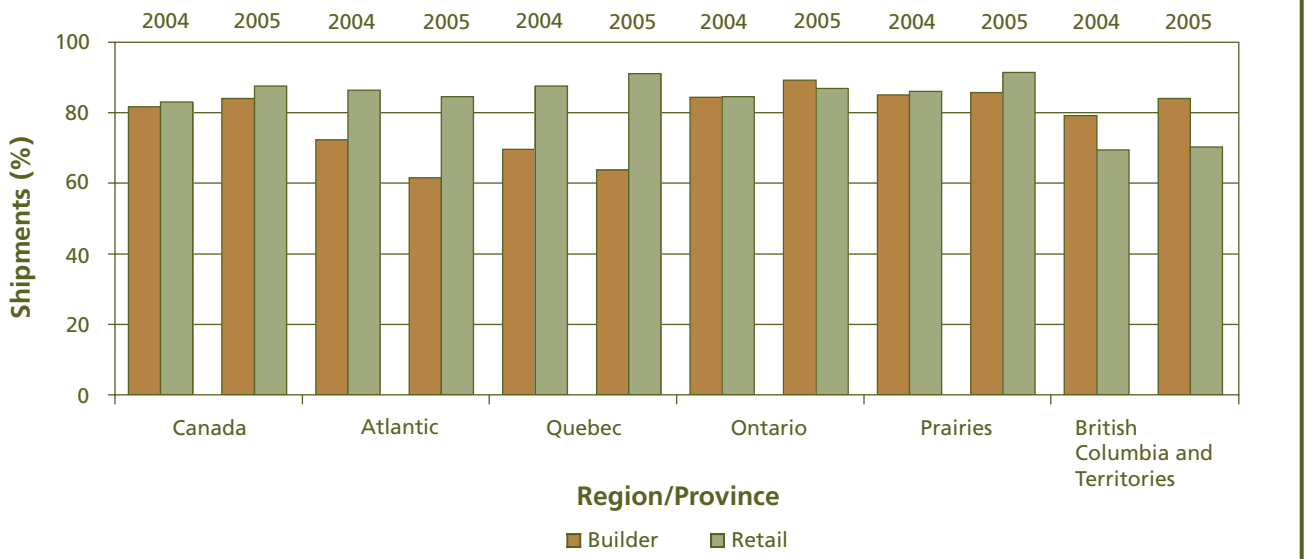
FIGURE 1.13
Average Annual Unit Energy Consumption of Refrigerators by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.10 in Appendix D, "Detailed Tables."

Figure 1.13 demonstrates the breakdown of the average annual UEC of refrigerators by shipments for retail purposes and for the builder trade by region/province for 2004 and 2005. In all regions, the average annual UEC decreased slightly for retail and builder shipments. It seems that builders in the Atlantic provinces and Quebec are providing their customers with more energy-efficient refrigerators. This chart also shows that in most regions, the average annual UEC remained higher for refrigerators tagged for retail shipments. Retail refrigerators are generally larger and, therefore, consume more energy. In British Columbia and the Territories, however, the average annual UEC remained higher for refrigerators shipped to the builder trade. This is partly because builders in this region continued to provide their clients with larger refrigerators (those more than 16.5 cu. ft.) than those provided by builders in the rest of the country.

FIGURE 1.14
Distribution of Refrigerators Consuming Less Than 30 kWh/cu. ft. per Year, 2004 and 2005*



*For more information, see Table D.11 in Appendix D, "Detailed Tables."

Figure 1.14 demonstrates that nationally, there was a slight increase in builder and retail shipments of refrigerators consuming less than 30 kWh/cu. ft. per year, from 2004 to 2005. It also shows fluctuations of these proportions throughout the provinces/regions. For example, builder shipments in Quebec and retail shipments in British Columbia and the Territories were somewhat more energy-intensive than the national average in 2004 and 2005.

1.4 Energy Savings

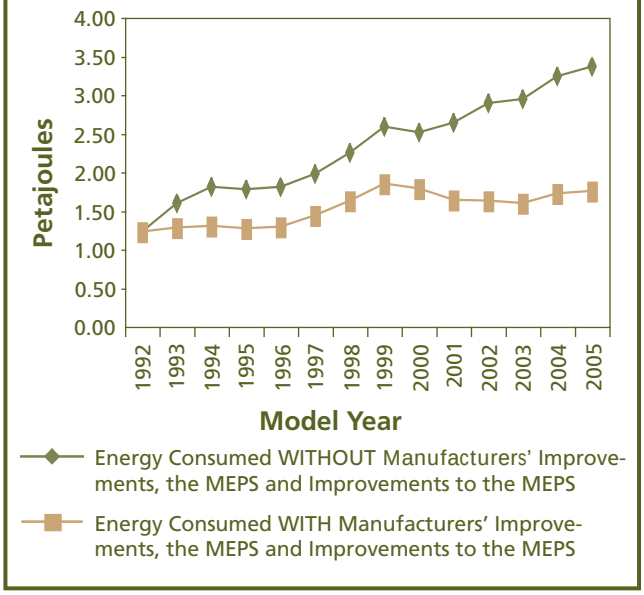
Figure 1.15 shows how much energy refrigerators might have consumed annually between 1992 and 2005 without the decrease in average annual UEC *(top line)* and how much energy refrigerators actually consumed during those years *(bottom line)*.

The divergence of the two lines in Figure 1.15 represents incremental annual energy savings. Even though the MEPS did not come into effect until 1995, the calculation of energy savings is based on data from 1992 onward. This is because energy efficiency began to improve almost immediately after the *Energy Efficiency Act* came into force in 1992, thanks to such market forces as the regulations expected from the Act and United States regulations.

The average annual energy savings for refrigerators were estimated to be 0.9 petajoules (PJ) between 1993 and 2005. (No savings were expected in 1992.) This indicates that, on average, refrigerators consumed about 0.9 PJ less per year than they would have without the factors described above.

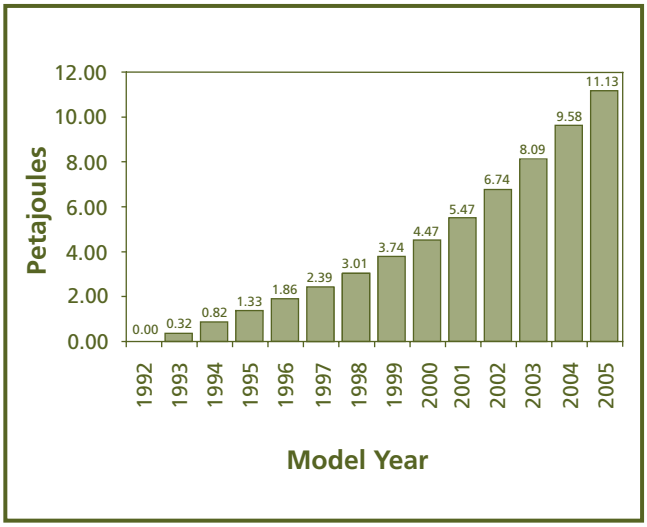
Cumulative energy savings for refrigerators are shown in Figure 1.16 and in Table D.12 in Appendix D, "Detailed Tables." In 2005, refrigerators consumed about 1.61 PJ less than they would have otherwise. They reached a total savings of 11.13 PJ in 2005, taking into account the life expectancy factor of refrigerators. (This calculation is explained further in Appendix A, "Methodology.")

FIGURE 1.15
Annual Energy Savings for Refrigerators, 1992–2005*



*For more information, see Table D.12 in Appendix D, "Detailed Tables."

FIGURE 1.16
Cumulative Energy Savings for Refrigerators, 1992–2005*



*For more information, see Table D.12 in Appendix D, "Detailed Tables."

1.5 Refrigerators Summary

Type 3 refrigerators (refrigerator-freezers with a top-mounted freezer and automatic defrost) remained the most popular type in Canada (64.8 percent of the market in 2005). However, their market share had declined since 1990, when they represented 84.9 percent of the market. Shipments of refrigerators with a bottom-mounted freezer (Type 5) continued to rise in popularity in 2005, and refrigerators with a side-mounted freezer and through-the-door ice service (Type 7) remained popular.

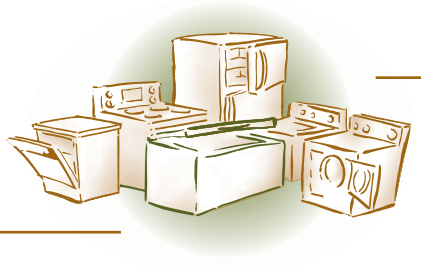
Of the refrigerators shipped in 2005, 37.6 percent were ENERGY STAR qualified. Table D.A.1 in Appendix D, "Detailed Tables," shows that 2004 and 2005 shipments of ENERGY STAR refrigerators were down slightly from 2003. This decrease is due to the introduction in 2004 of more stringent specifications for refrigerators to qualify for the ENERGY STAR registered mark.

In 2005, the most popular size category of refrigerators was 16.5 to 18.4 cu. ft., although there remained a continued trend for larger ones (those more than 18.5 cu. ft.). Refrigerators, however, were becoming more efficient – from 2000 to 2005, the market share of refrigerators requiring less than 30 kWh per cu. ft. increased from 12.2 percent to 86.7 percent. As mentioned previously in this chapter, the larger the volume capacity of refrigerators shipped in 2005, the greater the decrease in their average annual UEC.

In 2005, 83.0 percent of all refrigerators were categorized as retail shipments, whereas 17.0 percent of them were tagged as builder shipments. British Columbia and the Territories continued to have a substantially larger share of builder shipments than the rest of the country, whereas Quebec continued to have a somewhat smaller builder share.

The average annual energy savings for refrigerators were estimated to be 0.9 PJ between 1992 and 2005, with total energy savings for that period reaching 11.13 PJ (3.09 billion kWh). Dollar savings for refrigerators for the study period were estimated to be $284 million (calculated at 9.2 cents/kWh).

2 FREEZERS



Freezers are available in various sizes and styles, all of which affect energy consumption. This is why EnerGuide groups freezers according to type, enabling you to compare the energy consumption of similar models. As previously noted, because of restrictions in the market information available, the freezer shipment data are not as comprehensive as for the other appliances and should be used with caution.

Upright freezers

Type 8 Upright freezers with manual defrost

Type 9 Upright freezers with automatic defrost

Chest freezers

Type 10 Chest freezers and all other freezers

Compact freezers

Type 16 Compact upright freezers with manual defrost

Type 17 Compact upright freezers with automatic defrost

Type 18 Compact chest freezers and all other freezers

2.1 2005 Market Snapshot

Although Type 10 (chest) freezers were again the most popular type in 2005, their popularity decreased substantially from 2004 to 2005, mostly in favour of Type 18 (compact chest freezers). The shipment-weighted average annual unit energy consumption (UEC) for Type 10 freezers was 352 kilowatt hours (kWh), compared with 269 kWh for Type 18 (as outlined in Table D.16 in Appendix D, "Detailed Tables").

Freezers were included in the ENERGY STAR® Initiative in 2003. More detailed data on qualified freezers will be included in future analyses, as they become more readily available.

The energy efficiency of freezers improved between 1990 and 2005. In 1990, almost all freezers required more than 50 kWh per year to freeze each cubic foot of space. By 2005, 74.7 percent of all freezers required less than 40 kWh per year to freeze each cubic foot of space.

2.2 Distribution of Shipments

2.2.1 Distribution by Type

TABLE 2.1
Distribution of Freezers by Type

Model Year	Type 8 (%)	Type 9 (%)	Type 10 (%)	Type 16 (%)	Type 18 (%)
1990	16.8	0.0	64.9	0.0	18.3
1991	11.8	0.4	81.2	0.0	6.7
1992	12.9	0.3	79.2	0.0	7.6
1993	14.4	0.6	70.3	0.0	14.8
1994	12.9	0.6	71.3	0.0	15.1
1995	16.0	0.7	66.5	0.0	16.7
1996	17.1	1.1	64.0	0.1	17.7
1997	19.1	1.0	60.2	0.3	19.4
1998	21.2	1.8	57.5	0.0	19.5
1999	21.6	2.5	60.3	0.1	15.5
2000	23.9	3.1	56.2	1.2	15.5
2001	27.8	6.7	58.3	1.8	13.8
2002	24.9	9.8	48.9	0.0	16.4
2003	27.8	9.2	47.4	0.0	15.6
2004	29.4	8.3	45.5	0.0	16.8
2005	30.4	10.7	35.7	0.0	23.2
Total Change	13.6%	10.7%	29.2%	0.0%	4.8%

Type 10 freezers have dominated the freezer market in Canada throughout the study period. However, as demonstrated in Table 2.1 and Figure 2.1, the market share of chest freezers (Types 10 and 18) declined from 83.2 percent to 58.9 percent during those years. Conversely, upright freezers (Types 8 and 9) gained a 24.3 percent increase in market share between 1990 and 2005. They accounted for 41.1 percent of the market in 2005. (For more information, see Table D.13 in Appendix D, "Detailed Tables") Unfortunately, Types 8 and 9 freezers are less energy efficient than Type 10 freezers. That is because lifting the door on a chest unit releases less cold air than opening the door to an upright freezer, where the cold air flows down and out.[27]

[27] Natural Resources Canada, *EnerGuide Appliance Directory* 2005 (Ottawa: February 2005), p. 127.

FIGURE 2.1
Distribution of Freezers by Type, 1990 and 2005

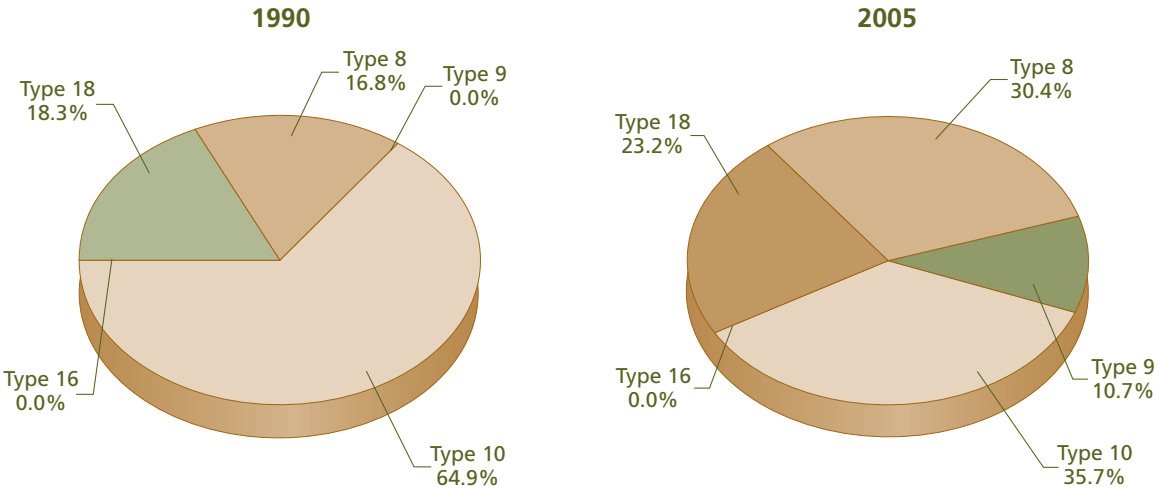
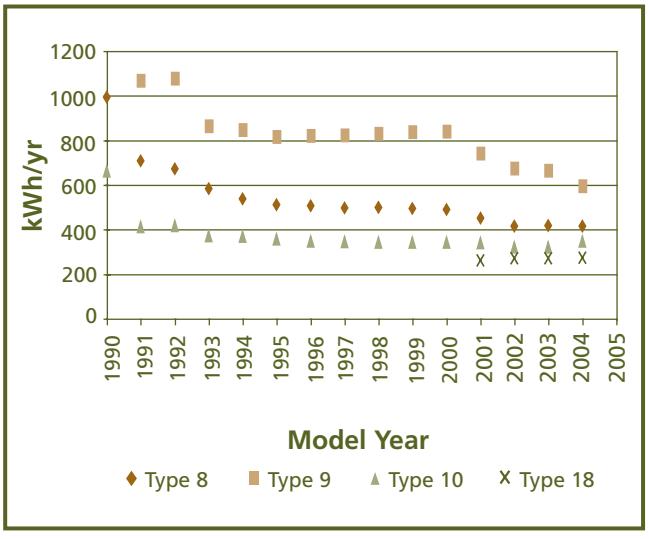


Figure 2.2 demonstrates the average annual UEC of the various freezer types during the study period. Types 10 and 18 freezers remained the most energy-efficient ones on the market, followed by Types 8 and 9.

FIGURE 2.2
Average Annual Unit Energy Consumption of Freezers by Type, by Model Year*

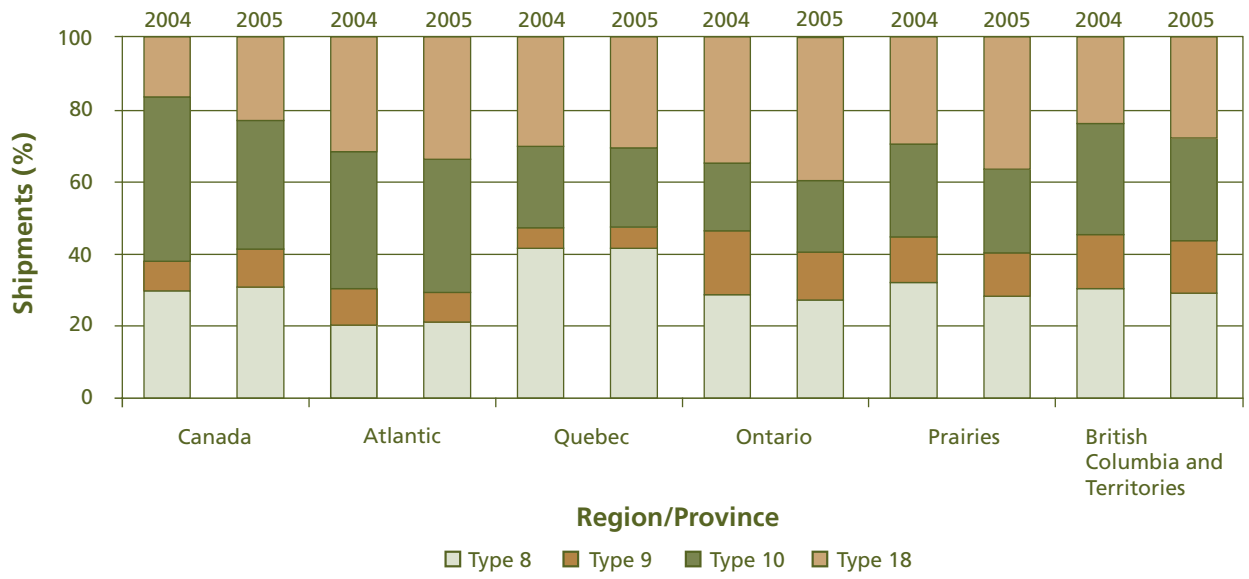


*For more information, see Table D.16 in Appendix D, "Detailed Tables."

2.2.2 Distribution by Type, by Region/Province

Figure 2.3 compares the tendencies toward different freezer types for 2004 and 2005. Shipments of Type 10 (chest) freezers decreased slightly in all regions except Ontario; shipments of Type 18 (compact chest) freezers increased slightly in all regions except Quebec. Once again, Quebec seemed to favour Type 8 (upright with manual defrost) freezers. A similar trend is found in Table 5.5 of the *2003 Survey of Household Energy Use*,[28] showing that in 2003, upright freezers were popular in Quebec. In addition, this table and Figure 2.3 show that upright freezers were less popular in the Atlantic provinces.

FIGURE 2.3
Distribution of Freezers by Type, by Region/Province, 2004 and 2005*



*For more information, see Table D.13 in Appendix D, "Detailed Tables."

[28] Natural Resources Canada, *2003 Survey of Household Energy Use, Detailed Statistical Report* (Ottawa: 2006), p. 69. Available: oee.nrcan.gc.ca/Publications/statistics/sheu03/pdf/sheu03.pdf.

2.2.3 Distribution by Average Annual Unit Energy Consumption per Cubic Foot

TABLE 2.2
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot

Model Year	kWh/cu.ft. per year 20–29.9 (%)	30–39.9 (%)	40–49.9 (%)	50–59.9 (%)	60–69.9 (%)	70–79.9 (%)	>80 (%)
1990	0.0	0.0	0.9	32.1	19.3	38.3	9.4
1991	0.0	28.3	20.3	31.2	4.1	15.9	0.3
1992	3.1	18.9	58.3	15.0	4.5	0.3	0.0
1993	16.5	57.0	16.5	8.4	1.6	0.0	0.0
1994	15.4	39.0	34.9	9.0	1.9	0.0	0.0
1995	12.7	39.6	41.2	5.4	1.2	0.0	0.0
1996	12.4	40.4	37.0	10.3	0.0	0.0	0.0
1997	11.7	36.7	39.0	12.0	0.0	0.6	0.0
1998	11.0	34.6	43.1	11.3	0.0	0.0	0.0
1999	10.8	42.3	37.0	9.6	0.0	0.3	0.0
2000	10.0	37.6	41.3	8.8	0.0	2.3	0.0
2001	17.5	36.3	38.2	3.9	0.0	4.0	0.0
2002	26.7	47.5	24.9	0.8	0.0	0.0	0.0
2003	28.6	47.4	23.2	0.8	0.0	0.0	0.0
2004	28.9	48.8	22.3	0.1	0.0	0.0	0.0
2005	29.5	45.2	25.3	0.0	0.0	0.0	0.0
Total Change	28.9%	48.8%	21.4%	32.0%	19.3%	38.3%	9.4%

Table 2.2 and Figure 2.4 demonstrate that in 1990, almost all freezers required more than 50 kWh per year to freeze each cubic foot of space. By 2005, all freezers consumed less than 50 kWh per year, and 74.7 percent of all freezers required less than 40 kWh per year to freeze each cubic foot of space (although this is down slightly from 2004).

At the beginning of the study period, freezers with an average annual UEC between 70.0 and 79.9 kWh/cubic foot (cu. ft.) per year dominated the market, accounting for 38.3 percent of the market. By comparison, most freezers in 2005 consumed between 30 and 39.9 kWh/cu. ft. annually (although this is down slightly from 2004).

2.2.4 Distribution by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province

FIGURE 2.4
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot, 1990 and 2005

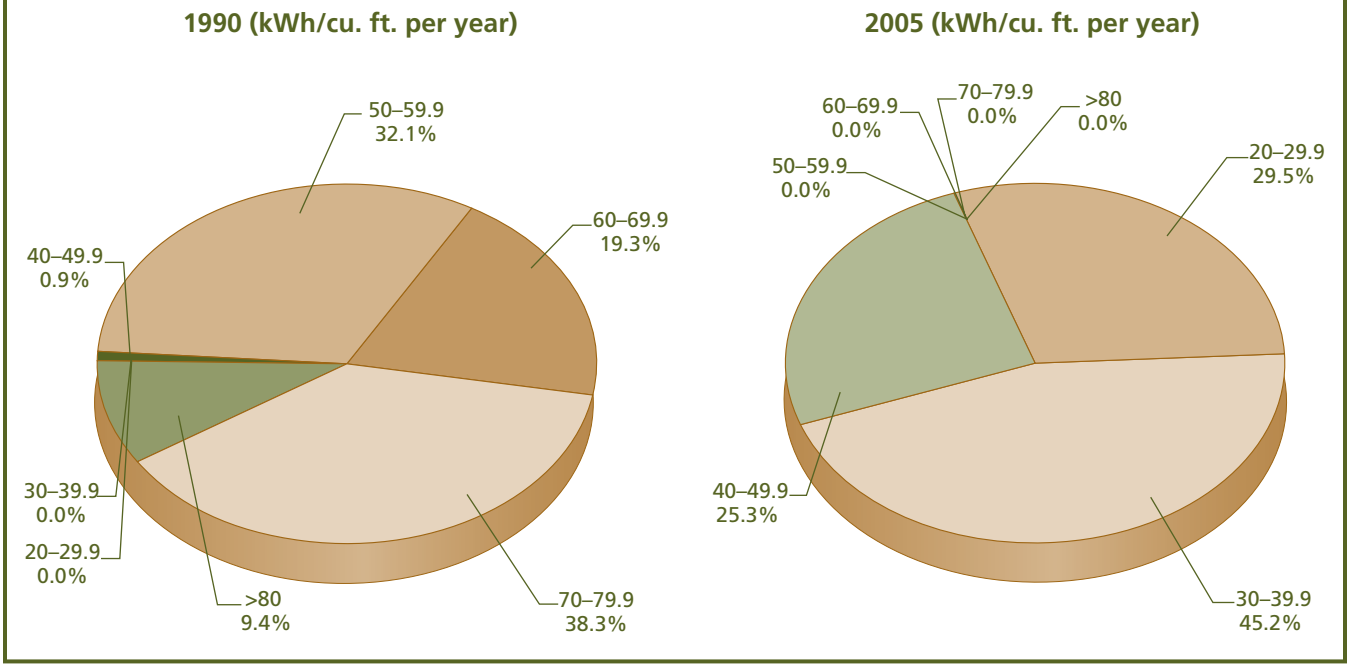
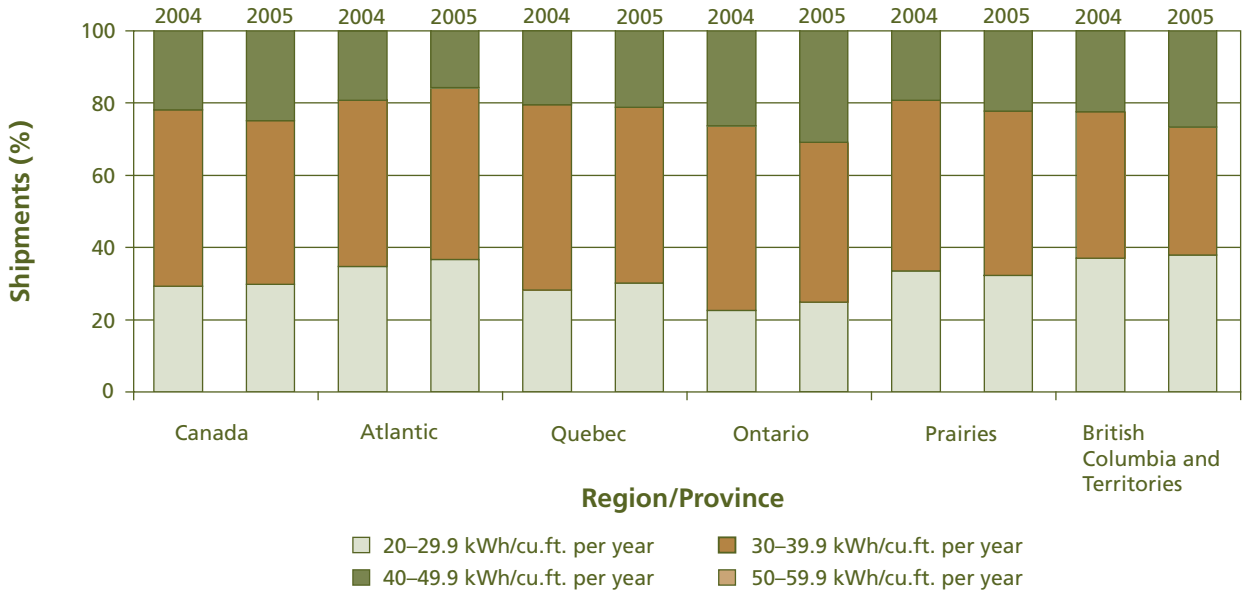


FIGURE 2.5
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004 and 2005*

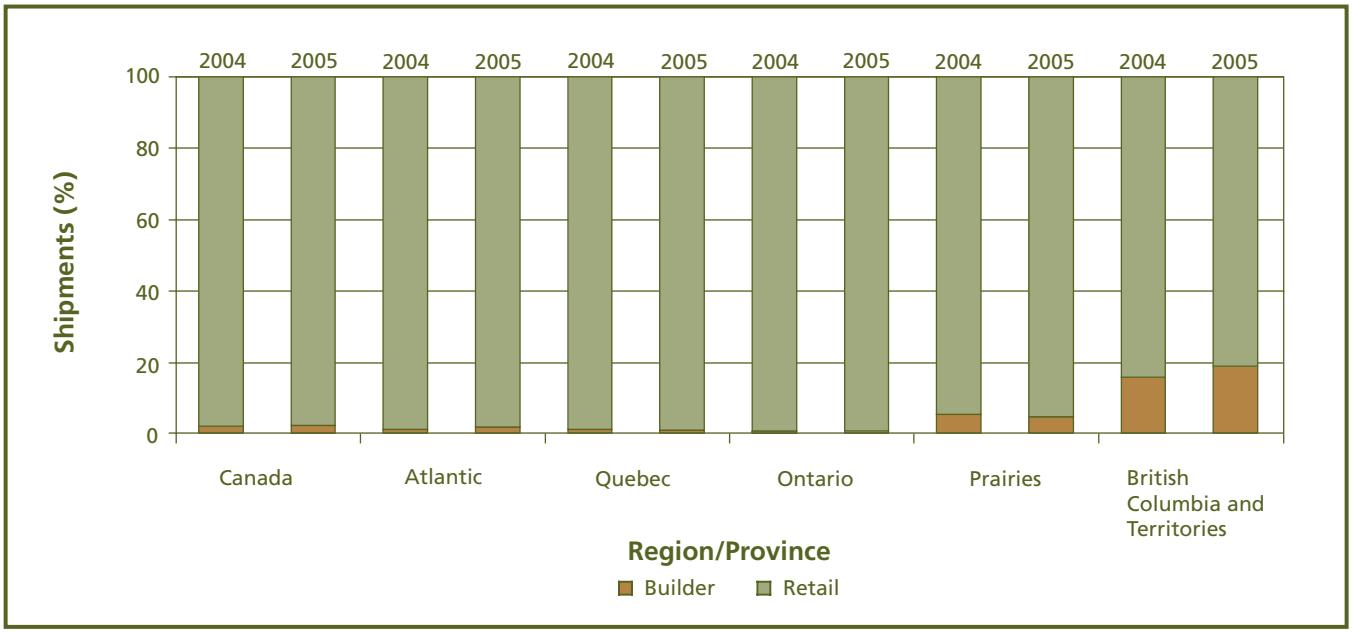


*For more information, see Table D.14 in Appendix D, "Detailed Tables."

Figure 2.5 demonstrates that nationally, in 2004 and 2005, most freezers consumed between 30 and 39.9 kWh/cu. ft. per year. However, in 2005, there was a slight increase in freezers consuming between 40.0 and 49.9 kWh/cu. ft. per year, due to the growth in market share of Types 8 and 9 (upright) freezers. This chart shows that this slight increase was more noticeable in Ontario and in British Columbia and the Territories.

2.2.5 Distribution by Channel, by Region/Province

FIGURE 2.6
Distribution of Freezers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.15 in Appendix D, "Detailed Tables."

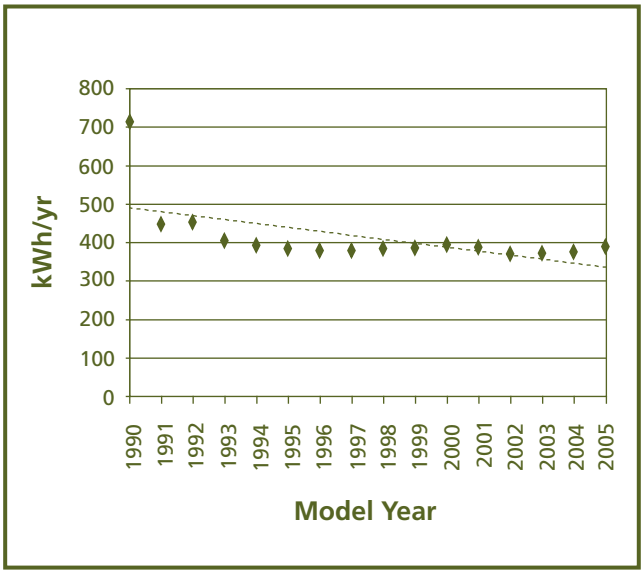
Figure 2.6 illustrates the proportion of freezers shipped for retail sales versus those shipped for the building trade in 2004 and 2005. There were no major differences in this proportion, except in British Columbia and the Territories where builder shipments increased slightly.

2.3 Energy Consumption

2.3.1 Average Annual Unit Energy Consumption by Model Year

Freezers became more energy efficient between 1990 and 2005. As Figure 2.7 shows, the average annual UEC decreased significantly in 1991 and then decreased gradually until 1997. After 1997, the average annual UEC fluctuated only slightly. Overall, the average annual UEC decreased by 46.0 percent, or 328 kWh, during the study period.

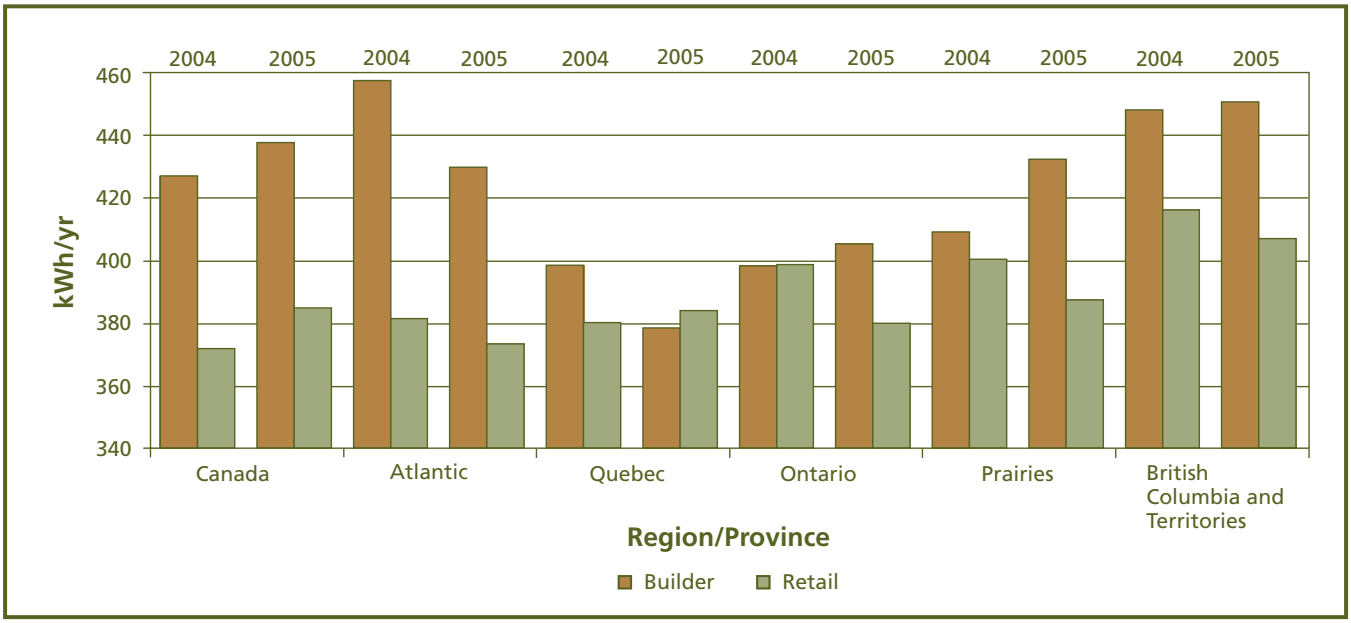
FIGURE 2.7
Average Annual Unit Energy Consumption of Freezers by Model Year*



*For more information, see Table D.16 in Appendix D, "Detailed Tables."

2.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province

FIGURE 2.8
Average Annual Unit Energy Consumption of Freezers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.17 in Appendix D, "Detailed Tables."

Figure 2.8 demonstrates the breakdown of the average annual UEC of freezers by shipments for retail purposes and for the builder trade by region/province for 2004 and 2005. Nationally, there was a slight increase in the average annual UEC of freezers in 2005, yet some regions exhibited a decrease in the average annual UEC for either one or both channels. Details of these findings can be seen in Table D.17 in Appendix D, "Detailed Tables." Note, however, that the freezer shipment data are not as comprehensive as data for the other appliances; in particular, the provincial/regional breakdown of shipments is not as detailed as the national level of data and, therefore, should be used with caution.

2.4 Energy Savings

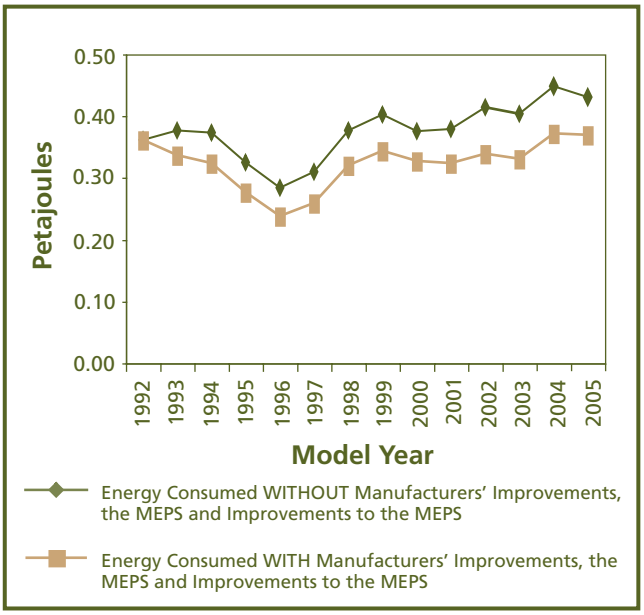
It is estimated that annual freezer energy consumption was slightly lower between 1993 and 2005 than it would have been without the minimum energy performance standards (MEPS), the 2001 amendment to the MEPS and the general improvements in energy efficiency.[29]

As with Figure 1.15 in Chapter 1, "Refrigerators," the difference between the two lines in Figure 2.9 represents the incremental annual energy savings.

The average annual energy savings for freezers were estimated to be 0.06 petajoules (PJ) from 1993 to 2005. (No savings were expected for 1992.)

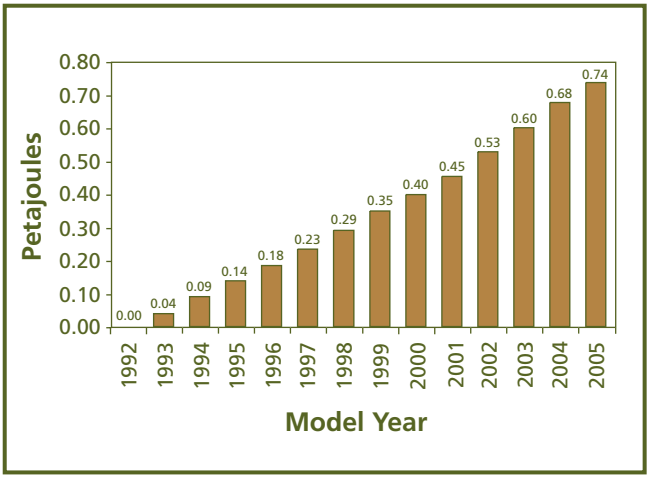
Cumulative energy savings grew steadily between 1992 and 2005 to reach 0.74 PJ in 2005, taking into account the life expectancy factor of freezers. (This calculation is explained in Appendix A, "Methodology.") These energy savings are shown in Figure 2.10.

FIGURE 2.9
Annual Energy Savings for Freezers, 1992–2005*



*For more information, see Table D.18 in Appendix D, "Detailed Tables."

FIGURE 2.10
Cumulative Energy Savings for Freezers, 1992–2005*



*For more information, see Table D.18 in Appendix D, "Detailed Tables."

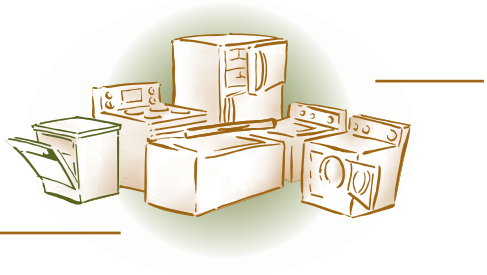
[29] For more information about the 2001 amendment to the MEPS for freezers, visit the following Web site: oee.nrcan.gc.ca/regulations/refrigerators.cfm.

2.5 Freezers Summary

Type 10 (chest freezers) and Type 18 (compact chest freezers) continued to be the most popular types in 2005 (58.9 percent of the market). However, Types 8 and 9 (upright freezers with manual and automatic defrost) grew in popularity, accounting for 41.1 percent of the market (up from 16.8 percent in 1990).

The energy efficiency of freezers improved between 1990 and 2005. By 2005, all freezers required less than 50 kWh per year to freeze each cubic foot of space, whereas in 1990, almost all freezers (99.1 percent) required more than 50 kWh per year. The average annual energy savings for freezers were estimated to be 0.06 PJ between 1993 and 2005, with total energy savings for that period reaching 0.74 PJ (205.56 million kWh). Dollar savings for freezers for the study period were estimated to be $18 million (calculated at 9.2 cents/kWh).

3 DISHWASHERS



3.1 2005 Market Snapshot

The shipment-weighted average annual unit energy consumption (UEC) of dishwashers in 2005 was 396 kilowatt hours (kWh). Nearly 91 percent of the standard models on the market that year – that is, those with an exterior width of more than 56 centimetres – qualified as ENERGY STAR® products, exceeding the minimum energy performance standards (MEPS) by at least 25 percent.

Between 1990 and 2005, the energy performance of dishwashers improved remarkably. The average annual UEC decreased by about 61 percent, or 630 kWh, during the period.

3.2 Distribution of Shipments

3.2.1 Distribution by Average Annual Unit Energy Consumption

Table 3.1 and Figure 3.1 illustrate that in 1990, dishwashers consuming more than 700 kWh annually represented 99.8 percent of the market. The majority (68.7 percent) of these dishwashers consumed at least 1000 kWh.

By 2005, all dishwashers consumed less than 700 kWh annually, with 75.1 percent consuming less than 400 kWh annually. Improvement in efficiency from 2003 to 2005 is most likely attributable to the 2004 amendment to the MEPS. Dishwashers are now rated to a new energy-consumption standard, reducing the annual energy consumption for all models. However, this decrease may not reflect any improvement in the energy efficiency of those models. Instead, this standard reduces the amount of energy these appliances may consume each year.

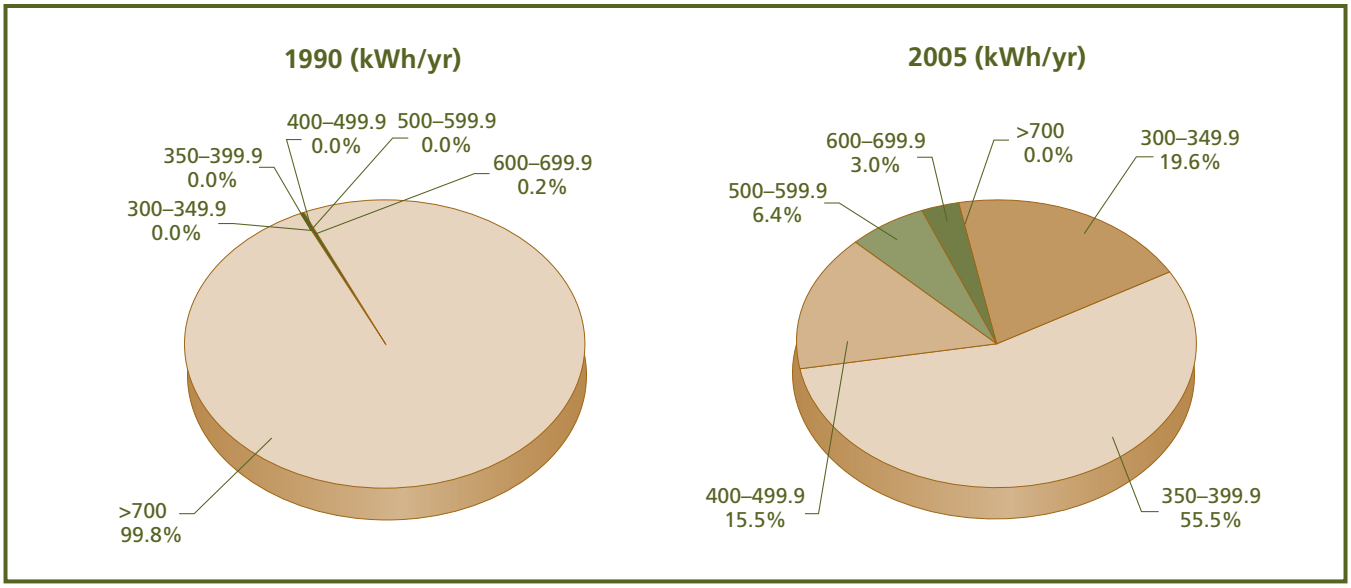
Dishwashers are also subject to new energy-consumption testing procedures. Previously, these appliances were rated according to an average of 264 loads per year. However, new data indicate that Canadians have reduced dishwasher use, so the test average is now 215 loads per year. The new ratings take into account standby power consumption (the energy used while the appliance is idle) and continue to include the energy required to heat the water. Soil-sensing dishwashers are also subject to a new test procedure that reflects the average energy used when they are tested under light, medium and heavy soil loads.[30]

[30] Natural Resources Canada, *EnerGuide Appliance Directory 2005* (Ottawa: February 2005), p. 173.

TABLE 3.1
Distribution of Dishwashers by Average Annual Unit Energy Consumption

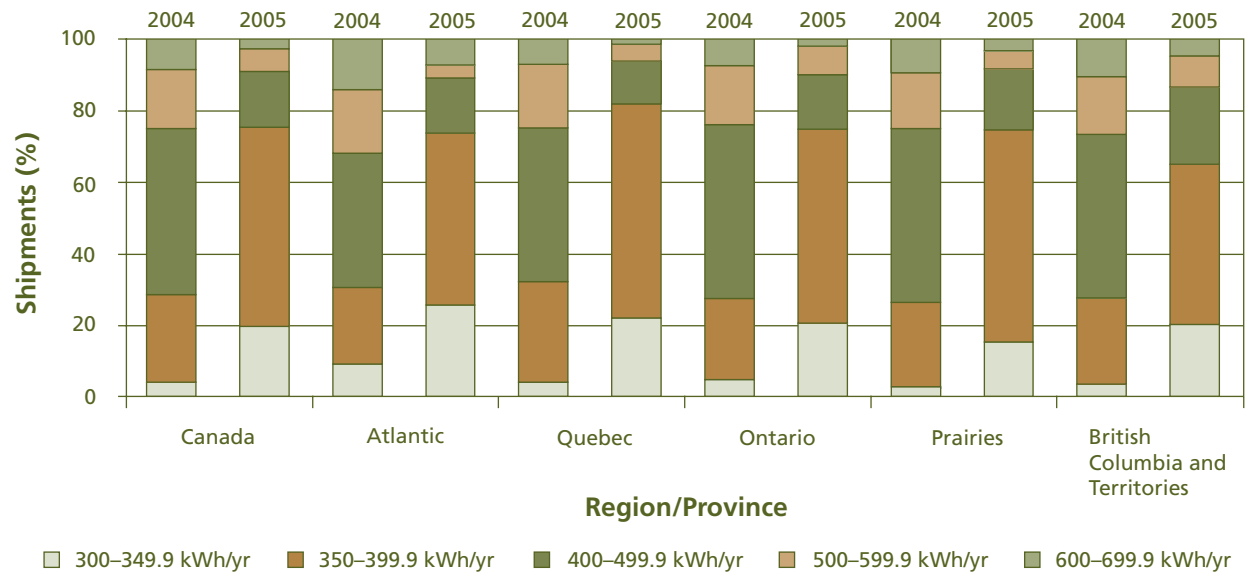
Model Year	300–349.9 kWh/yr (%)	350–399.9 kWh/yr (%)	400–499.9 kWh/yr (%)	500–599.9 kWh/yr (%)	600–699.9 kWh/yr (%)	>700 kWh/yr (%)
1990	0.0	0.0	0.0	0.0	0.2	99.8
1991	0.0	0.0	0.0	0.0	5.8	94.2
1992	0.0	0.0	0.0	0.0	8.5	91.5
1993	0.0	0.0	0.0	0.4	7.7	91.9
1994	0.0	0.0	0.5	0.5	32.9	66.1
1995	0.0	0.2	0.9	0.9	63.7	34.2
1996	0.0	0.2	0.9	3.9	63.0	32.0
1997	0.0	0.4	1.1	20.5	56.9	21.2
1998	0.0	0.2	1.2	23.4	71.6	3.7
1999	0.0	0.2	1.4	24.9	73.6	0.0
2000	0.0	0.1	3.9	19.3	76.7	0.0
2001	0.0	0.0	5.5	23.9	70.6	0.0
2002	0.0	3.2	13.6	37.8	45.5	0.0
2003	0.0	9.1	33.6	36.5	20.7	0.0
2004	4.0	24.3	46.4	16.5	8.8	0.0
2005	19.6	55.5	15.5	6.4	3.0	0.0
Total Change	19.6%	55.5%	15.5%	6.4%	2.8%	99.8%

FIGURE 3.1
Distribution of Dishwashers by Average Annual Unit Energy Consumption, 1990 and 2005



3.2.2 Distribution by Average Annual Unit Energy Consumption, by Region/Province

FIGURE 3.2
Distribution of Dishwashers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005*

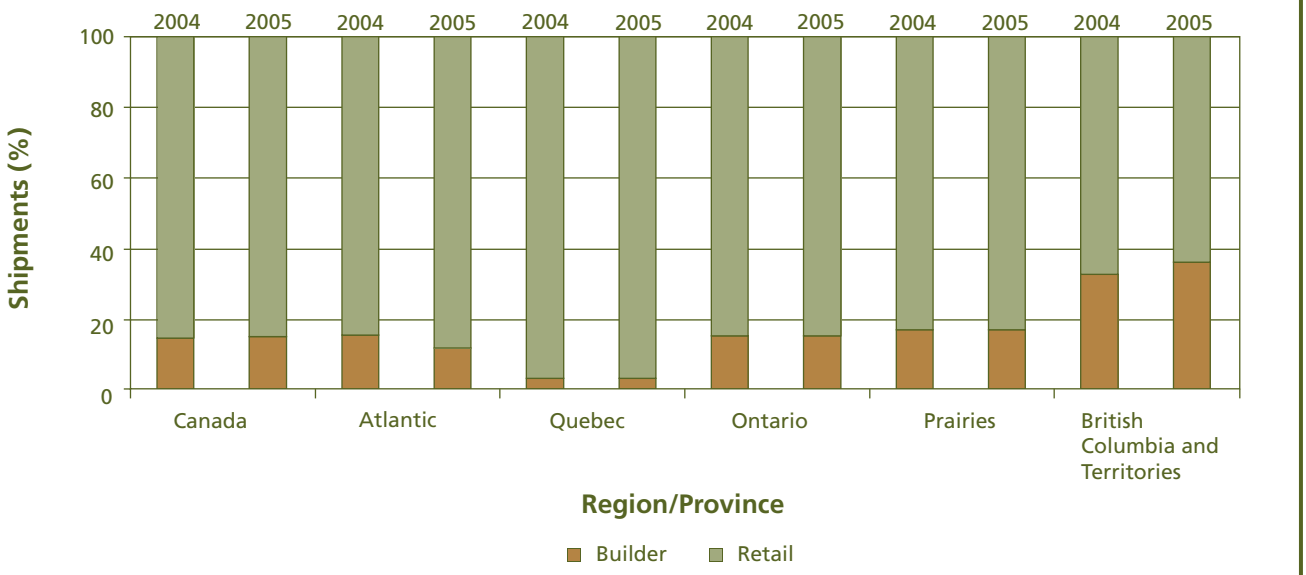


*For more information, see Table D.19 in Appendix D, "Detailed Tables."

Figure 3.2 shows that there were significant improvements in the average annual UEC of dishwashers throughout the country. In 2004, 28.3 percent of all dishwashers shipped in Canada consumed less than 400 kWh, whereas in 2005, 75.1 percent did. This significant improvement occurred throughout the regions, as demonstrated in Figure 3.2, and is attributed to the new energy-consumption standard and testing procedures mentioned previously.

3.2.3 Distribution by Channel, by Region/Province

FIGURE 3.3
Distribution of Dishwashers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.20 in Appendix D, "Detailed Tables."

Figure 3.3 demonstrates the proportion of dishwashers shipped for retail sales versus those shipped for the building trade, in 2004 and 2005. There were only slight changes in the tendencies throughout the country: builder shipments decreased in the Atlantic provinces and increased in British Columbia and the Territories.

3.3 Energy Consumption

3.3.1 Average Annual Unit Energy Consumption by Model Year

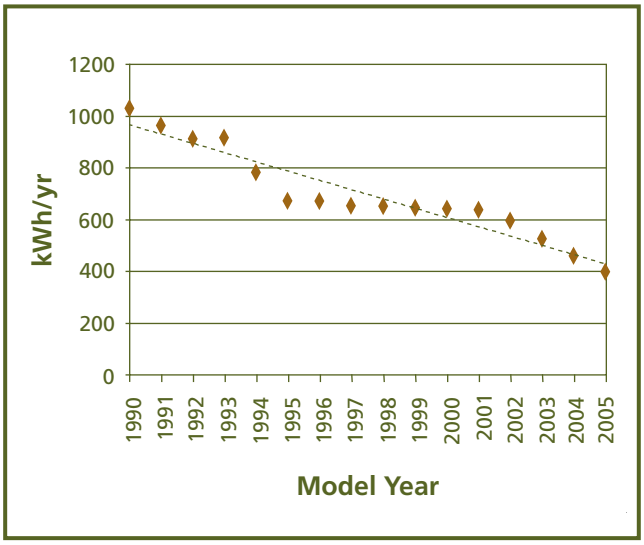
Between 1990 and 2005, the energy performance of dishwashers improved remarkably. As Figure 3.4 shows, the average annual UEC decreased by about 61 percent, or 630 kWh, during the period. A good part of the improvement occurred before 1995, when the average annual UEC decreased from 1026 to 671 kWh – a decrease of 355 kWh, or 35 percent. After 1995, the decrease in the average annual UEC tapered off substantially. But in 2001, a noticeable decrease began

to re-emerge, most likely due to the increase in availability of ENERGY STAR dishwashers and partly due to the announcement of the upcoming 2004 amendment to the MEPS. In 2005, the average annual UEC was 395.7 kWh, a decrease of 275 kWh, or 41 percent, from the 1995 level.

3.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province

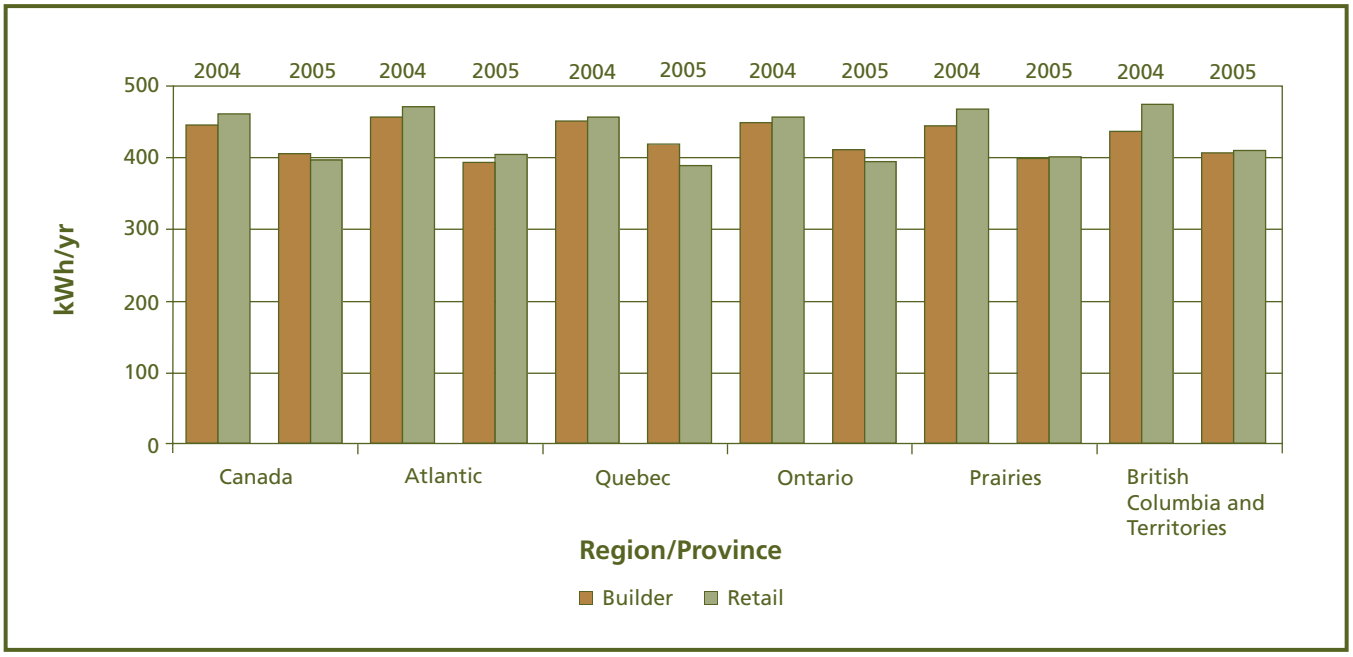
Figure 3.5 demonstrates the breakdown of the average annual UEC of dishwashers by shipments for retail purposes and for the builder trade by region/province for 2004 and 2005. It shows that, in 2005, the gap between the average annual UEC for builder and retail shipments narrowed, compared with 2004 figures.

FIGURE 3.4
Average Annual Unit Energy Consumption of Dishwashers by Model Year*



*For more information, see Table D.21 in Appendix D, "Detailed Tables."

FIGURE 3.5
Average Annual Unit Energy Consumption of Dishwashers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.22 in Appendix D, "Detailed Tables."

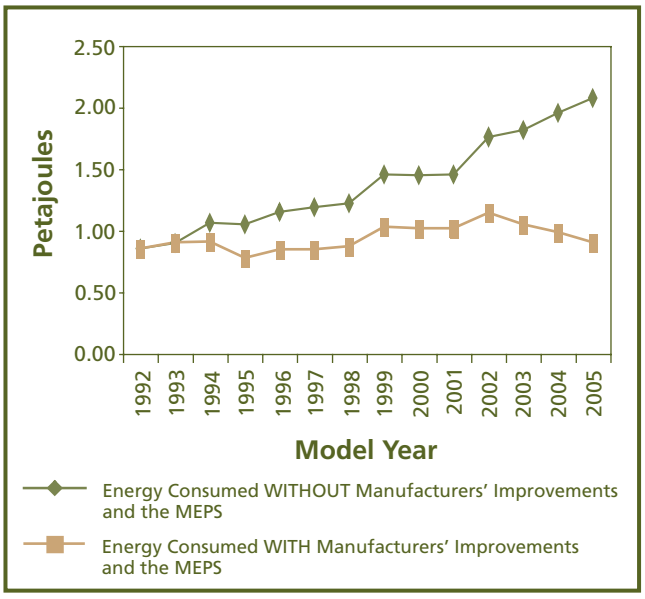
3.4 Energy Savings

Figure 3.6 shows how much energy dishwashers might have consumed annually between 1992 and 2005 without the factors previously outlined (*top line*) and how much energy actually was consumed by refrigerators during those years (*bottom line*).

The average annual energy savings for dishwashers were estimated to be 0.48 petajoules (PJ) from 1993 to 2005. (No energy savings were expected for 1992.) The largest annual energy savings occurred in 2005, when dishwashers consumed 1.17 PJ less than they might have otherwise.

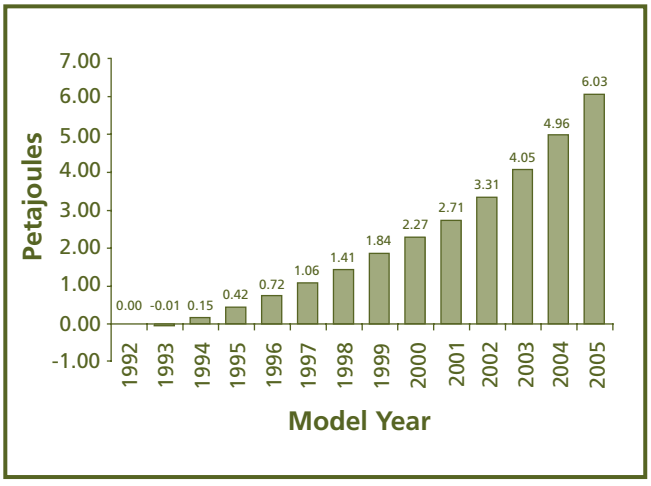
The cumulative energy savings for dishwashers are shown in Figure 3.7. Cumulative energy savings for the study period reached 6.03 PJ in 2005, taking into account the life expectancy factor of dishwashers (this calculation is explained further in Appendix A, "Methodology"). Note that this change to this report's methodology affected only slightly the previous energy savings calculations for 2002 and 2003. The majority of savings occurred post-1999 – between 2000 and 2005 – when energy savings amounted to 3.76 PJ, or 1.04 billion kWh.

FIGURE 3.6
Annual Energy Savings for Dishwashers, 1992–2005*



*For more information, see Table D.23 in Appendix D, "Detailed Tables."

FIGURE 3.7
Cumulative Energy Savings for Dishwashers, 1992–2005*



*For more information, see Table D.23 in Appendix D, "Detailed Tables."

3.5 Dishwashers Summary

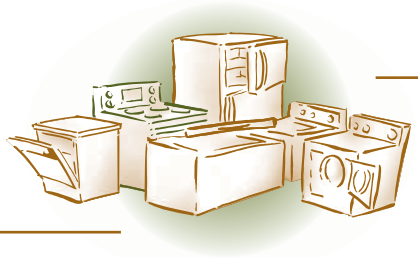
The energy efficiency of dishwashers improved significantly between 1990 and 2005. By 2005, nearly all dishwashers consumed less than 700 kWh annually, with 75.1 percent consuming less than 400 kWh; whereas in 1990, almost all dishwashers (99.8 percent) consumed more than 700 kWh per year.

Of the dishwasher shipments available in 2005, 90.8 percent were ENERGY STAR qualified. A revision to increase the stringency of the ENERGY STAR specification for dishwashers was introduced in January 2007 to address the high percentage of shipments meeting the standard.

About 85.3 percent of all dishwashers were shipped for retail sales, whereas 14.7 percent were tagged for builder shipments. British Columbia and the Territories had a substantially larger share of builder shipments (35.9 percent) than the rest of the country, whereas Quebec had a somewhat lower share (2.9 percent).

The average annual energy savings for dishwashers were estimated to be 0.48 PJ between 1993 and 2005, with total energy savings for that period reaching 6.03 PJ (1.68 billion kWh). Dollar savings for dishwashers for the study period were estimated to be $154 million (calculated at 9.2 cents/kWh).

4 ELECTRIC RANGES



4.1 2005 Market Snapshot

In 2005, 58.8 percent of the electric ranges shipped in Canada were self-cleaning units. The shipment-weighted average annual unit energy consumption (UEC) for self-cleaning ranges was 558 kilowatt hours (kWh), compared with 593 kWh for regular electric ranges. Even though the energy consumption rating takes into account the energy used during the self-cleaning cycles (based originally on 11 cleanings per year but recently reduced to 4), these ranges use less energy than the regular electric ranges. That is because their ovens are generally better insulated and the door seals are better than those in the non-self-cleaning ovens. This means that the self-cleaning units lose less heat through the oven door.

Electric ranges typically make up 92 percent of the market; gas ranges constitute the remainder.[31]

In 1990, the electric ranges that dominated the market (73.2 percent) consumed between 750 and 850 kWh per year. In 2005, the market share of electric ranges in these categories fell to 13.7 percent.

4.2 Distribution of Shipments

4.2.1 Distribution by Type

As illustrated in Table 4.1 and Figure 4.1, in 1990, self-cleaning electric ranges accounted for less than one quarter (22.9 percent) of all electric ranges available on the market. By 2005, self-cleaning ranges had increased in popularity, with market share increasing to 58.8 percent. This represents a 36 percent increase since 1990, or an annual growth rate of 2.4 percent.

In contrast, the market share of electric ranges that were not self-cleaning decreased by 36 percent, dropping from 77.1 percent in 1990 to 41.2 percent in 2005.

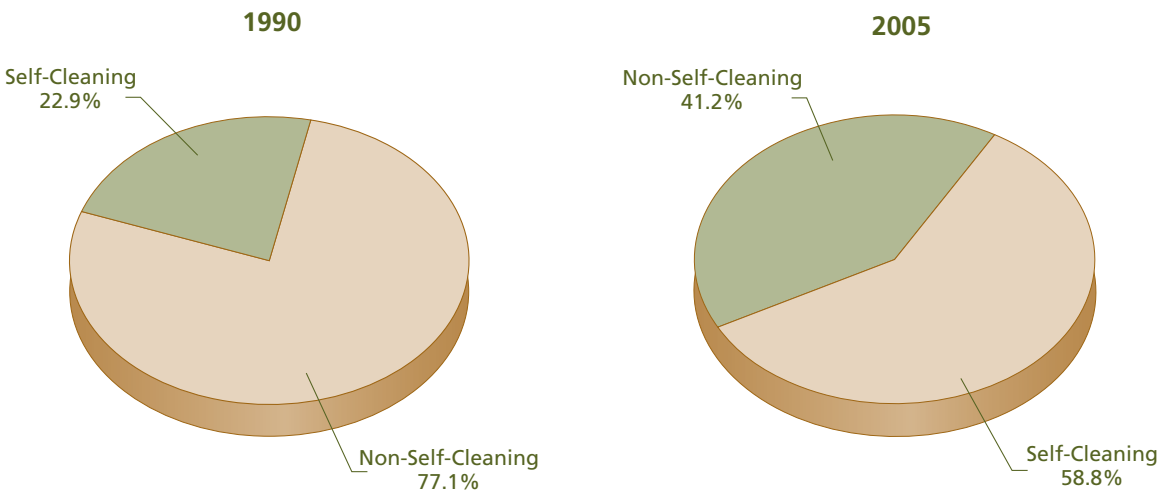
As noted above, self-cleaning ovens are usually better insulated than non-self-cleaning ones, resulting in less heat loss and less energy consumption.

TABLE 4.1
Distribution of Electric Ranges by Type

Model Year	Non-Self-Cleaning (%)	Self-Cleaning (%)
1990	77.1	22.9
1991	71.3	28.7
1992	71.6	28.4
1993	70.1	29.9
1994	69.4	30.6
1995	68.3	31.7
1996	66.6	33.4
1997	64.1	35.9
1998	59.2	40.8
1999	59.4	40.6
2000	55.6	44.4
2001	47.8	52.2
2002	42.7	57.3
2003	44.9	55.1
2004	42.3	57.7
2005	41.2	58.8
Total Change	35.9%	35.9%

[31] Natural Resources Canada, *EnerGuide Appliance Directory* 2005 (Ottawa: February 2005), p.144.

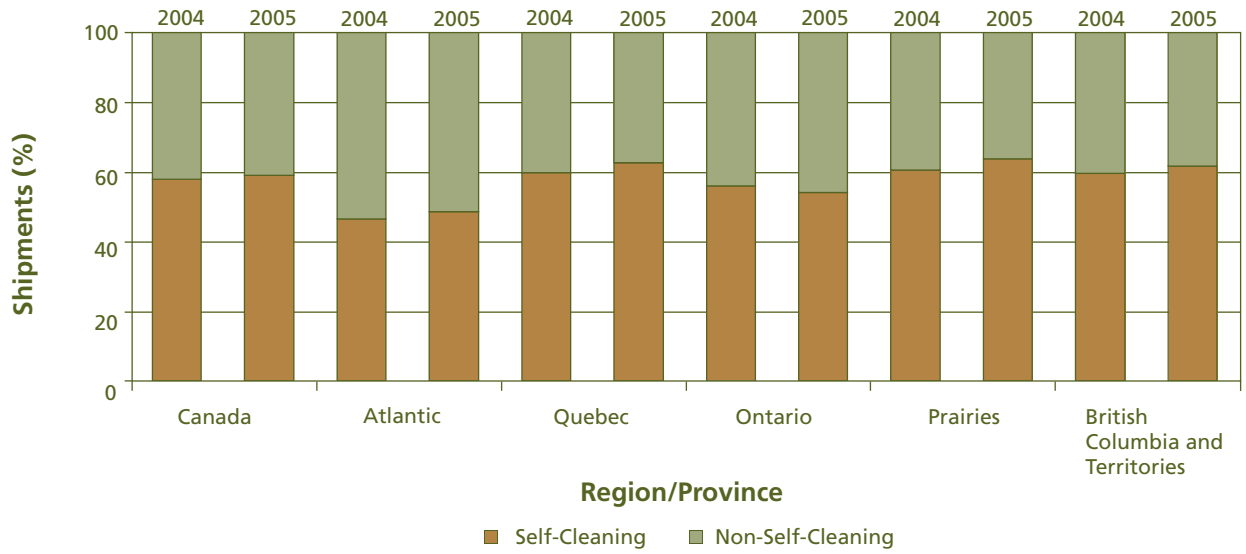
FIGURE 4.1
Distribution of Electric Ranges by Type, 1990 and 2005



4.2.2 Distribution by Type, by Region/Province

Self-cleaning ranges substantially increased their market share during the study period, with a national average of 58.8 percent in 2005. Figure 4.2 demonstrates the proportion of self-cleaning versus non-self-cleaning ranges throughout the country for 2004 and 2005. It shows a slight increase in self-cleaning ranges from the previous year throughout the regions, with the exception of Ontario, where shipments of self-cleaning ranges decreased slightly.

FIGURE 4.2
Distribution of Electric Ranges by Type, by Region/Province, 2004 and 2005*



*For more information, see Table D.24 in Appendix D, "Detailed Tables."

4.2.3 Distribution by Average Annual Unit Energy Consumption

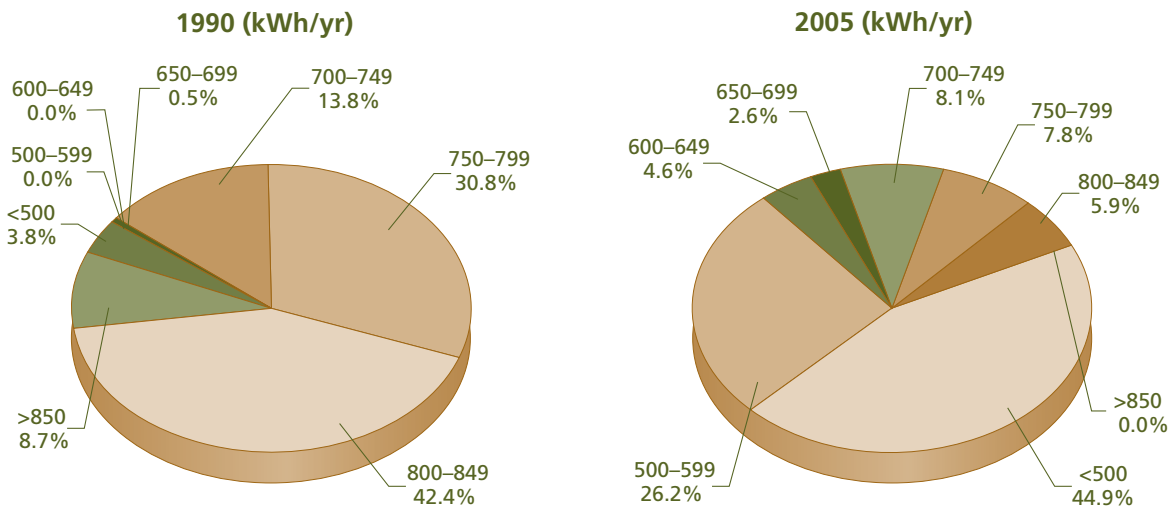
Table 4.2 and Figure 4.3 demonstrate that in 1990, the electric ranges that dominated the market (73.2 percent) consumed between 750 and 850 kWh per year. In 2005, the market share of electric ranges in these categories fell to 13.7 percent. By 2003, there was a considerable increase in the market share of electric ranges that consumed less than 600 kWh, reaching 71.1 percent in 2005. This is due to an energy-consumption standard introduced in October 2003.[32] Testing to the new standard provided a new method for calculating energy consumption and resulted in a lower EnerGuide rating in kilowatt hours per year. Several important changes were made to the calculation for the rating, including the number of times the self-cleaning cycle is used; this was lowered from 11 times per year to 4 because consumers are not using these appliances as much as they did in the past.

[32] Natural Resources Canada, *EnerGuide Appliance Directory, 2005* (Ottawa: February 2005), p. 144.

TABLE 4.2
Distribution of Electric Ranges by Average Annual Unit Energy Consumption

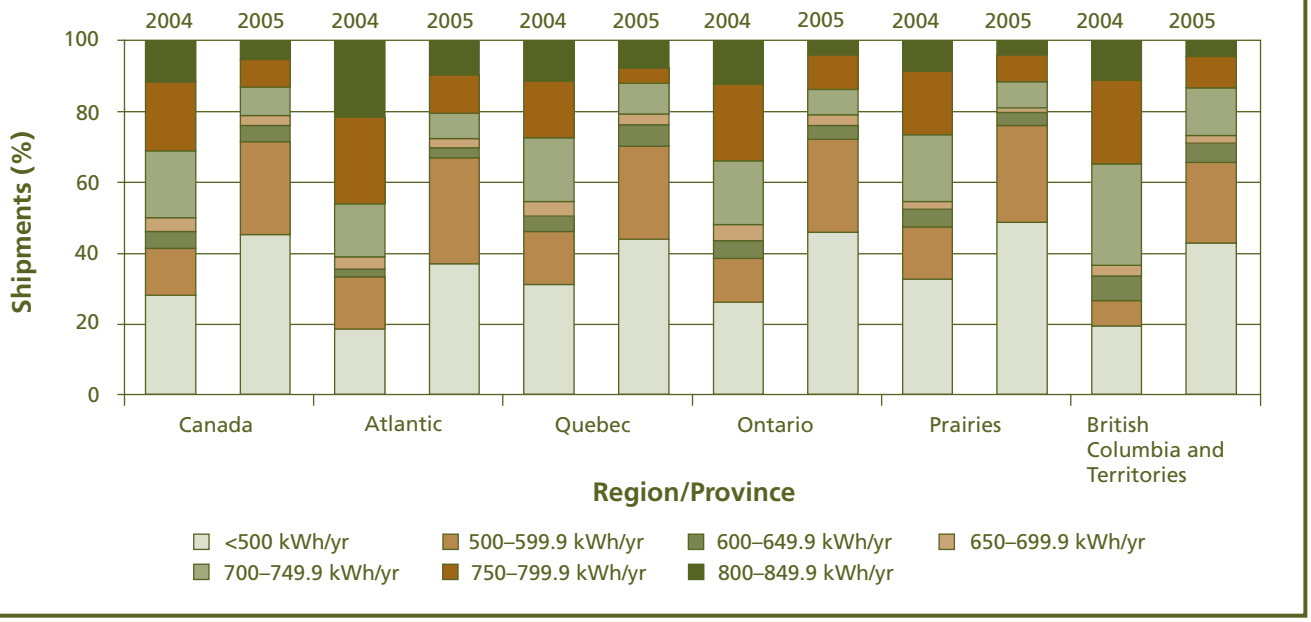
Model Year	<500 (%)	500–599.9 (%)	600–649.9 (%)	kWh/yr 650–699.9 (%)	700–749.9 (%)	750–799.9 (%)	800–849.9 (%)	>850 (%)
1990	3.8	0.0	0.0	0.5	13.8	30.8	42.4	8.7
1991	0.0	0.0	0.0	0.8	15.9	27.6	54.0	1.8
1992	0.0	0.0	0.0	0.0	15.0	58.1	26.5	0.3
1993	0.0	0.0	0.0	0.1	18.4	42.8	38.5	0.2
1994	0.0	0.0	0.1	1.7	32.2	28.5	37.4	0.1
1995	0.0	0.0	0.1	3.3	35.0	22.5	39.2	0.0
1996	0.0	0.0	0.0	3.2	27.6	26.4	42.8	0.0
1997	0.0	0.0	0.0	3.6	27.6	29.0	39.8	0.0
1998	0.0	0.0	0.0	8.6	23.3	30.6	37.4	0.0
1999	0.0	0.0	0.0	15.3	28.2	31.6	24.9	0.0
2000	0.0	0.0	0.0	14.3	30.9	29.5	25.3	0.0
2001	0.0	0.0	0.0	15.0	27.3	29.2	28.5	0.0
2002	0.0	0.0	0.0	15.9	30.4	33.5	20.2	0.0
2003	12.5	5.4	0.4	7.9	30.0	27.3	16.5	0.0
2004	27.8	13.3	4.8	3.8	18.8	19.5	12.0	0.0
2005	44.9	26.2	4.6	2.6	8.1	7.8	5.9	0.0
Total Change	41.1%	26.2%	4.6%	2.1%	5.7%	23.0%	36.5%	8.7%

FIGURE 4.3
Distribution of Electric Ranges by Average Annual Unit Energy Consumption, 1990 and 2005



4.2.4 Distribution by Average Annual Unit Energy Consumption, by Region/Province

FIGURE 4.4
Distribution of Electric Ranges by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005*

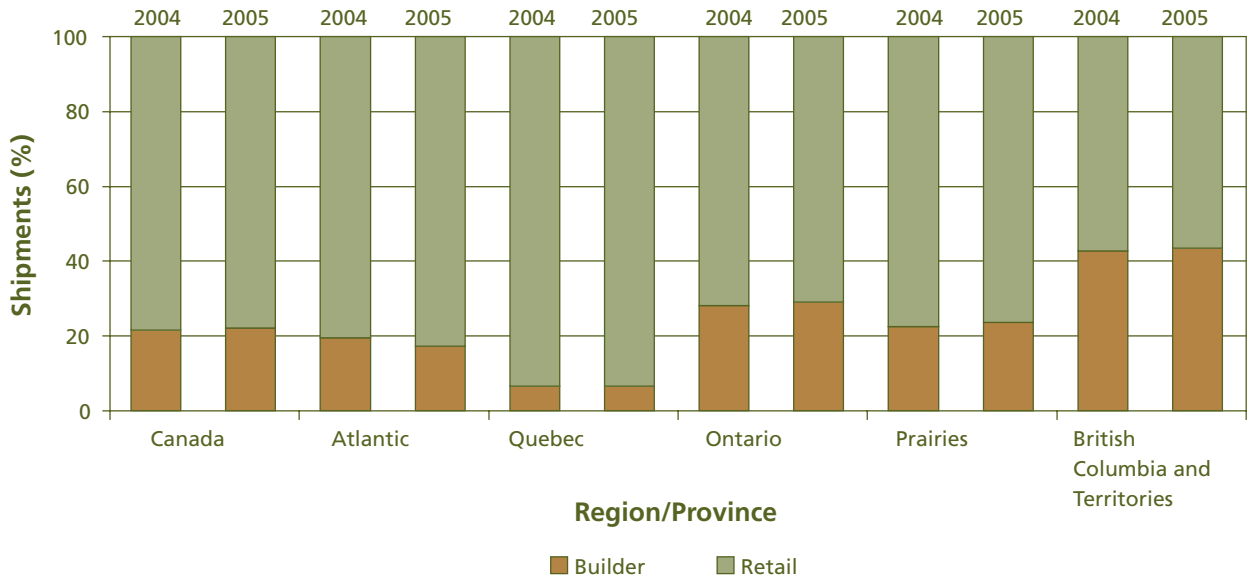


*For more information, see Table D.25 in Appendix D, "Detailed Tables."

In 2005, 71.1 percent of all electric ranges shipped in Canada consumed less than 600 kWh per year, compared with 41.1 percent in 2004. Figure 4.4 shows that this was the tendency throughout the regions. As mentioned previously, a new testing method and energy-consumption standard was introduced in October 2003. Far more of the electric ranges shipped in 2005 were of models newly listed in the 2004 and 2005 EnerGuide appliance directories. Therefore, the proportion of models rated using this new testing standard was considerably higher than in 2004.

4.2.5 Distribution by Channel, by Region/Province

FIGURE 4.5
Distribution of Electric Ranges by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.26 in Appendix D, "Detailed Tables."

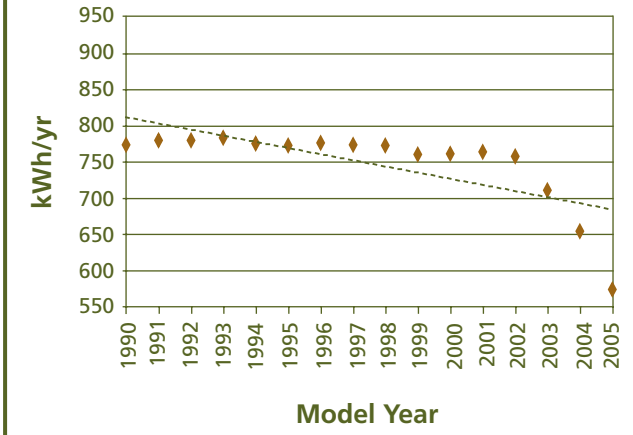
Figure 4.5 illustrates the proportion of electric ranges shipped for retail sales versus those shipped for the building trade, for 2004 and 2005. There was little change in proportion of retail versus builder shipments throughout the country between 2004 and 2005. British Columbia and the Territories still had a substantially larger builder shipment representation (43.5 percent) than the rest of the country, and Quebec had a somewhat lower share (6.5 percent).

4.3 Energy Consumption

4.3.1 Average Annual Unit Energy Consumption by Model Year

Between 1990 and 2002, the energy consumption of electric ranges remained relatively unchanged. The decrease in average annual UEC, as illustrated in Figure 4.6, was about 2 percent, or 16 kWh. However, from 2003 to 2005, the average annual UEC decreased substantially, from 756.0 to 572.5 kWh, due to a 2003 amendment to the minimum energy performance standards (MEPS), which is attributable to a new reference standard for electric ranges having been put into place in 2003. This resulted in the reduction of the annual energy consumption for all models. However, this reduction may not reflect any improvement in the energy efficiency of those models.

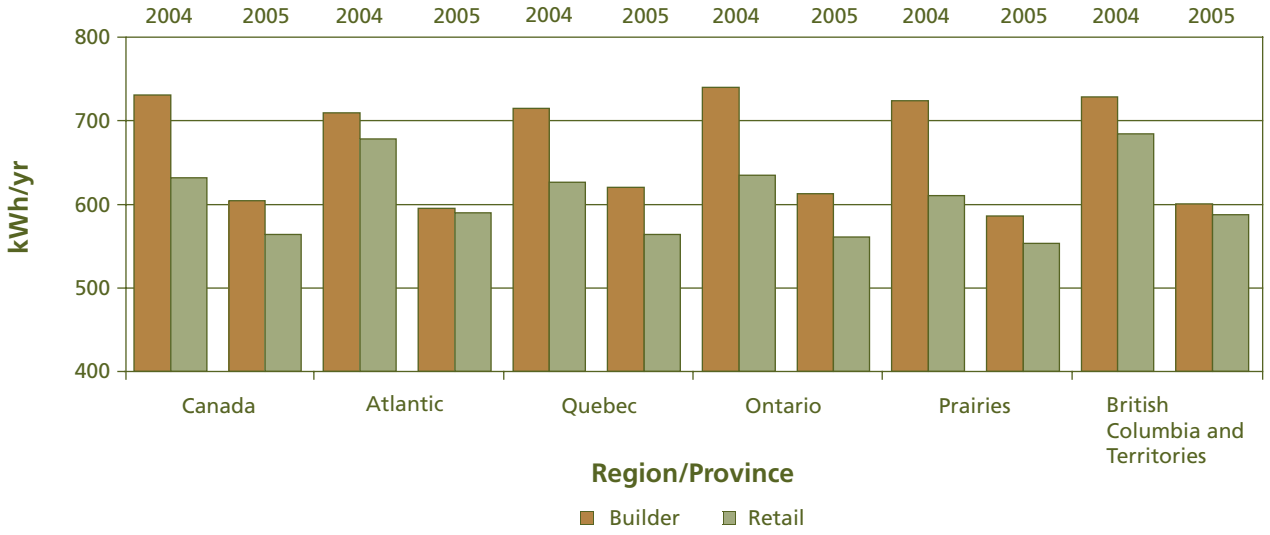
FIGURE 4.6
Average Annual Unit Energy Consumption of Electric Ranges by Model Year*



*For more information, see Table D.27 in Appendix D, "Detailed Tables."

4.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province

FIGURE 4.7
Average Annual Unit Energy Consumption of Electric Ranges by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.28 in Appendix D, "Detailed Tables."

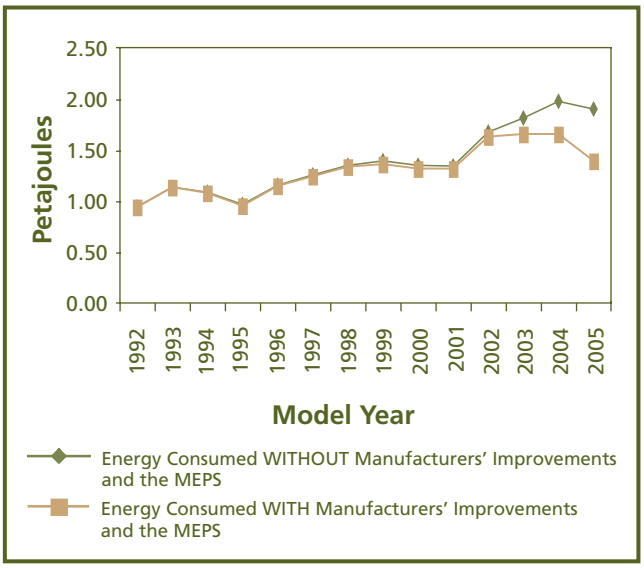
Figure 4.7 demonstrates the breakdown of the average annual UEC of electric ranges by retail shipments versus builder shipments, by region/province for 2004 and 2005. The chart shows that the average annual UEC decreased substantially in 2005 for retail and builder shipments. Also, in all regions, the average annual UEC remained lower for retail shipments than for builder shipments, but the gap between the two did become smaller.

4.4 Energy Savings

Figure 4.8 shows how much energy might have been consumed by electric ranges without the MEPS or general improvements in energy efficiency (*top line*) and how much energy they actually consumed (*bottom line*). Graphically, the gap between the two lines represents annual energy savings – on average, 0.02 petajoules (PJ) per year for 1992–2001 and 0.26 PJ per year for 2002–2005.

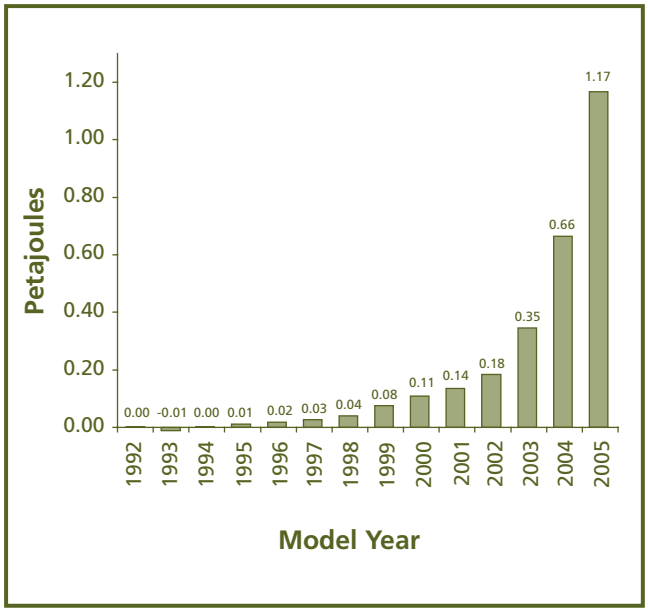
The cumulative energy savings for electric ranges are shown in Figure 4.9. Cumulative energy savings grew slowly but steadily between 1994 and 2002, as annual energy savings began to accrue. The savings increased substantially from 2003 to 2005, due to a new testing method and energy consumption standard introduced in October 2003. Savings reached 1.17 PJ in 2005, taking into account the life expectancy factor of electric ranges (this calculation is explained further in Appendix A, "Methodology").

FIGURE 4.8
Annual Energy Savings for Electric Ranges, 1992–2005*



*For more information, see Table D.29 in Appendix D, "Detailed Tables."

FIGURE 4.9
Cumulative Energy Savings for Electric Ranges, 1992–2005*



*For more information, see Table D.29 in Appendix D, "Detailed Tables."

4.5 Electric Ranges Summary

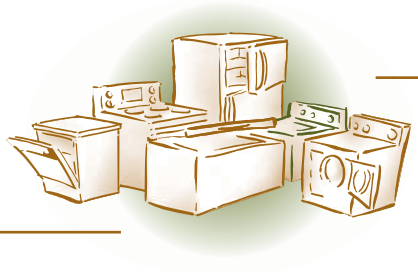
By 2005, self-cleaning ranges had increased in popularity by 36 percent, with market share increasing to 58.8 percent. In 2005, the shipment-weighted average annual UEC for self-cleaning ranges was 558.0 kWh, compared with 593.2 kWh for regular electric ranges.

By 2005, 71.1 percent of electric ranges consumed less than 600 kWh per year, whereas in 1990, those that dominated the market consumed between 800 and 849 kWh (42.4 percent).

About 77.9 percent of all electric ranges were shipped for retail sales, whereas 22.1 percent were tagged for builder shipments. British Columbia and the Territories had a substantially larger builder shipment representation (43.5 percent) than the rest of the country, whereas Quebec had a somewhat lower share (6.5 percent).

Cumulative energy savings grew slowly but steadily between 1994 and 2002, as annual energy savings began to accrue. The savings increased substantially between 2003 and 2005 due to a new testing method and energy-consumption standard introduced in October 2003. Total energy savings for the study period reached 1.17 PJ (325.00 million kWh). Dollar savings for electric ranges for the study period were estimated to be $29 million (calculated at 9.2 cents/kWh).

5 CLOTHES WASHERS



5.1 2005 Market Snapshot

In 2005, 42.3 percent of the clothes washers shipped in Canada were front-loading units. The shipment-weighted average annual unit energy consumption (UEC) of front-loading clothes washers was 219 kilowatt hours (kWh), compared with 609 kWh for top-loading ones.

As previously noted, the ENERGY STAR® level for standard clothes washers increased in stringency in 2004. In 2005, 45.9 percent of the standard models on the market qualified for the ENERGY STAR specification, exceeding the minimum energy performance standards (MEPS) by at least 36 percent and having a modified energy factor of at least 40.21 litres per kWh per cycle. These criteria increased again in January 2007.

In 1990, 98.2 percent of the clothes washers shipped used more than 800 kWh per year. By 2005, 80.0 percent of all clothes washers consumed less than 600 kWh. This significant improvement is partly due to the 2004 amendment to the MEPS and the increased popularity of front-loading models.

5.2 Distribution of Shipments

5.2.1 Distribution by Type

Although front-loading clothes washers have been used for many years – most often in commercial laundries – appliance manufacturers have more recently developed new models of front-loading clothes washers for domestic use. Overall, front-loading clothes washers are more energy efficient, using about 40 percent less water per load and more than 60 percent less energy than top-loading clothes washers.[33]

Table 5.1 demonstrates the increase in popularity of front-loading models versus top-loading ones since 2001 (the first year that shipment data for front-loading clothes washers were available), with market share increasing to 42.3 percent in 2005. This represents a 26.6 percent increase since 2001, or an annual growth rate of 6.7 percent.

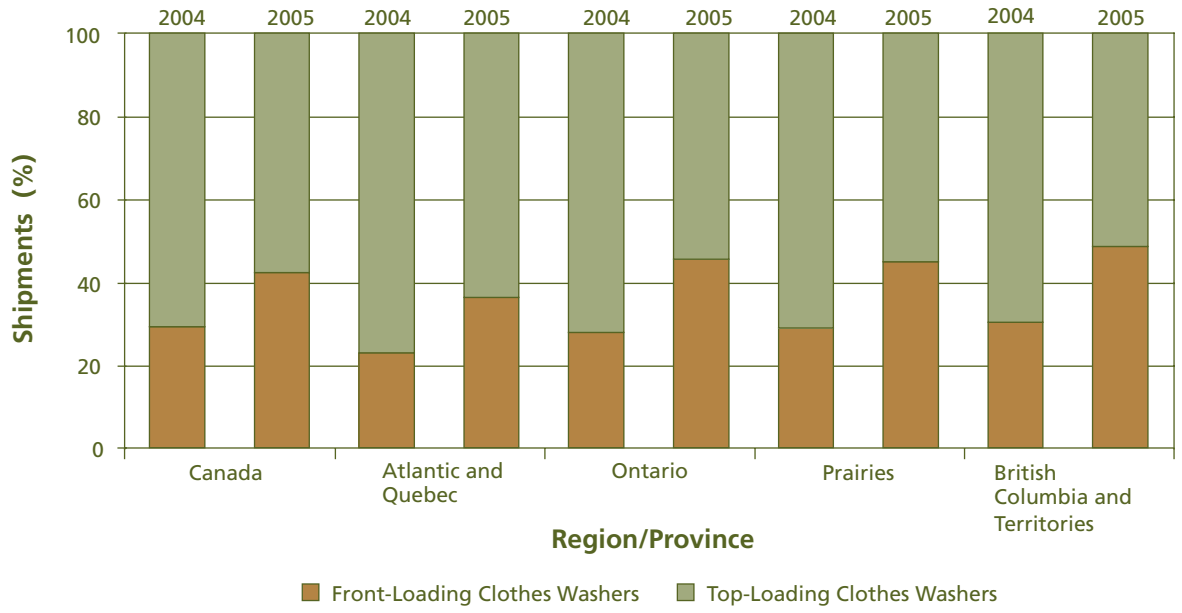
TABLE 5.1
Distribution of Clothes Washers by Type

Model Year	Front-Loading Clothes Washers (%)	Top-Loading Clothes Washers (%)
2001	15.7	84.3
2002	16.8	83.2
2003	21.5	78.5
2004	29.2	70.8
2005	42.3	57.7
Total Change	26.6%	26.6%

[33] Natural Resources Canada, *EnerGuide Appliance Directory 2005* (Ottawa: February 2005), p. 192.

5.2.2 Distribution by Type, by Region/Province

FIGURE 5.1
Distribution of Clothes Washers by Type, by Region/Province, 2004 and 2005*



*For more information, see Table D.30 in Appendix D, "Detailed Tables."

As reported previously, front-loading clothes washers have steadily increased their market share since 2001. Figure 5.1 demonstrates this increase nationally and regionally between 2004 and 2005. For confidentiality reasons, the Atlantic provinces and Quebec have been grouped for this analysis.

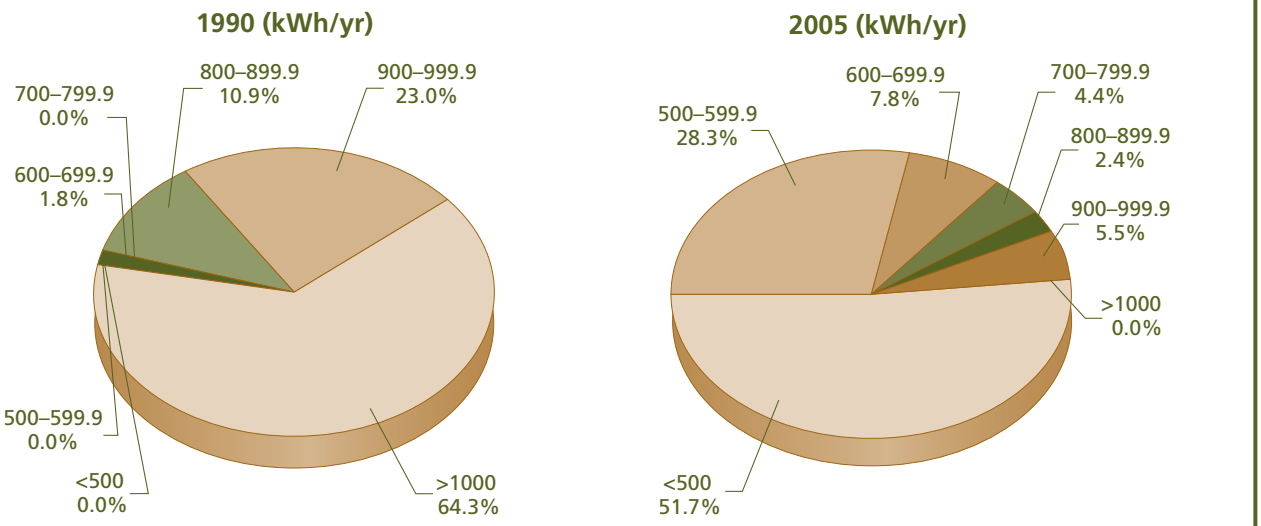
5.2.3 Distribution by Average Annual Unit Energy Consumption

TABLE 5.2
Distribution of Clothes Washers by Average Annual Unit Energy Consumption

Model Year	kWh/yr <500 (%)	500–599.9 (%)	600–699.9 (%)	700–799.9 (%)	800–799.9 (%)	900–999.9 (%)	>1000 (%)
1990	0.0	0.0	1.8	0.0	10.9	23.0	64.3
1991	0.0	0.0	0.4	0.0	21.8	12.2	65.7
1992	0.0	0.0	0.1	0.0	10.4	12.2	77.3
1993	0.0	0.0	0.1	0.3	15.6	13.4	70.6
1994	0.0	0.0	0.2	0.5	23.5	25.5	50.3
1995	0.0	0.0	0.4	0.5	26.7	28.0	44.4
1996	0.2	0.0	1.5	0.6	34.9	17.9	44.9
1997	2.7	0.0	1.6	0.3	37.1	10.4	47.9
1998	7.8	0.0	1.1	1.8	28.5	11.1	49.6
1999	11.9	0.0	1.6	10.3	18.4	31.3	26.4
2000	13.3	0.0	0.8	12.9	15.7	45.9	11.4
2001	17.1	0.0	0.3	13.1	14.9	51.6	3.0
2002	22.3	0.0	0.1	12.5	14.5	45.5	5.0
2003	28.6	4.2	0.2	10.3	18.2	36.9	1.6
2004	38.2	16.6	10.0	8.3	10.2	16.7	0.0
2005	51.7	28.3	7.8	4.4	2.4	5.5	0.0
Total Change	51.7%	28.3%	6.0%	4.4%	8.5%	17.5%	64.3%

As shown in Table 5.2 and Figure 5.2, the energy consumption of clothes washers improved significantly during the study period. In 1990, 98.2 percent of the clothes washers shipped used more than 800 kWh per year. By 2005, 80.0 percent all clothes washers shipped consumed less than 600 kWh (compared with 54.8 percent in 2004). This significant improvement is partly due to the 2004 amendment to the MEPS and the increased popularity of front-loading models.

FIGURE 5.2
Distribution of Clothes Washers by Average Annual Unit Energy Consumption, 1990 and 2005

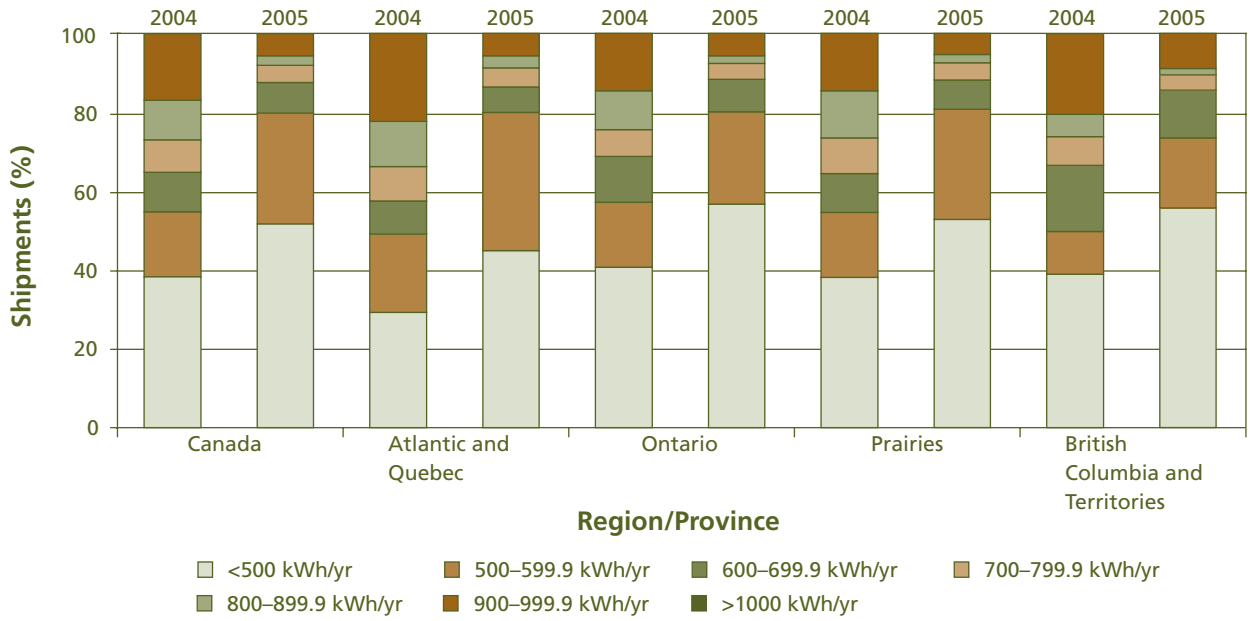


5.2.4 Distribution by Average Annual Unit Energy Consumption, by Region/Province

In 2005, 80.0 percent of all clothes washers shipped in Canada consumed less than 600 kWh, compared with 54.8 percent in 2004. Figure 5.3 shows the distribution tendencies throughout the regions/provinces, for 2004 and 2005. This increase in shipments of clothes washers consuming less than 600 kWh is also evident throughout the regions. The Atlantic provinces and Quebec once again had a somewhat lower market share of those consuming less than 500 kWh per year. However, based on findings in *SHEU–2003*,[34] the Atlantic region and Quebec had the highest percentage of households with a clothes washer that washed and rinsed with cold water, at 86 and 84 percent, respectively (compared with 76 percent to 80 percent in the other regions). Even though these regions had relatively less energy-efficient clothes washers, they seemed to have more energy-efficient clothes-washing habits than other regions.

[34] Natural Resources Canada, 2003 *Survey of Household Energy Use, Summary Report* (Ottawa: 2006), Chart 43, p. 23. Available: oee.nrcan.gc.ca/publications/statistics/sheu-summary/index.cfm.

FIGURE 5.3
Distribution of Clothes Washers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005*

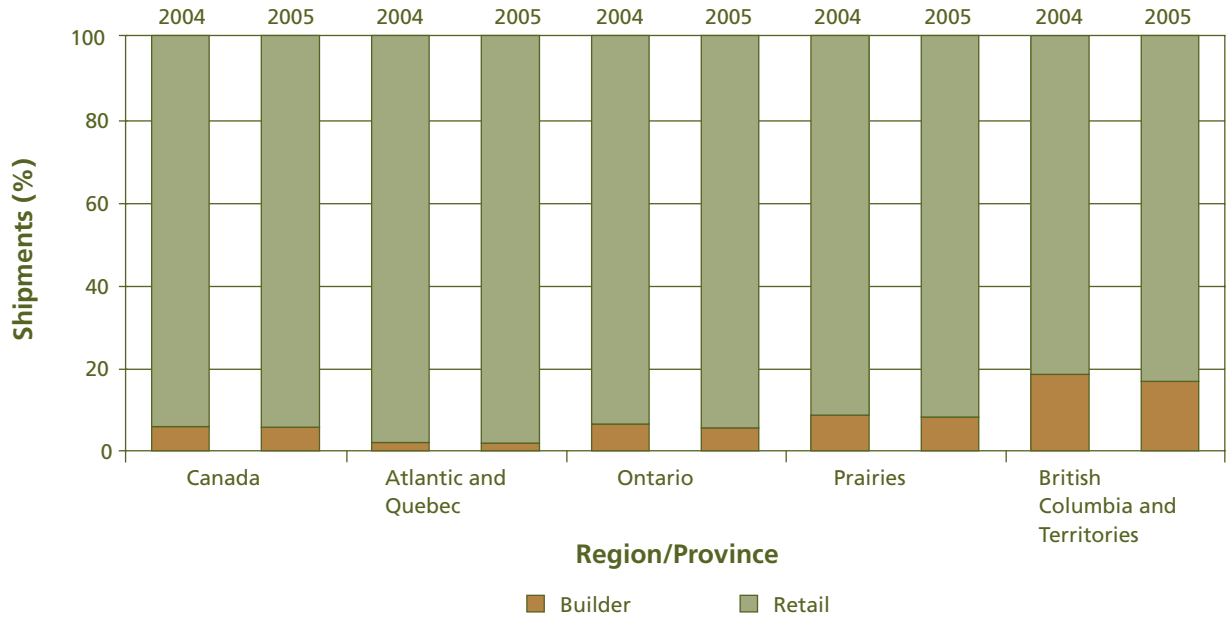


*For more information, see Table D.31 in Appendix D, "Detailed Tables."

5.2.5 Distribution by Channel, by Region/Province

Figure 5.4 illustrates the breakdown of clothes washers shipped for retail sales versus those shipped for the building trade, for 2004 and 2005. Once again, most clothes washers were shipped for retail sales. British Columbia and the Territories again had a slightly larger share of builder shipments than the rest of the country. The data also show that, on average, 18.2 percent of builder shipments were front-loading clothes washers, which are more energy-efficient than top-loading ones. In British Columbia and the Territories, however, this proportion was 38.8 percent.

FIGURE 5.4
Distribution of Clothes Washers by Channel, by Region/Province, 2004 and 2005*



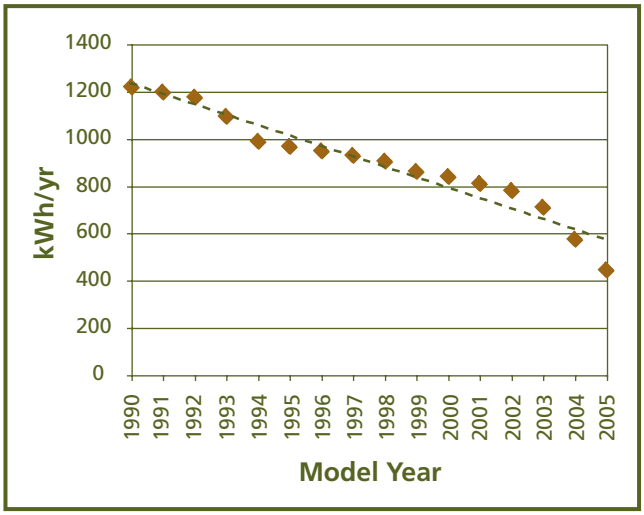
*For more information, see Table D.32 in Appendix D, "Detailed Tables."

5.3 Energy Consumption

5.3.1 Average Annual Unit Energy Consumption by Model Year

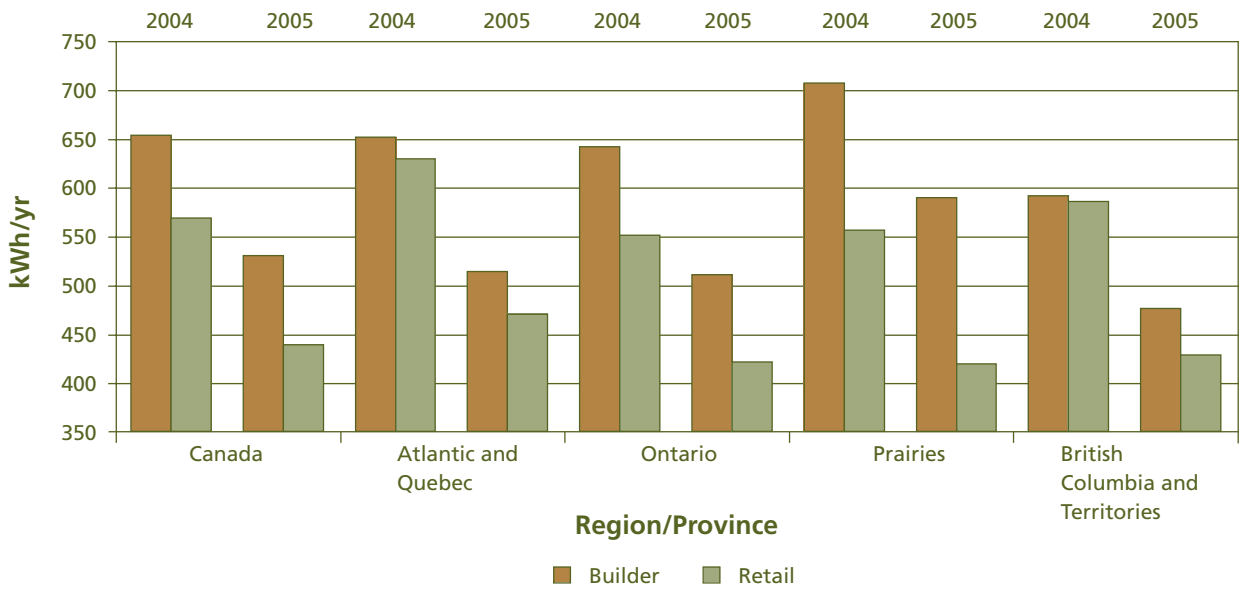
Between 1990 and 2005, the average annual UEC of clothes washers improved remarkably. As Figure 5.5 shows, the average annual UEC decreased by 774.4 kWh, or 63.6 percent. The significant decrease in average annual UEC from 2002 to 2005 (more than 335 kWh per year) coincided with the 2004 amendment to the MEPS. This trend is likely to continue because, on January 1, 2007, the MEPS and the ENERGY STAR qualifying level for clothes washers were strengthened, leading to greater increases in the efficiency of clothes washers.

FIGURE 5.5
Average Annual Unit Energy Consumption of Clothes Washers by Model Year*



*For more information, see Table D.33 in Appendix D, "Detailed Tables."

FIGURE 5.6
Average Annual Unit Energy Consumption of Clothes Washers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.34 in Appendix D, "Detailed Tables."

5.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province

Figure 5.6 demonstrates the breakdown of the average annual UEC of clothes washers by shipments for retail purposes and the builder trade by region/province for 2004 and 2005. In all regions, the average annual UEC was substantially lower for retail and builder shipments in 2005. Builders in British Columbia and the Territories seemed to supply their customers with significantly more energy-efficient clothes washers than did the rest of the country, whereas those in the Prairies did not. As previously mentioned, builders in British Columbia and the Territories provided the largest percentage of front-loading clothes washers, which are more energy efficient than top-loading models. Retail shipments in Ontario and the Western provinces were once again slightly more energy efficient than the national average.

5.4 Energy Savings

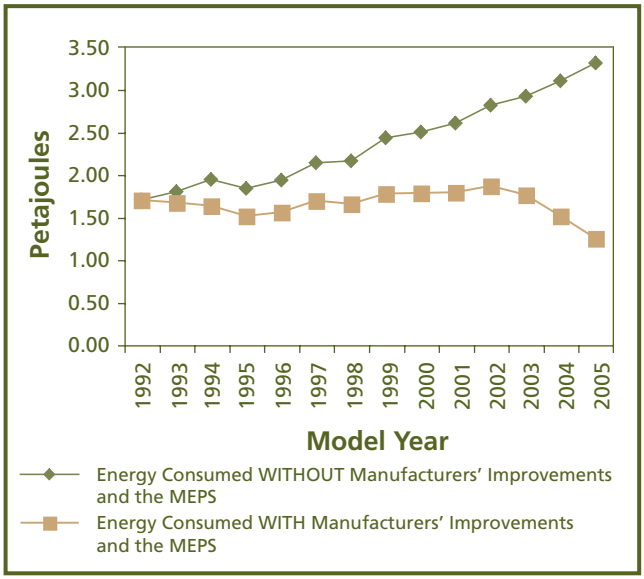
It is estimated that the annual energy consumption for clothes washers was significantly less from 1993 to 2005 than it would have been without the contributing factors referred to in previous chapters. The annual savings have been increasing steadily since 1993.

Figure 5.7 illustrates the likely annual energy consumption for clothes washers if manufacturers had not met the MEPS and general improvements in energy efficiency (*top line*) and shows how much energy actually was consumed (*bottom line*).

Graphically, the divergence of the two lines in the figure represents incremental annual energy savings. On average, clothes washers would have consumed 0.77 petajoules (PJ) more per year. The largest annual energy savings occurred in 2005, when clothes washers consumed about 2.06 PJ less than they might have otherwise.

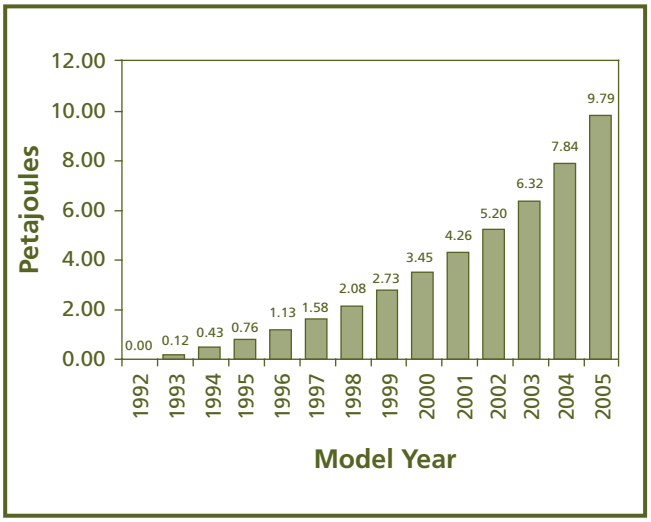
The cumulative energy savings for clothes washers are shown in Figure 5.8. Accrued energy savings reached 9.79 PJ in 2005, taking into account the life expectancy factor of clothes washers (this calculation is explained further in Appendix A, "Methodology"). The majority of savings occurred post-1999 – between 2000 and 2005, energy savings amounted to 6.34 PJ, or 1.76 billion kWh.

FIGURE 5.7
Annual Energy Savings for Clothes Washers, 1992–2005*



*For more information, see Table D.35 in Appendix D, "Detailed Tables."

FIGURE 5.8
Cumulative Energy Savings for Clothes Washers, 1992–2005*



*For more information, see Table D.35 in Appendix D, "Detailed Tables."

5.5 Clothes Washers Summary

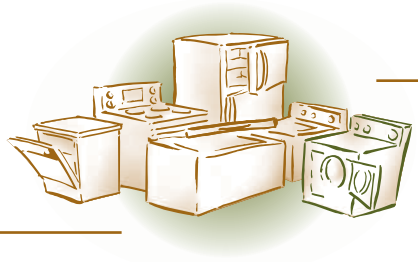
The energy efficiency of clothes washers improved steadily between 1990 and 2005. By 2005, 80.0 percent of all clothes washers consumed less than 600 kWh per year, whereas in 1990, almost two thirds (64.3 percent) consumed more than 1000 kWh per year. Since 2001 – the first year that shipment data for front-loading clothes washers were available – there had been a substantial increase in popularity of the more energy-efficient front-loading models versus top-loading ones. Market share increased from 15.7 percent to 42.3 percent between 2001 and 2005.

Of the clothes washer models available in 2005, 45.9 percent were ENERGY STAR qualified.

Approximately 94.3 percent of all clothes washers were shipped for retail sales, whereas 5.7 percent were tagged for builder shipments. British Columbia and the Territories continued to have a substantially larger builder shipment representation (16.7 percent). The Atlantic provinces and Quebec had a somewhat smaller builder shipment representation (1.9 percent) than the rest of the country.

The average annual energy savings for clothes washers were estimated to be 0.77 PJ between 1993 and 2005, with total energy savings for that period reaching 9.79 PJ (2.72 billion kWh). Dollar savings for clothes washers for the study period were estimated to be $250 million (calculated at 9.2 cents/kWh).

6 ELECTRIC CLOTHES DRYERS



6.1 2005 Market Snapshot

In 2005, the shipment-weighted average annual unit energy consumption (UEC) of all electric clothes dryers was 904 kilowatt hours (kWh) per year.

Electric clothes dryers typically make up 96 percent of the market; gas clothes dryers constitute the remainder.

There was a significant improvement in energy efficiency of electric clothes dryers from 1991 to 1993, when the average annual UEC decreased from 1109 to 929 kWh. After 1993, the average annual UEC remained relatively constant.

6.2 Distribution of Shipments

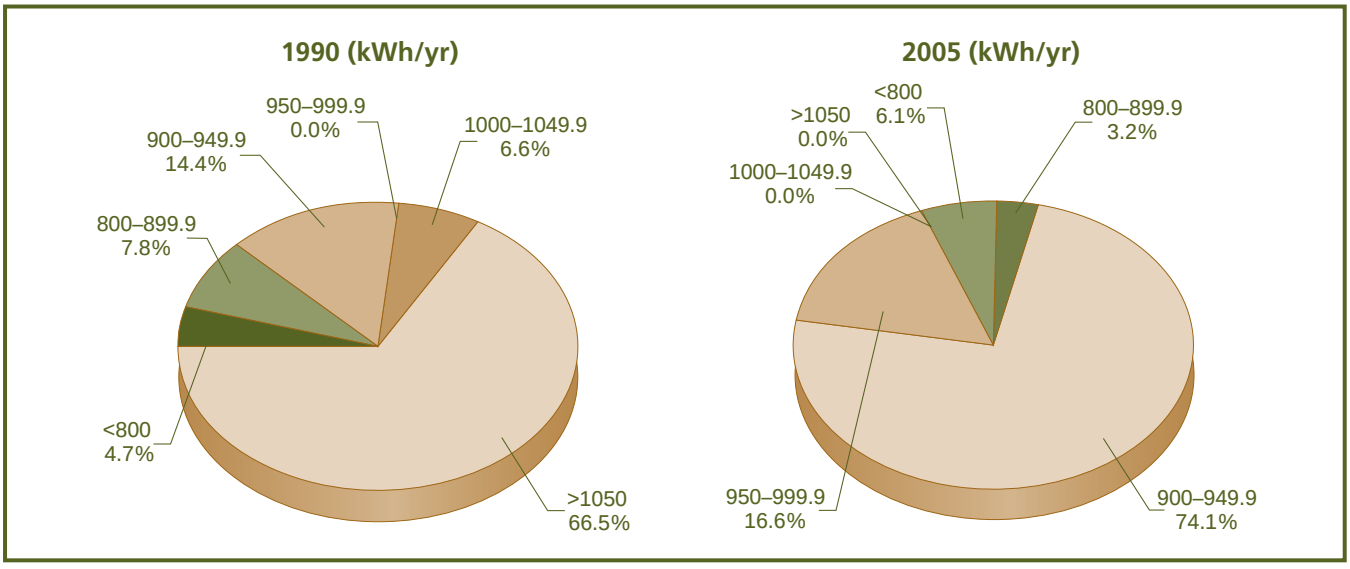
6.2.1 Distribution by Average Annual Unit Energy Consumption

Table 6.1 and Figure 6.1 demonstrate that between 1990 and 2005, electric clothes dryers exhibited relatively steady improvements in energy efficiency. A consumption level of more than 1050 kWh per year had dominated the market (66.5 percent) in 1990. It had almost disappeared by 2005, when 74.1 percent of electric clothes dryers consumed between 900 and 949 kWh.

TABLE 6.1
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption

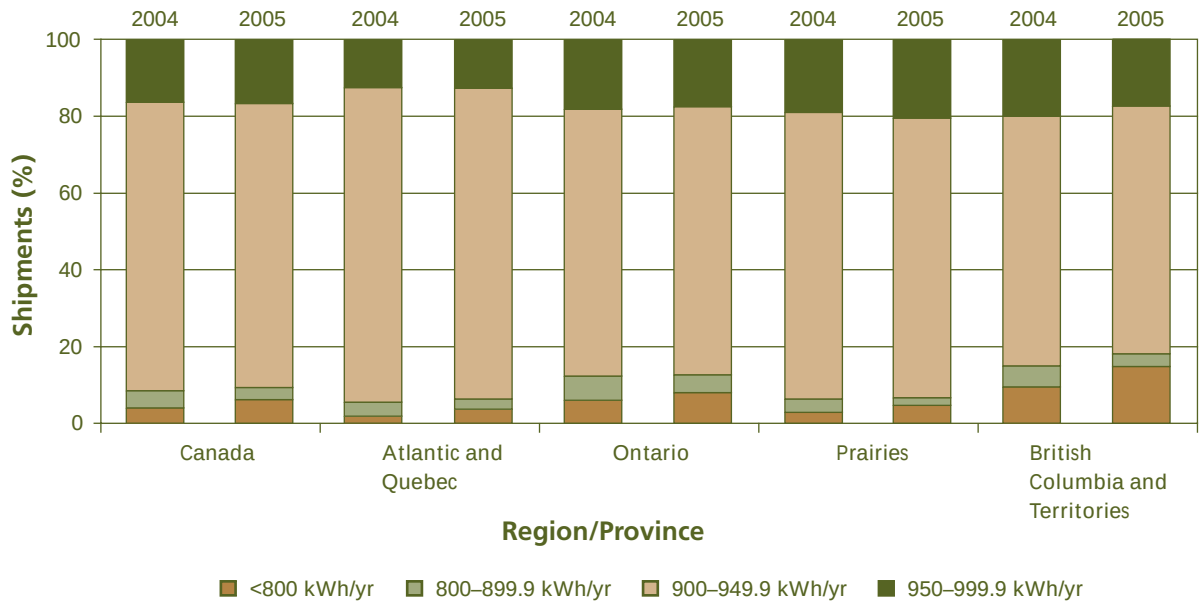
Model Year	<800 (%)	800–899.9 (%)	900–949.9 (%)	950–999.9 (%)	1000–1049.9 (%)	>1050 (%)
			kWh/yr			
1990	4.7	7.8	14.4	0.0	6.6	66.5
1991	5.3	0.2	30.0	22.6	15.4	26.5
1992	4.4	28.9	37.5	13.6	4.6	11.0
1993	4.1	28.9	53.6	0.1	7.1	6.1
1994	4.3	24.0	54.6	0.0	14.9	2.2
1995	3.2	16.2	68.5	0.8	10.0	1.3
1996	4.2	11.8	82.8	1.1	0.2	0.0
1997	4.9	12.9	80.7	1.4	0.0	0.0
1998	3.2	8.8	87.0	1.0	0.0	0.0
1999	2.7	7.2	88.3	1.8	0.0	0.0
2000	2.7	7.7	84.6	5.0	0.0	0.0
2001	2.3	4.3	87.1	6.3	0.0	0.0
2002	2.5	5.2	85.5	6.7	0.0	0.0
2003	2.7	10.0	77.0	10.3	0.0	0.0
2004	4.0	4.4	75.3	16.3	0.0	0.0
2005	6.1	3.2	74.1	16.6	0.0	0.0
Total Change	1.4%	4.5%	59.7%	16.6%	6.6%	66.5%

FIGURE 6.1
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption, 1990 and 2005



6.2.2 Distribution by Average Annual Unit Energy Consumption, by Region/Province

FIGURE 6.2
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005*



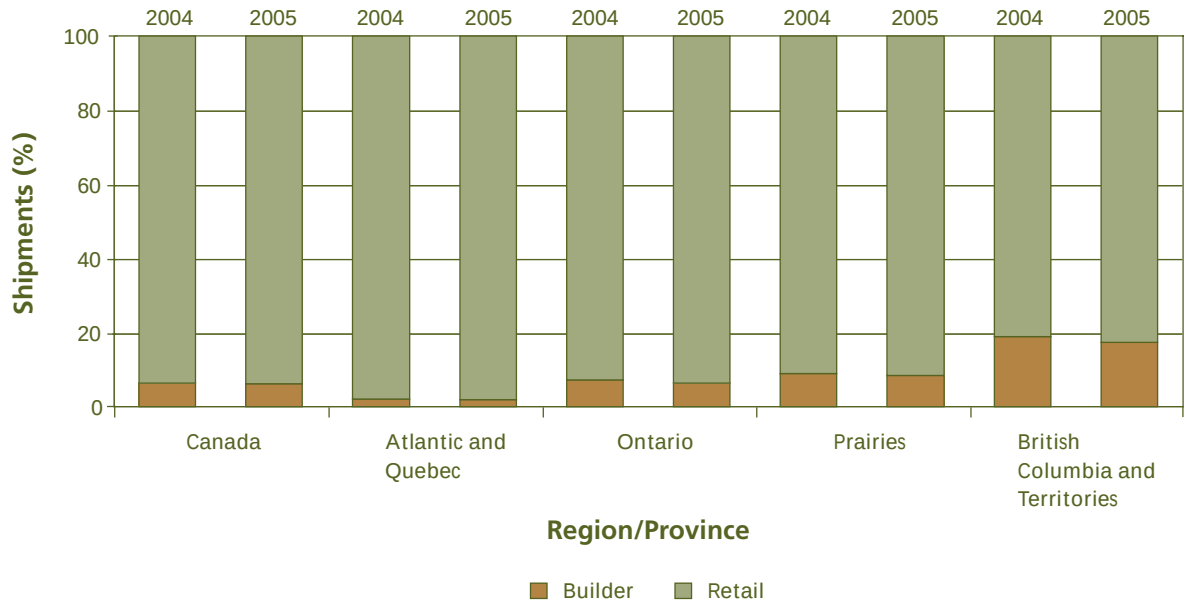
*For more information, see Table D.36 in Appendix D, "Detailed Tables."

In 2005, 74.1 percent of all electric clothes dryers shipped in Canada consumed between 900 and 949 kWh. Figure 6.2 shows that in 2005, as in 2004, Ontario and British Columbia and the Territories had a slight tendency towards lower-energy-consuming dryers (less than 900 kWh per year). For confidentiality reasons, the Atlantic provinces and Quebec have been grouped for this analysis. Although this chart reflects that the Atlantic provinces and Quebec favoured slightly more energy-consuming dryers, Chart 45 in *SHEU–2003*[35] shows that more than one quarter of households in those regions that used a clothes dryer within their dwelling in 2003 did not use it during an average week in the summer of 2003.

[35] Natural Resources Canada, *2003 Survey of Household Energy Use, Summary Report* (Ottawa: 2006), p. 23. Available: oee.nrcan.gc.ca/publications/statistics/sheu-summary/index.cfm.

6.2.3 Distribution by Channel, by Region/Province

FIGURE 6.3
Distribution of Electric Clothes Dryers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.37 in Appendix D, "Detailed Tables."

Figure 6.3 demonstrates the proportion of electric clothes dryers shipped for retail sales versus those shipped for the building trade for 2004 and 2005. There was little change in the proportion of retail versus builder shipments throughout the country between 2004 and 2005. British Columbia and the Territories still had a substantially larger builder shipment representation (17.3 percent) than the rest of the country, and Atlantic and Quebec had a somewhat lower share (1.9 percent).

6.3 Energy Consumption

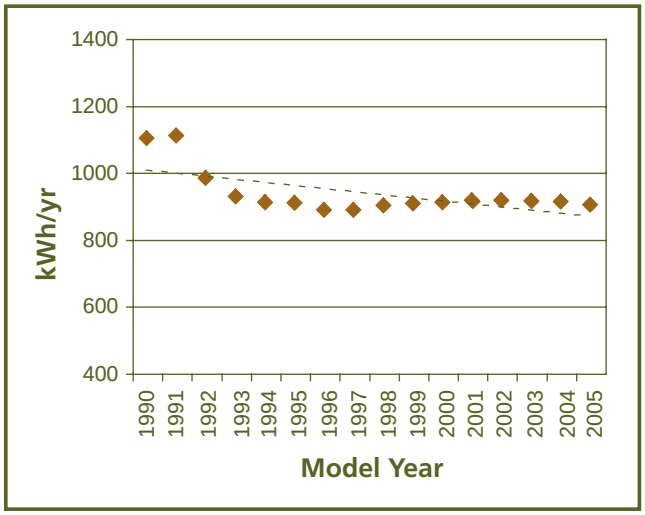
6.3.1 Average Annual Unit Energy Consumption by Model Year

The improvement in energy efficiency for electric clothes dryers between 1990 and 2005 is illustrated in Figure 6.4. It shows a decrease in the average annual UEC of 198.8 kWh, or about 18 percent. This figure and Table D.38 (in Appendix D, "Detailed Tables") show a significant improvement from 1991 to 1993, when the average annual UEC decreased from 1109 to 929 kWh (180 kWh or 16 percent). After 1993, the average annual UEC remained relatively constant.

6.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province

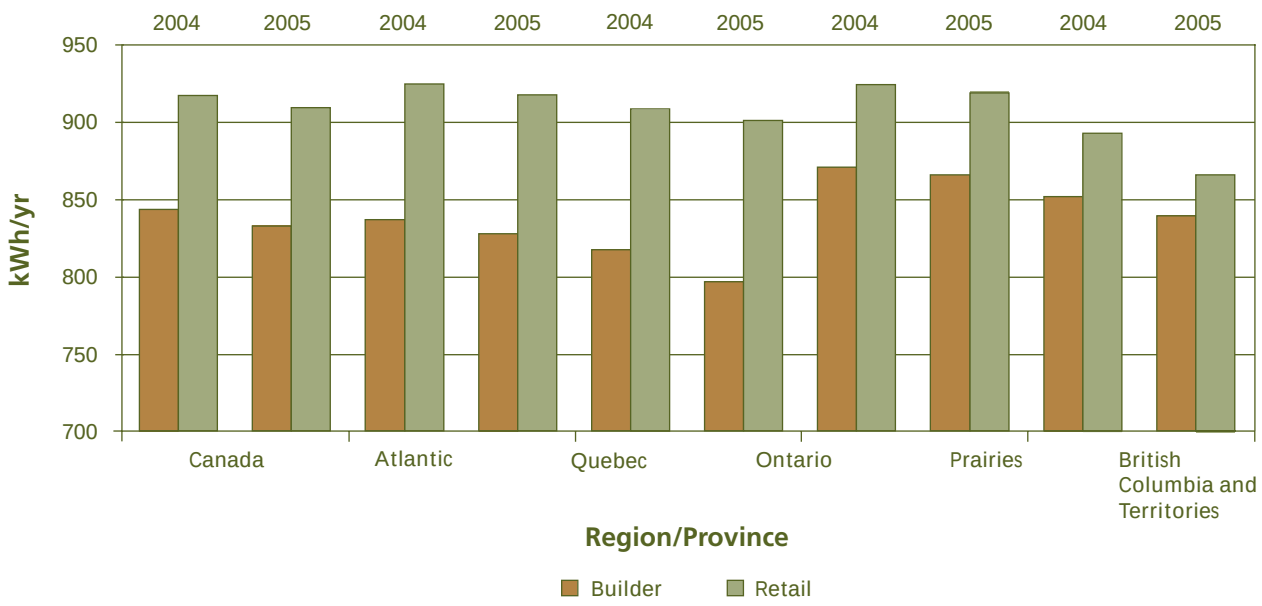
Figure 6.5 demonstrates the breakdown of the average annual UEC of electric clothes dryers by shipments for retail purposes and for the builder trade by region/province for 2004 and 2005. In all regions, the average annual UEC remained higher for retail shipments than for builder ones. In 2005, the average annual UEC for builder shipments decreased the most in Ontario; the average annual UEC for retail shipments decreased the most in British Columbia and the Territories.

FIGURE 6.4
Average Annual Unit Energy Consumption of Electric Clothes Dryers by Model Year*



*For more information, see Table D.38 in Appendix D, "Detailed Tables."

FIGURE 6.5
Average Annual Unit Energy Consumption of Electric Clothes Dryers by Channel, by Region/Province, 2004 and 2005*



*For more information, see Table D.39 in Appendix D, "Detailed Tables."

6.4 Energy Savings

It is estimated that from 1993 to 2005, the annual energy consumption of electric clothes dryers was lower than it would have been had manufacturers not met the minimum energy performance standards (MEPS) or improved energy efficiency. Figure 6.6 shows how much energy might have been consumed annually by electric clothes dryers without the contributing factors (*top line*) and how much energy they actually consumed (*bottom line*).

Graphically, the gap between the two lines represents incremental annual energy savings – on average, 0.12 petajoules (PJ) per year. The largest annual energy savings occurred in 2005, when electric clothes dryers consumed 0.19 PJ less than they might have otherwise.

The cumulative energy savings for electric clothes dryers are shown in Figure 6.7. Savings grew steadily between 1992 and 2005, as annual energy savings began to accrue. They reached 1.62 PJ in 2005, taking into account the life expectancy factor of freezers (this calculation is explained further in Appendix A, "Methodology").

6.5 Electric Clothes Dryers Summary

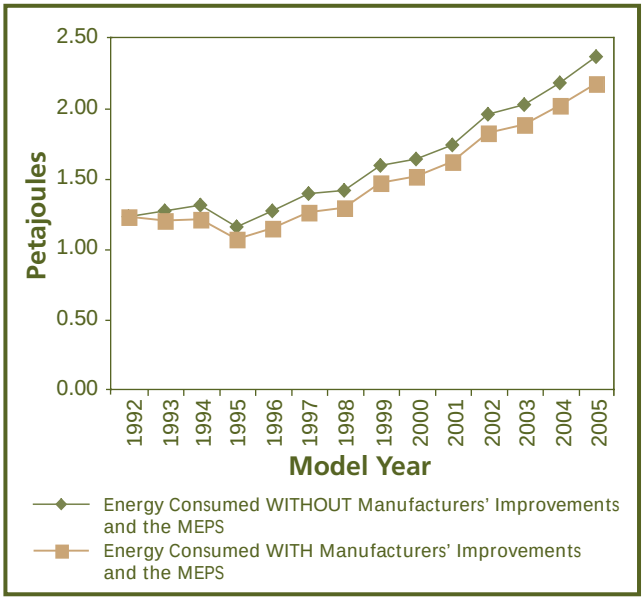
The energy efficiency of electric clothes dryers improved steadily between 1990 and 2005. By 2005, 74.1 percent of all electric clothes dryers consumed between 900 and 949 kWh per year, whereas in 1990, almost two thirds (66.5 percent) consumed more than 1050 kWh per year.

About 93.9 percent of all electric clothes dryers were shipped for retail sales, whereas 6.1 percent were tagged for builder shipments. Once again, British Columbia and the Territories had a substantially larger builder shipment representation (17.3 percent) than the rest of the country.

The average annual energy savings for electric clothes dryers were estimated to be 0.12 PJ between 1993 and 2005, with total energy savings for that period reaching 1.62 PJ (500 million kWh).

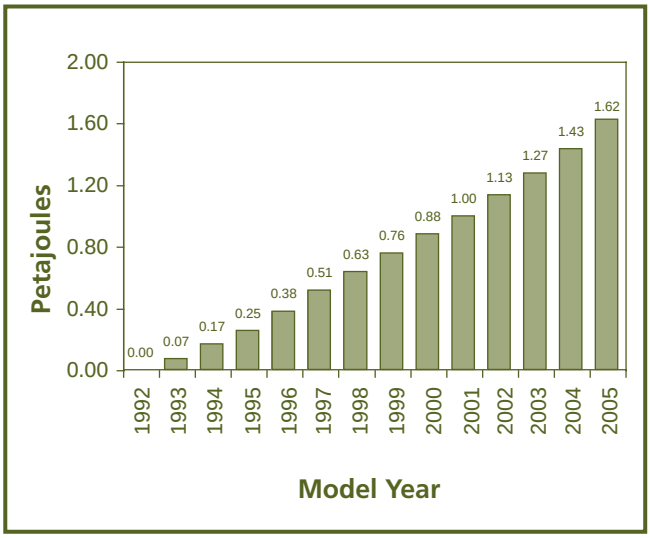
Dollar savings for electric clothes dryers for the study period were estimated to be $41 million (calculated at 9.2 cents/kWh).

FIGURE 6.6
Annual Energy Savings for Electric Clothes Dryers, 1992–2005*



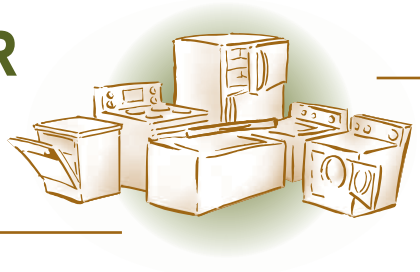
*For more information, see Table D.40 in Appendix D, "Detailed Tables."

FIGURE 6.7
Cumulative Energy Savings for Electric Clothes Dryers, 1992–2005*



*For more information, see Table D.40 in Appendix D, "Detailed Tables."

7 SUMMARY OF MAJOR HOUSEHOLD APPLIANCES

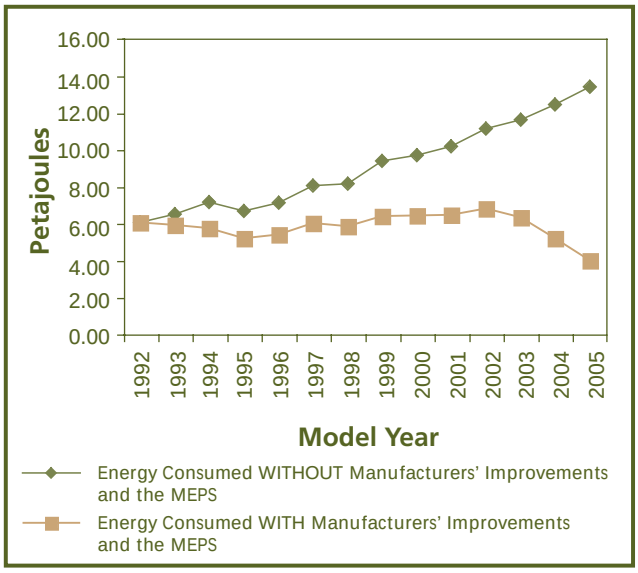


7.1 Total Energy Savings

Annual energy consumption for all major household appliances during the study period was significantly reduced, most likely due to the following factors: the significant research and development activities carried out by appliance manufacturers, improvements to the minimum energy performance standards (MEPS), the EnerGuide for Equipment program, the ENERGY STAR® Initiative and various incentives and rebates offered by the federal, provincial and municipal governments and utilities. Figure 7.1 shows the estimated annual energy consumption of major appliances between 1992 and 2005 without these factors as well as how much energy was actually consumed by major appliances during this period.

The gap between the two lines in Figure 7.1 represents incremental annual energy savings. Energy efficiency began to improve almost immediately after the *Energy Efficiency Act* came into force in 1992, thanks to market forces, such as the regulations expected from the Act and United States regulations.

FIGURE 7.1
Annual Energy Savings for All Major Household Appliances, 1992–2005*

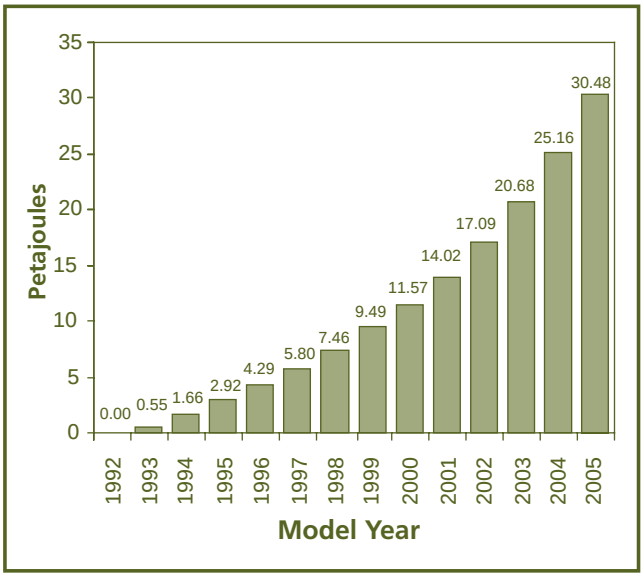


*For more information, see Table D.41 in Appendix D, "Detailed Tables."

The average annual energy savings for major appliances were estimated to be 2.34 petajoules (PJ) between 1993 and 2005. (No energy savings had been expected in 1992.) This indicates that, on average, major appliances consumed about 2.34 PJ less per year than they would have without the contributing factors.

The largest annual energy savings occurred in 2005, when major appliances consumed about 5.60 PJ less than they would have otherwise. Cumulative energy savings for major appliances are shown in Figure 7.2 and Table D.41 (in Appendix D, "Detailed Tables"). Because the energy saved in any given year accrues over time, cumulative energy savings grew steadily between 1992 and 2005. They reached a total savings of 30.48 PJ (8.47 billion kilowatt hours [kWh]) in 2005 (taking into account the life expectancy factor of the various appliances). That is the equivalent of a year's energy for about 274 000 households. It is estimated that these energy savings resulted in consumers saving approximately $779 million (or $60–$70 2005 dollars per household), calculated at 9.2 cents/kWh.[36]

FIGURE 7.2
Cumulative Energy Savings for All Major Household Appliances, 1992–2005*



*For more information, see Table D.41 in Appendix D, "Detailed Tables."

[36] Source: *Energy Use Data Handbook* table, which can be found on the OEE Web site at oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_18_e_2.cfm. Note that this is a national average.

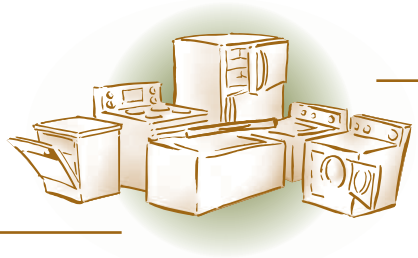
7.2 Average Annual Unit Energy Consumption of All Major Household Appliances

TABLE 7.1
Average Annual Unit Energy Consumption of All Major Household Appliances, 1990–2005

Appliance	1990	1997	1999	2001	2003	2005
			(kWh/yr)			
Refrigerators						
Type 3 (16.5–18.4 cu.ft.) Refrigerators	947	635	636	544	461	454
ENERGY STAR Qualified Type 3 (16.5–18.4 cu.ft.) Refrigerators	–	–	–	440	435	408
Total Refrigerators	956	657	646	559	487	469
Total ENERGY STAR Qualified Refrigerators	–	–	–	495	481	469
Freezers						
Total Freezers	714	377	383	384	369	386
Dishwashers						
Standard Dishwashers	1026	649	640	634	524	396
ENERGY STAR Qualified Dishwashers	–	–	–	534	452	379
Electric Ranges						
Self-Cleaning Electric Ranges	727	759	742	741	691	558
Non-Self-Cleaning Electric Ranges	786	780	770	786	732	593
Clothes Washers						
Front-Loading Clothes Washers	–	–	–	287	275	219
Top-Loading Clothes Washers	–	–	–	905	827	609
ENERGY STAR Qualified Front-Loading Clothes Washers	–	–	–	302	275	217
ENERGY STAR Qualified Top-Loading Clothes Washers	–	–	–	304	337	317
Total Clothes Washers	1218	930	860	810	708	444
Electric Clothes Dryers						
Total Electric Clothes Dryers	1103	887	908	916	914	904

Table 7.1 provides an overview of the average annual unit energy consumption for the six major household appliances for six years during the study period. It demonstrates a significant improvement in energy efficiency as evidenced throughout this report.

APPENDIX A METHODOLOGY



A.1 Data Preparation

A.1.1 Introduction

To improve the monitoring of trends in Canadian energy use, Natural Resources Canada's (NRCan's) Office of Energy Efficiency proposed an annual data collection arrangement with the Canadian Appliance Manufacturers Association (CAMA) in 1996, as part of the National Energy Use Database initiative.

Under this agreement, CAMA members contributed for analysis their annual shipment data for six appliance categories – refrigerators, freezers, dishwashers, electric ranges, clothes washers and electric clothes dryers. To keep their data confidential, these appliance manufacturers suggested that a third party receive and prepare the database in a format in which no one (other than the third party) could determine the shipment data for an individual model or manufacturer. NRCan retained the services of Electro-Federation Canada (EFC), chosen by CAMA, as the third party to receive the data.

For 2005 (and for the previous year), the manufacturers agreed to provide data on their shipments by province/region and by distribution channel (builder versus retailer), where possible. These additional shipment data have allowed a more detailed analysis of the distribution and energy efficiency of the appliances.

A.1.2 Database Preparation Process

The data presented in this report combine shipment figures from the major appliance manufacturers in Canada with the energy use information in NRCan's annual *EnerGuide Appliance Directory*. Analysts from EFC matched the model number from the manufacturer with the corresponding model in the *EnerGuide Appliance Directory*. Thus they arrived at the energy consumption represented by all shipments of that model within each year. The analysts then aggregated these figures by province/region, by channel and for Canada to provide the data presented in this report. They produced separate aggregated data for ENERGY STAR® models, where appropriate.

The analysts assembled the data using standard database and spreadsheet software and submitted it to NRCan for analysis and report generation. For the reporting stages, any information that could identify the manufacturer or model number was removed.

A.1.3 Manufacturers' Data

NRCan sent a letter to each appliance manufacturer, requesting annual shipment data for each model of refrigerator, freezer, dishwasher, electric range, clothes washer and electric clothes dryer on the Canadian market from 1990 to 2005. When the project began in 1996, only three manufacturers provided shipment data. The number of data contributors has since increased to eight, covering the majority of appliance models sold in Canada. NRCan is approaching additional manufacturers to improve the coverage for future data collection.

Manufacturers submitted the data in various electronic and printed formats. EFC converted the electronic data to a common database format. The analysts entered the data into the database from the printed reports.

The data included the appliance type, model number and number of shipments (by province/region and channel, where possible, for 2004 data onwards) for each year. Because each manufacturer provided data in a different format, the analysts amalgamated the files to produce a single file for all models subdivided by appliance type, province/region, channel and model year.

The nature of the freezer market prevented EFC from obtaining a model-by-model breakdown of shipments. Instead, the analysts received total shipments and average energy use by freezer type. NRCan used this information to generate the freezer reports.

A.1.4 EnerGuide Data

The analysts used the size, type and unit energy information from NRCan's EnerGuide ratings for each appliance to calculate the shipment-weighted energy use of each appliance type. Also, the *EnerGuide Appliance Directory* was used to identify which models were listed as ENERGY STAR.

A.1.5 Data Matching

Analysts from EFC matched the manufacturer's data for each model with the corresponding energy consumption data from the *EnerGuide Appliance Directory* for that model. They then multiplied the manufacturer's shipments for each model by the corresponding EnerGuide model's energy rating. This result is the shipment-weighted total energy consumption for that model. Each appliance category (such as refrigerator, dishwasher) and type and size category (as defined in the EnerGuide directories, such as Type 7 refrigerators, self-cleaning ranges, front-loading clothes washers) was then subtotalled so that the average unit energy consumption could be calculated.

The *EnerGuide Appliance Directory* shows the basic model numbers for appliances available on the Canadian market. Many slight model variants have the same energy rating; therefore, the listings use symbols (such as * and #) to indicate model families. Because some model numbers have additional prefixes or suffixes to indicate features that do not affect energy use (such as colour and door-swing), there were relatively few one-to-one matches.

Analysts needed to manipulate the data to perform pattern matching. They wrote programs to compare the model numbers supplied by the manufacturers with those in the *EnerGuide Appliance Directory*. When a match was found, the corresponding energy consumption figure and the information about the type from the *EnerGuide Appliance Directory* were added to the record for the annual shipments of the model.

Because there were many combinations of character substitution, the analysts adopted a method to work from the closest matches to the least likely matches. Matches in which only one character differed were flagged and removed. Attempts were then made with a difference of two characters, and so on.

The analysts developed reasonability tests to ensure the integrity of the data-matching process. For example, if the manufacturer's model number contained many characters but was matched by a model in the *EnerGuide Appliance Directory* that had considerably fewer characters, the model was flagged for manual checking. They also realized that manufacturers might re-use the same numbers for different models after several years.

For example, 128 models of refrigerators in the file containing 1980 to 1993 data from the *EnerGuide Appliance Directory* have the same model number as those in the 1997 file, but with different energy ratings. They flagged these models for special treatment. During the matching process, analysts applied "reasonability" criteria. For example, a model would be checked manually if its shipments were reported more than three years after the last time the corresponding model appeared in the EnerGuide list or if the EnerGuide model number contained considerably fewer characters than that of the manufacturer.

Some difficulties occurred when the model number in NRCan's *EnerGuide Appliance Directory* differed from the actual model numbers used by the manufacturers in their internal shipment recording systems. In some cases, for example, manufacturers used special codes to denote models that were branded for other companies, such as department stores. The manufacturers helped resolve most of these cases.

Some models remained unmatched even after the automated processes were performed. Whenever one of these models represented a substantial number of shipments for that appliance type, analysts handled it on an exceptional basis. Manufacturers were again helpful in identifying these models and verifying energy ratings and types.

The process continued until all but a few minor models were matched.

A.1.6 Data Summary and Transfer

After the matching process, analysts summarized the data. To calculate the total annual energy consumption for each model, they multiplied the model's energy rating by the number of shipments for the year. This yielded the shipment-weighted total energy use of that model for that year. For example, model XYZ has annual shipments of 5238 and an annual energy consumption of 683 kilowatt hours (kWh); its shipment-weighted total energy use for the year is 5238 × 683 kWh = 3 577 554 kWh. This aggregate figure and the shipment figures were added as necessary to provide totals for each appliance type and size category as appropriate. Separate aggregated data were provided for ENERGY STAR models. All these aggregate figures were given for province/region, channel and country.

For refrigerators, the actual volume of each model was available from the *EnerGuide Appliance Directory*. Therefore, it was possible to monitor the trend of changes in the size of refrigerators over the years. Furthermore, it was possible to determine the amount of energy used by each size category. Analysts summarized this information and added it to the database for NRCan.

The final database prepared by EFC consisted of such information as the appliance type, model year, total energy consumption and average unit consumption. Refrigerators were further categorized by type and size. The aggregated data were broken down by ENERGY STAR versus non-ENERGY STAR (as of 1999) and province/region and channel (as of 2004). All the information was transferred to spreadsheets and sent to NRCan for analysis and reporting.

A.2 Analysis

The shipment-weighted average annual unit energy consumption (UEC) by category was calculated as total energy consumption of all the refrigerators sold in Canada in that category divided by total number of shipments in that category. The following gives an example of the shipment-weighted average UEC for the refrigerators:

$$\frac{\sum_{i=1}^{12} S\_type_i \times \overline{UEC\_type_i}}{\sum_{i=1}^{12} S\_type_i}$$

where S_type_i = Number of Shipments of Type i refrigerators
and $\overline{UEC\_type_i}$ = Average Unit Energy Consumption of Type i refrigerators

As mentioned in section A.1, "Data Preparation," data were obtained for some appliances by size category. Therefore, the UEC per cubic foot was calculated by dividing the UEC of a given size category by the midpoint of the category.

A.2.1 Incremental Energy Savings

Calculating the incremental energy savings for each appliance type was a three-step process, as follows:

1. Baseline levels of energy consumption were estimated for each appliance type for each year between 1990 and 2005. For all appliances, baseline levels of energy consumption reflected NRCan's assumptions about how much energy each appliance type would have consumed without the energy efficiency improvements made by manufacturers and the minimum energy performance standards (MEPS). To estimate baseline levels of energy consumption, the following was assumed:

- Without the implementation of Canada's *Energy Efficiency Regulations* and general energy efficiency improvements made by manufacturers, the UEC for all appliance types would have remained constant at the 1992 levels.
- The number of units shipped would have remained the same between 1990 and 2005 even in the absence of the general efficiency improvements made by manufacturers and the implementation of the *Energy Efficiency Regulations*.

Even though the MEPS were not introduced until 1995, the baseline year used for all estimates of energy savings was 1992. This is because energy efficiency began to improve almost immediately after the Energy Efficiency Act *came into force in 1992, thanks to market forces, such as the regulations expected from the Act and United States regulations.*

2. "Actual" or current levels of consumption for all appliances were calculated in an identical fashion. The average annual UEC for each appliance type for each model year was used, instead of holding it constant at 1992 levels, to determine the actual levels of energy consumption.

3. Incremental energy savings for all appliances were then calculated as the difference between baseline and actual levels of energy consumption.

   Because 1992 was the baseline year used in the calculations, a retirement function was included to take into account the aging of appliances, based on the life expectancies set out in the 2005 *EnerGuide Appliance Directory*.[37] Applying this retirement function was done to avoid overestimating the actual energy savings from appliance stock that has been retired (or is no longer in use). The calculation involved using the average life expectancy, annual shipment data and annual incremental energy savings for each appliance type. Average life expectancy and annual shipment data for each appliance type were used to estimate the annual stock of each appliance type in use. This estimate was then applied to the annual incremental unit energy savings for each appliance type (shipment-weighted UEC for 1992 less the shipment-weighted UEC for each year) to calculate the cumulative energy savings.

A.2.2 Cumulative Energy Savings

This calculation was a four-step process, as follows:

1. The average life expectancy of each appliance type was assumed to be the industry average reported in the 2005 *EnerGuide Appliance Directory*:
   a. refrigerators – 17 years
   b. freezers – 21 years
   c. electric ranges – 18 years
   d. dishwashers – 13 years
   e. clothes washers – 14 years
   f. electric clothes dryers – 18 years

2. A retirement function was used to estimate the retirement rate of each appliance type. In this linear function, no appliances retire in the first two thirds (0.67) of their average life expectancy, and all units are retired by four thirds (1.33) of their average life expectancy. The ranges for the retirement function are as follows:
   a. if age < {2/3 * (average life expectancy)}, 100 percent survive
   b. if age > {4/3 * (average life expectancy)}, 0 percent survive
   c. otherwise, {2 – age * 1.5/(average life expectancy)} survive

3. The rate of retirement was applied to the annual shipments of each appliance type to estimate the total stock of appliances in use for each year since the baseline year of 1992.

[37] Natural Resources Canada *EnerGuide Appliance Directory 2005* (Ottawa: February 2005), p. 13.

4. The total stock of appliances for each year since 1992 was separated into categories based on the year the appliances were shipped. Cumulative energy savings were then calculated by multiplying the annual shipments that made up the stock by the incremental unit energy savings for each corresponding year.

This retirement function is demonstrated in Figures A.1 and A.2.

FIGURE A.1
Retirement Function for Aging Appliances

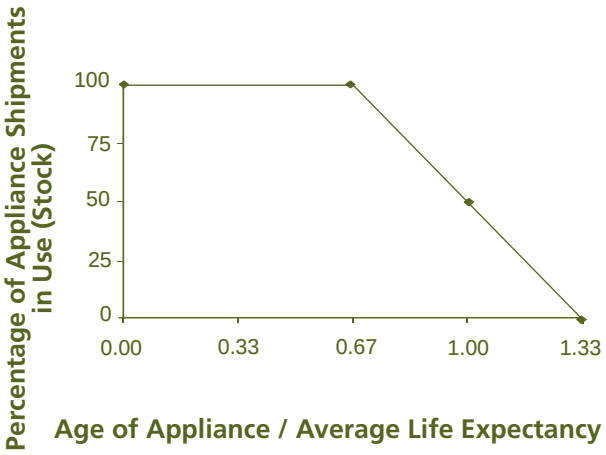
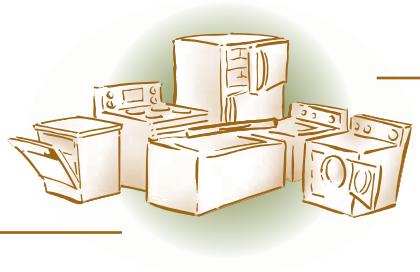


FIGURE A.2
Cumulative Energy Savings for All Appliances With and Without Retirement Factor, 1992–2005

APPENDIX B DEFINITIONS



Clothes Washer

An appliance that is designed to clean clothes using a water solution of soap or detergent or both and mechanical agitation or other movement.

Canada's *Energy Efficiency Regulations* apply to standard or compact electrically operated household clothes washers that are top- or front-loading and that have an internal control system that regulates the water temperature without the need for user intervention after the machine starts.

Dishwasher

A cabinet-like appliance, either built-in or portable, that, with the aid of water and detergent, washes, rinses and dries (when a drying process is included) dishware, glassware, eating utensils and most cooking utensils by chemical, mechanical and electrical means and then discharges the water into the plumbing drainage system.

The Regulations apply to electrically operated automatic household dishwashers that are not commercial, industrial or institutional machines.

Electric Clothes Dryer

A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced-air circulation. The heat source is electricity, and the drum and the blower(s) are driven by electric motor(s).

The *EnerGuide Appliance Directory* groups electric clothes dryers into two categories:

- Compact Size – a clothes dryer with drum volume of less than 125 litres
- Standard Size – a clothes dryer with drum volume of 125 litres

The Regulations apply to standard and compact electrically operated and electrically heated household tumble-type clothes dryers.

Electric Range

A consumer product using electric resistance heating and used as the major household cooking appliance. The product may consist of a cook top, one or more ovens, or a combination of the two, and may be built-in or free-standing.

The Regulations apply to household ranges that are any of the following

- free-standing appliances equipped with one or more surface elements and one or more ovens
- built-in appliances equipped with one or more surface elements and one or more ovens
- built-in appliances equipped with one or more ovens and no surface elements
- wall-mounted appliances equipped with one or more ovens and no surface elements
- counter-mounted appliances equipped with one or more surface elements and no ovens

but *do not* include the following

- microwave cooking appliances
- portable appliances designed for an electrical supply of 120 volts
- household appliances with one or more tungsten-halogen heating elements

Freezer

An appliance designed

- for the extended storage of food frozen at an average temperature of –17.8°C (0°F) or lower
- with the inherent capability for freezing food
- with a minimum freezing capability of 2 kilograms /100 litres in 24 hours

The process of freezing involves removing heat from products to lower their temperatures to a point where most of the water contained therein is solidified.

In 2005, freezers were typically built as either vertical models or chest models and grouped into the following types:

Type 8
Upright freezers with manual defrost

Type 9
Upright freezers with automatic defrost

Type 10
Chest freezers and all other freezers

Type 16
Compact upright freezers with manual defrost

Type 17
Compact upright freezers with automatic defrost

Type 18
Compact chest freezers and all other freezers

The Regulations apply to household freezers that have a capacity of not more than 850 litres (30 cubic feet).

Refrigerator

An appliance that consists of one or more compartments, with at least one of the compartments designed for the refrigerated storage of foods at temperatures above 0˚C (32˚F) and, if the model is a refrigerator-freezer, with at least one of the compartments designed for the freezing and storage of frozen foods at or below an average temperature of –15˚C (5˚F) and typically capable of being adjusted by the user to a temperature of ≤–17.8˚C (0˚F). The refrigerator with a freezer compartment is capable of maintaining simultaneously an average freezer temperature of ≤ –15˚C (5˚F) and an average fresh food compartment temperature of ≥ 0˚C ≤ 5˚C (≥ 32˚F ≤ 41˚F).

In 2005, refrigerators as per in the *EnerGuide Appliance Directory* were grouped under the following main categories:

Type 1
Refrigerators and refrigerator-freezers with manual defrost

Type 2
Refrigerator-freezers with partial automatic defrost

Type 3
Refrigerator-freezers with automatic defrost and top-mounted freezer, but without through-the-door ice service; also all-refrigerators[38] with automatic defrost

Type 4
Refrigerator-freezers with automatic defrost and side-mounted freezer but without through-the-door ice service

Type 5
Refrigerator-freezers with automatic defrost and bottom-mounted freezer, but without through the door ice service

Type 6
Refrigerator-freezers with automatic defrost, top-mounted freezer and through-the-door ice service

Type 7
Refrigerator-freezers with automatic defrost, side-mounted freezer and through-the-door ice service

Type 11
Compact refrigerators and refrigerator-freezers with manual defrost

Type 12
Compact refrigerators and refrigerator-freezers with partial automatic defrost

Type 13
Compact refrigerator-freezers with automatic defrost and top-mounted freezer; also compact all-refrigerators with automatic defrost

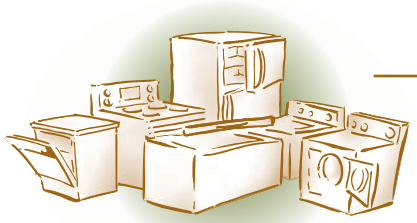
Type 14
Compact refrigerator-freezers with automatic defrost and side-mounted freezer

Type 15
Compact refrigerator-freezers with automatic defrost and bottom-mounted freezer

The Regulations apply to household refrigerators or combination refrigerator-freezers that have a capacity of not more than 1100 litres (39 cubic feet), with the exception of refrigerators that employ an absorption refrigeration system.

[38] The term “all-refrigerators” refers to models that have no freezer compartment.

APPENDIX C
QUESTIONS AND ANSWERS ABOUT CHANGES TO ENERGY STAR®



Why are the ENERGY STAR criteria changing for dishwashers and clothes washers?

Canada and the United States introduced a regulated minimum energy efficiency standard for clothes washers effective January 1, 2007. This new standard is designed to keep pace with technology developments that are enabling manufacturers to design and build products that achieve higher levels of energy efficiency than in the past. The new standard means that the least efficient models will be eliminated from the market, which in turn means that the ENERGY STAR criteria need to be strengthened so that only those products that are in the top 25 percent of energy performers can use this international symbol of energy efficiency.

In the case of dishwashers, the ENERGY STAR criteria have not been updated for several years, and almost all products currently on the market can meet the pre-January 1, 2007, requirement. In keeping with the ENERGY STAR objective to represent the top 25 percent of the market, the ENERGY STAR specification for dishwashers was strengthened on January 1, 2007.

Why does Canada regulate energy efficiency standards?

Canada regulates energy efficiency standards for a wide range of energy-using products, with the objective of eliminating the least energy-efficient products from the Canadian market. Energy efficiency is an important way that all sectors of the economy and individual consumers can reduce emissions of greenhouse gases that contribute to climate change and other pollutants that contribute to urban smog. Energy efficiency is also good for the economy because it saves consumers money, reduces business operating costs and contributes to Canada's competitiveness in domestic and international markets.

What is the difference between a regulated energy performance standard and the ENERGY STAR criteria?

The standards referenced in Canada's *Energy Efficiency Regulations* define test procedures for determining a product's energy performance and establish minimum energy performance requirements that a product must meet to be sold in Canada. ENERGY STAR is a separate, voluntary, labelling initiative that uses an internationally recognized symbol to help consumers identify products that not only exceed the minimum energy performance requirements but also are among the most energy efficient on the market.

Will the new ENERGY STAR criteria affect product performance?

No. ENERGY STAR identifies products that meet a specified level of energy performance based on verified testing results. To qualify for ENERGY STAR, product features must not be compromised. ENERGY STAR qualified products deliver the same or better performance as comparable models while using less energy. Only those products whose energy performance under normal operating conditions puts them in the top 25 percent of products on the market are eligible to use the ENERGY STAR symbol.

How can I determine whether a product qualifies under the new criteria or the old criteria?

Natural Resources Canada (NRCan) maintains up-to-date lists of all products that qualify for ENERGY STAR in Canada. If you have a specific appliance model in

mind, you can check these lists on the ENERGY STAR Web site to determine if it meets the new criteria. NRCan has also posted lists of products that qualified under the pre-January 1, 2007, criteria – and may still be using the ENERGY STAR symbol – but do not meet the new requirements.

If the model you are considering purchasing was manufactured after January 1, 2007, and bears the ENERGY STAR symbol, you can be assured that it meets the new criteria. If it is an older model, it may still qualify for ENERGY STAR, but you should check the list on the ENERGY STAR Web site.

If a product qualifies under the old criteria but does not meet the new requirements, does this mean the product is now considered a poor energy performer?

No – it could, for example, still be in the mid-range of products on the market. The best way to determine this is to check the scale on the EnerGuide label, which has an indicator arrow that shows how the product compares with similar models in terms of energy consumption. One thing is certain, however: if a product does not meet the new ENERGY STAR criteria, it is no longer considered to be among the most energy-efficient models available on the market. More energy-efficient models are available that will deliver lower operating costs and long-term savings.

Why does ENERGY STAR qualification matter?

Buying the most energy-efficient model that meets your needs will save you energy and money for as long as you use the appliance. For example, ENERGY STAR qualified washers use up to 50 percent less energy and 35 to 50 percent less water than traditional models. Dishwashers that meet the new ENERGY STAR criteria are at least 41 percent more energy-efficient than the least efficient models sold in Canada. Saving energy does more than put money in your pocket – it also reduces emissions of greenhouse gases and other pollutants that are damaging the environment.

Will rebate offers be honoured, regardless of whether the product qualifies under the new or old criteria?

Some provinces and utilities may pay rebates for products that qualify under the old ENERGY STAR criteria and were purchased after January 1, 2007, but others may not. The best strategy is to check directly with the organization offering the rebate to make sure a specific model is eligible for the rebate before you buy it.

Are the ENERGY STAR criteria for these products the same in Canada as in the United States?

Yes. The ENERGY STAR criteria are the same in Canada and the United States for these products. The ENERGY STAR name and the ENERGY STAR symbol are registered trademarks of the United States Environmental Protection Agency (EPA), which establishes the criteria for different products. ENERGY STAR in Canada is administered by NRCan through an agreement with the EPA. Due to the high level of integration in the North American equipment market, Canada and the United States also strive to harmonize their regulated minimum energy efficiency standards, which facilitates having the same ENERGY STAR criteria in both countries.

Can we expect more changes in the future?

Canada and the United States are continually updating their minimum energy performance standards for major household appliances to help transform the market to increased energy efficiency. As new standards are implemented from time to time, the criteria for ENERGY STAR qualification will also be updated.

APPENDIX D
DETAILED TABLES

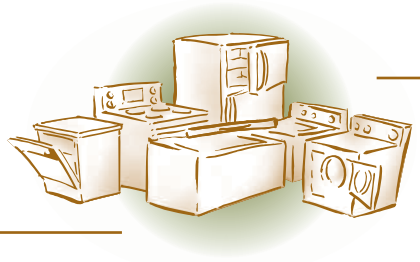


TABLE D.A.1
ENERGY STAR® Qualified Appliances as a Percentage of Total Shipments in Canada, 1999–2005

Appliance	1999 (%)	2000 (%)	2001 (%)	2002 (%)	2003 (%)	2004 (%)	2005 (%)
Dishwashers	0.6	1.6	9.7	29.8	56.5	81.0	90.8
Clothes Washers	1.9	2.2	9.2	22.1	30.6	36.2	45.9
Refrigerators	–	–	11.4	22.3	40.7	34.2	37.6

TABLE D.A.2
ENERGY STAR Qualified Appliances as a Percentage of Total Shipments by Region/Province, 2004 and 2005

Region/Province	Dishwashers		Clothes Washers		Refrigerators	
	2004 (%)	2005	2004 (%)	2005	2004 (%)	2005
Canada	81.0	90.8	36.2	45.9	34.2	37.6
Atlantic	75.4	88.4	–	–	23.3	21.3
Quebec	81.3	92.9	29.9	41.7	36.9	37.2
Ontario	83.3	90.8	37.6	50.1	38.6	39.9
Prairies	78.4	90.3	36.2	48.2	33.0	40.6
British Columbia and Territories	79.5	87.9	36.4	50.3	29.3	30.4

TABLE D.1
Average Annual Unit Energy Consumption of Refrigerators by Model Year

Model Year	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 11	Type 12	Type 13	Type 14	Type 15	Total
						(kWh/yr)							
1990	706.2	720.0	947.4	1321.4	1128.4	–	–	337.0	–	370.0	–	–	956.2
1991	685.0	636.0	923.2	1218.8	1140.0	–	1162.9	337.0	–	370.0	–	–	931.2
1992	696.5	464.8	873.5	1215.1	1160.4	–	1175.5	337.0	–	370.0	507.0	–	901.7
1993	512.4	477.4	702.4	889.3	782.5	772.2	953.2	337.0	–	370.0	–	–	719.6
1994	461.8	465.0	640.5	764.0	741.8	763.4	891.5	328.7	–	370.0	–	–	650.4
1995	382.7	465.0	630.8	786.6	752.6	743.4	865.6	330.6	–	370.0	–	–	641.6
1996	378.4	465.0	620.8	767.7	776.9	781.2	833.7	318.1	–	370.0	–	–	640.4
1997	397.2	465.0	635.0	773.7	631.1	818.9	860.6	317.0	–	370.0	–	–	656.5
1998	422.3	478.2	640.9	792.3	673.2	839.9	870.0	320.8	419.0	432.1	–	–	653.5
1999	403.7	–	635.9	798.7	665.1	771.6	870.9	322.4	419.0	430.0	–	–	645.5
2000	413.2	–	629.3	781.1	660.9	742.9	862.8	323.4	419.0	430.0	–	–	639.5
2001	403.0	–	544.1	701.2	610.2	707.2	725.9	330.6	419.0	430.0	–	–	559.4
2002	323.5	–	485.6	646.9	547.0	604.1	659.2	331.1	419.0	405.0	–	–	506.3
2003	321.0	–	460.8	625.2	522.4	553.5	636.7	323.1	419.0	326.7	–	463.0	487.1
2004	–	–	458.4	582.6	496.0	554.0	619.8	321.3	419.0	356.7	–	–	477.7
2005	321.0	–	453.8	566.0	493.2	550.8	611.2	327.8	419.0	406.6	–	–	469.2

TABLE D.2
Distribution of Refrigerators by Type, by Region/Province, 2004 and 2005

Region/Province	Type 3		Type 5		Type 7		Type 11		Types 1, 2, 4, 6, 12, 13	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)	
Canada	66.4	64.9	15.5	17.9	11.0	9.6	4.5	6.3	2.5	1.3
Atlantic	83.2	81.3	6.4	8.0	8.0	7.6	1.1	2.7	1.3	0.3
Quebec	69.5	68.9	18.8	20.9	6.1	4.9	3.2	7.0	3.3	1.5
Ontario	64.5	62.6	14.6	17.7	13.8	11.2	3.9	7.0	3.3	1.5
Prairies	69.2	65.5	13.6	17.6	14.4	12.3	0.5	3.1	2.3	1.5
British Columbia and Territories	59.6	56.5	13.6	15.6	13.2	11.3	11.0	16.0	2.7	0.6

TABLE D.3
Distribution of Refrigerators by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	18.6	17.0	81.4	83.0
Atlantic	19.1	15.8	80.9	84.2
Quebec	6.3	5.6	93.7	94.4
Ontario	22.5	19.9	77.5	80.1
Prairies	20.8	19.1	79.2	80.9
British Colombia and Territories	36.1	32.3	63.9	67.7

TABLE D.4
Distribution of Refrigerators by Volume, by Region/Province, 2004 and 2005

Region/Province	<10.5 cu. ft.		10.5–12.4 cu. ft.		12.5–14.4 cu. ft.		14.5–16.4 cu. ft.		16.5–18.4 cu. ft.		18.5–20.4 cu. ft.		>20.5 cu. ft.	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Canada	4.3	6.9	2.6	2.5	3.6	2.3	11.7	9.7	39.5	41.7	14.0	15.2	24.2	21.7
Atlantic	1.9	3.8	6.4	7.4	7.8	7.9	21.4	13.9	40.3	47.1	9.4	8.3	12.9	11.5
Quebec	4.3	4.8	2.0	1.8	2.8	2.1	8.0	6.6	48.9	49.6	17.3	19.3	16.7	15.7
Ontario	4.4	7.5	1.3	1.6	4.7	2.7	14.8	12.8	34.6	37.9	12.9	14.1	27.3	23.3
Prairies	0.6	3.7	2.8	2.4	3.0	1.6	10.5	8.7	40.8	42.1	12.7	13.9	29.6	27.7
British Columbia and Territories	12.7	17.3	7.6	6.2	0.8	0.6	9.3	6.3	29.1	32.4	13.8	13.7	26.7	23.5

TABLE D.5
Distribution of Refrigerators for Retail Shipments by Volume, by Region/Province, 2004 and 2005

Region/Province	<10.5 cu. ft.		10.5–12.4 cu. ft.		12.5–14.4 cu. ft.		14.5–16.4 cu. ft.		16.5–18.4 cu. ft.		18.5–20.4 cu. ft.		>20.5 cu. ft.	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Canada	6.7	7.9	1.5	1.1	2.2	1.4	8.2	6.6	39.9	42.3	16.5	17.5	25.0	23.0
Atlantic	1.2	4.3	3.1	3.9	6.5	5.4	22.0	14.3	41.7	50.4	10.9	9.2	14.7	12.5
Quebec	4.5	4.7	0.6	0.7	2.5	1.9	7.0	5.7	49.5	50.4	18.4	20.4	17.5	16.4
Ontario	5.7	9.1	0.4	1.1	1.8	0.9	9.1	6.7	35.7	38.7	15.3	17.0	32.0	26.7
Prairies	0.7	4.1	0.9	0.7	3.1	1.4	8.9	6.8	39.7	41.4	15.4	16.6	31.2	29.0
British Columbia and Territories	19.4	24.7	2.8	3.0	0.7	0.9	10.3	5.9	24.2	28.2	17.2	15.6	25.4	21.7

TABLE D.6
Distribution of Refrigerators for Builder Shipments by Volume, by Region/Province, 2004 and 2005

Region/Province	<10.5 cu. ft.		10.5–12.4 cu. ft.		12.5–14.4 cu. ft.		14.5–16.4 cu. ft.		16.5–18.4 cu. ft.		18.5–20.4 cu. ft.		>20.5 cu. ft.	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Canada	0.5	2.0	10.2	9.2	8.7	6.5	23.8	24.4	36.3	38.5	4.1	4.0	16.4	15.4
Atlantic	4.9	2.6	20.2	26.1	13.2	21.1	18.9	11.8	34.6	28.9	3.2	3.3	5.1	6.3
Quebec	0.3	7.2	23.4	21.1	7.6	7.0	22.2	22.0	40.2	37.1	0.7	1.1	5.5	4.7
Ontario	0.1	1.3	4.5	3.7	14.7	10.1	34.5	37.5	30.8	35.0	4.6	2.8	10.9	9.7
Prairies	0.3	1.8	9.9	9.7	2.7	2.4	17.0	16.4	44.8	45.1	1.9	2.6	23.4	21.9
British Columbia and Territories	0.8	1.7	16.2	12.9	0.9	0.4	7.6	7.1	37.9	41.2	7.6	9.7	29.0	27.1

TABLE D.7
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004 and 2005

Region/Province	<30 kWh/cu. ft. per year		30–39.9 kWh/cu. ft. per year		40–49.9 kWh/cu. ft. per year		50–59.9 kWh/cu. ft. per year		>60 kWh/cu. ft. per year	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)	
Canada	82.6	86.7	11.0	6.5	1.3	0.2	0.2	0.2	5.0	6.4
Atlantic	83.3	80.5	11.9	16.1	3.7	0.3	0.0	0.3	1.1	2.9
Quebec	86.1	89.3	9.2	6.1	0.9	0.1	0.0	0.1	3.7	4.3
Ontario	84.1	87.1	10.7	5.4	0.8	0.1	0.0	0.2	4.4	7.2
Prairies	82.5	90.0	14.9	6.5	1.6	0.1	0.0	0.1	1.1	3.3
British Columbia and Territories	72.6	74.4	13.5	7.8	1.6	0.6	0.0	0.8	12.3	16.4

TABLE D.8
Average Annual Unit Energy Consumption of Refrigerators by Volume

Model Year	cu. ft. 0–2.4	2.5–4.4	4.5–6.4	6.5–8.4	8.5–10.4	10.5–12.4	12.5–14.4	14.5–16.4	16.5–18.4	18.5–20.4	20.5–22.4	22.5–24.4	24.5–26.4	26.5–28.4	28.5–30.4	30.5–32.4
	(kWh/yr)															
1990	–	–	367	–	716	740	850	955	1067	1133	1041	1478	1416	–	–	–
1991	–	–	366	–	658	727	877	915	1018	978	950	1481	1371	–	–	–
1992	–	–	367	465	478	697	750	924	940	998	1047	1269	1400	1486	–	–
1993	–	–	367	465	440	593	600	700	731	799	848	939	1004	1228	1110	–
1994	308	336	365	465	407	563	547	627	665	720	805	906	856	1206	1105	–
1995	308	336	364	465	383	554	540	626	662	715	775	872	829	1123	977	–
1996	304	330	364	461	385	547	570	631	646	680	731	894	885	1051	1070	–
1997	299	315	338	440	400	548	567	632	664	695	716	924	901	923	1092	–
1998	299	322	436	385	415	564	562	629	675	703	722	853	883	860	983	–
1999	287	324	430	483	500	552	575	629	666	667	723	833	900	844	977	–
2000	283	325	430	503	521	550	583	625	667	637	696	809	894	820	976	–
2001	281	333	430	503	521	502	493	562	582	534	594	689	749	698	919	–
2002	278	333	405	502	421	433	428	480	521	489	543	664	677	669	839	710
2003	299	325	348	–	420	429	424	449	475	496	535	660	641	662	660	744
2004	366	323	390	–	424	432	420	455	465	487	518	644	609	654	627	639
2005	348	328	343	356	421	412	425	415	468	477	508	614	601	638	628	640

TABLE D.9
Average Annual Unit Energy Consumption per Cubic Foot of Refrigerators by Volume

Model Year	4.5–6.4	6.5–8.4	8.5–10.4	10.5–12.4	12.5–14.4	14.5–16.4	16.5–18.4	18.5–20.4	20.5–22.4	22.5–24.4	24.5–26.4	26.5–28.4	28.5–30.4	30.5–32.4
							cu. ft. (kWh/yr)							
1990	67	–	76	65	63	62	61	58	49	63	56	–	–	–
1991	67	–	70	64	65	59	58	50	44	63	54	–	–	–
1992	67	62	51	61	56	60	54	51	49	54	55	54	–	–
1993	67	62	47	52	45	45	42	41	40	40	39	45	38	–
1994	67	62	43	49	41	41	38	37	38	39	34	44	38	–
1995	67	62	41	48	40	41	38	37	36	37	33	41	33	–
1996	67	62	41	48	42	41	37	35	34	38	35	38	36	–
1997	62	59	42	48	42	41	38	36	33	39	35	34	37	–
1998	80	52	44	49	42	41	39	36	34	36	35	31	33	–
1999	79	65	53	48	43	41	38	34	34	36	35	31	33	–
2000	79	67	55	48	43	40	38	33	32	35	35	30	33	–
2001	79	68	55	44	37	36	33	27	28	29	29	25	31	–
2002	74	67	45	38	32	31	30	25	25	28	27	24	28	23
2003	64	–	44	38	32	29	27	26	25	28	25	24	22	24
2004	72	–	45	38	31	29	27	25	24	27	24	24	21	20
2005	63	48	45	36	32	27	27	25	24	26	24	23	21	20

TABLE D.10
Average Annual Unit Energy Consumption of Refrigerators by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	464.3	457.2	480.7	471.7
Atlantic	463.8	436.8	477.8	468.4
Quebec	455.6	437.5	471.7	468.0
Ontario	451.9	444.1	489.0	475.0
Prairies	477.8	475.1	497.1	480.8
British Columbia and Territories	483.3	479.0	469.2	450.8

TABLE D.11
Distribution of Refrigerators Consuming Less Than 30 kWh/cu. ft. per Year, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	81.4	83.8	82.8	87.3
Atlantic	71.9	61.3	86.0	84.2
Quebec	69.3	63.4	87.2	90.8
Ontario	84.0	88.9	84.2	86.6
Prairies	84.8	85.4	85.7	91.1
British Columbia and Territories	78.8	83.7	69.1	70.0

TABLE D.12
Annual Energy Savings for Refrigerators, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements, the MEPS and Improvements to theMEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements, the MEPS and Improvements to the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	1.22	1.22	0.00	0.00
1993	1.59	1.27	0.32	0.32
1994	1.80	1.30	0.50	0.82
1995	1.77	1.26	0.51	1.33
1996	1.80	1.28	0.52	1.86
1997	1.96	1.43	0.53	2.39
1998	2.24	1.63	0.62	3.01
1999	2.58	1.84	0.73	3.74
2000	2.51	1.78	0.73	4.47
2001	2.63	1.63	1.00	5.47
2002	2.88	1.62	1.26	6.74
2003	2.93	1.59	1.35	8.09
2004	3.23	1.72	1.51	9.58
2005	3.36	1.75	1.61	11.13

TABLE D.13
Distribution of Freezers by Type, by Region/Province, 2004 and 2005

Region/Province	Type 8		Type 9		Type 10		Type 18	
	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)	
Canada	29.4	30.4	8.3	10.7	45.5	35.7	16.8	23.2
Atlantic	19.8	20.8	10.2	8.2	38.0	37.0	32.0	34.1
Quebec	41.3	41.1	5.6	6.0	22.7	21.9	30.4	31.0
Ontario	28.2	26.7	17.8	13.4	18.9	19.9	35.1	39.8
Prairies	31.7	27.9	12.6	12.1	25.9	23.3	29.8	36.7
British Columbia and Territories	30.0	28.8	15.0	14.6	30.8	28.5	24.1	28.1

TABLE D.14
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004 and 2005

Region/Province	20–29.9 kWh/cu. ft. per year		30–39.9 kWh/cu. ft. per year		40–49.9 kWh/cu. ft. per year		50–59.9 kWh/cu. ft. per year	
	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)	
Canada	28.9	29.5	48.8	45.2	22.3	25.3	0.1	0.0
Atlantic	34.3	36.4	46.0	47.6	19.3	16.0	0.3	0.0
Quebec	27.9	29.9	51.3	48.7	20.7	21.4	0.1	0.0
Ontario	22.2	24.5	51.1	44.3	26.6	31.1	0.1	0.0
Prairies	33.2	31.9	47.3	45.6	19.5	22.5	0.0	0.0
British Columbia and Territories	36.7	37.5	40.6	35.4	22.6	27.0	0.1	0.0

TABLE D.15
Distribution of Freezers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	1.8	2.1	98.2	97.9
Atlantic	0.9	1.6	99.1	98.4
Quebec	0.9	0.7	99.1	99.3
Ontario	0.5	0.4	99.5	99.6
Prairies	5.0	4.4	95.0	95.6
British Columbia and Territories	15.5	18.6	84.5	81.4

TABLE D.16
Average Annual Unit Energy Consumption of Freezers by Model Year

Model Year	Type 8	Type 9	Type 10 (kWh/yr)	Type 18	Total
1990	992.1	–	657.7	–	713.8
1991	706.4	1068.0	406.8	–	444.7
1992	670.4	1078.0	413.8	–	449.3
1993	581.3	863.3	368.2	–	401.7
1994	535.9	846.1	363.9	–	389.2
1995	508.9	817.1	353.2	–	381.6
1996	502.9	820.7	344.0	–	376.7
1997	494.8	823.7	341.9	–	376.5
1998	496.0	829.6	339.5	–	381.5
1999	492.1	838.6	337.5	–	383.4
2000	487.8	839.4	337.4	–	390.9
2001	447.6	740.5	336.7	258.3	383.9
2002	412.7	674.2	316.7	267.7	367.7
2003	414.8	665.4	317.8	268.3	369.1
2004	412.0	595.9	344.1	271.1	372.7
2005	420.8	650.1	351.8	269.1	385.6

TABLE D.17
Average Annual Unit Energy Consumption of Freezers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	426.7	437.3	371.7	384.5
Atlantic	457.0	429.5	381.3	373.2
Quebec	398.2	378.2	380.0	383.8
Ontario	397.9	404.9	398.4	379.8
Prairies	408.9	431.9	400.1	387.1
British Columbia and Territories	447.7	450.2	415.9	406.7

TABLE D.18
Annual Energy Savings for Freezers, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements, the MEPS and Improvements to the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements, the MEPS and Improvements to the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	0.36	0.36	0.00	0.00
1993	0.38	0.34	0.04	0.04
1994	0.37	0.32	0.05	0.09
1995	0.32	0.28	0.05	0.14
1996	0.28	0.24	0.05	0.18
1997	0.31	0.26	0.05	0.23
1998	0.38	0.32	0.06	0.29
1999	0.40	0.34	0.06	0.35
2000	0.37	0.33	0.05	0.40
2001	0.38	0.32	0.06	0.45
2002	0.41	0.34	0.07	0.53
2003	0.40	0.33	0.07	0.60
2004	0.45	0.37	0.08	0.68
2005	0.43	0.37	0.06	0.74

TABLE D.19
Distribution of Dishwashers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005

Region/Province	300–349.9 kWh/yr		350–399.9 kWh/yr		400–499.9 kWh/yr		500–599.9 kWh/yr		600–699.9 kWh/yr	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)	
Canada	4.0	19.6	24.3	55.5	46.4	15.5	16.5	6.4	8.8	3.0
Atlantic	9.0	25.5	21.3	48.0	37.6	15.3	17.6	3.6	14.5	7.5
Quebec	4.0	21.9	28.0	59.7	43.0	11.9	17.7	4.7	7.5	1.8
Ontario	4.6	20.5	22.7	54.0	48.5	15.2	16.4	8.0	7.8	2.2
Prairies	2.7	15.2	23.5	59.2	48.5	16.9	15.5	5.0	9.8	3.8
British Columbia and Territories	3.4	20.0	24.1	44.7	45.6	21.6	16.1	8.7	10.9	4.9

TABLE D.20
Distribution of Dishwashers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	14.3	14.7	85.7	85.3
Atlantic	15.3	11.6	84.7	88.4
Quebec	3.0	2.9	97.0	97.1
Ontario	15.1	15.1	84.9	84.9
Prairies	16.7	16.8	83.3	83.2
British Colombia and Territories	32.3	35.9	67.7	64.1

TABLE D.21
Average Annual Unit Energy Consumption of Dishwashers by Model Year

Model Year	kWh/yr
1990	1025.7
1991	959.0
1992	908.0
1993	913.5
1994	776.7
1995	670.9
1996	668.2
1997	649.2
1998	646.7
1999	640.1
2000	637.4
2001	633.7
2002	592.0
2003	523.9
2004	456.8
2005	395.7

TABLE D.22
Annual Unit Energy Consumption of Dishwashers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	443.0	404.0	459.1	394.2
Atlantic	454.4	391.2	469.4	402.9
Quebec	449.2	417.0	454.3	386.5
Ontario	447.0	408.9	454.7	392.6
Prairies	442.1	396.4	465.2	399.3
British Colombia and Territories	434.6	404.2	472.6	408.4

TABLE D.23
Annual Energy Savings for Dishwashers, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements and the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	0.85	0.85	0.00	0.00
1993	0.89	0.90	-0.01	-0.01
1994	1.06	0.90	0.15	0.15
1995	1.04	0.77	0.27	0.42
1996	1.14	0.84	0.30	0.72
1997	1.18	0.84	0.34	1.06
1998	1.21	0.87	0.35	1.41
1999	1.45	1.02	0.43	1.84
2000	1.45	1.01	0.43	2.27
2001	1.45	1.01	0.44	2.71
2002	1.75	1.14	0.61	3.31
2003	1.81	1.04	0.77	4.05
2004	1.95	0.98	0.97	4.96
2005	2.07	0.90	1.17	6.03

TABLE D.24
Distribution of Electric Ranges by Type, by Region/Province, 2004 and 2005

Region/Province	Non-Self-Cleaning 2004 (%)	Non-Self-Cleaning 2005 (%)	Self-Cleaning 2004 (%)	Self-Cleaning 2005 (%)
Canada	42.3	41.2	57.7	58.8
Atlantic	53.7	51.7	46.3	48.3
Quebec	40.4	37.6	59.6	62.4
Ontario	44.3	46.1	55.7	53.9
Prairies	39.7	36.5	60.3	63.5
British Colombia and Territories	40.7	38.6	59.3	61.4

TABLE D.25
Distribution of Electric Ranges by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005

Region/ Province	<500 kWh/yr		500–599.9 kWh/yr		600–649.9 kWh/yr		650–699.9 kWh/yr		700–749.9 kWh/yr		750–799.9 kWh/yr		800–849.9 kWh/yr	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)		(%)		(%)		(%)	
Canada	27.8	44.9	13.3	26.2	4.8	4.6	3.8	2.6	18.8	8.1	19.5	7.8	12.0	5.9
Atlantic	18.4	36.8	14.6	29.8	2.3	2.8	3.3	2.5	14.9	7.2	24.6	10.8	22.0	10.1
Quebec	30.9	43.7	15.0	26.1	4.1	6.1	4.1	3.0	18.1	8.5	16.0	4.5	11.8	8.0
Ontario	25.9	45.6	12.3	26.1	5.0	3.9	4.6	3.0	17.8	7.1	21.7	9.8	12.7	4.6
Prairies	32.3	48.4	14.7	27.1	5.0	3.7	2.3	1.4	18.8	7.3	17.8	7.6	9.1	4.6
British Columbia and Territories	19.3	42.6	7.1	22.6	6.8	5.4	3.0	2.2	28.6	13.3	23.6	9.0	11.6	5.0

TABLE D.26
Distribution of Electric Ranges by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	21.5	22.1	78.5	77.9
Atlantic	19.5	17.3	80.5	82.7
Quebec	6.6	6.5	93.4	93.5
Ontario	28.2	29.1	71.8	70.9
Prairies	22.6	23.6	77.4	76.4
British Columbia and Territories	42.8	43.5	57.2	56.5

TABLE D.27
Average Annual Unit Energy Consumption of Electric Ranges by Model Year

Model Year	Non-Self-Cleaning	Self-Cleaning	Total
	(kWh/yr)		
1990	785.7	726.8	772.2
1991	787.4	755.1	778.1
1992	788.3	754.1	778.6
1993	795.2	751.5	782.1
1994	785.4	746.6	773.6
1995	778.3	756.4	771.3
1996	780.3	762.5	774.4
1997	780.2	758.5	772.4
1998	778.5	759.6	770.8
1999	770.3	741.8	758.7
2000	770.7	746.3	759.9
2001	785.7	741.2	762.5
2002	783.9	735.2	756.0
2003	732.1	691.0	709.4
2004	694.1	622.4	652.7
2005	593.2	558.0	572.5

TABLE D.28
Average Annual Unit Energy Consumption of Electric Ranges by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	730.9	604.5	631.3	563.5
Atlantic	709.5	595.3	677.8	590.0
Quebec	714.3	620.3	625.9	563.8
Ontario	739.5	612.4	634.6	560.5
Prairies	724.1	586.1	610.2	553.3
British Columbia and Territories	728.7	600.3	684.2	587.8

TABLE D.29
Annual Energy Savings for Electric Ranges, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements and the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	0.94	0.94	0.00	0.00
1993	1.13	1.14	-0.01	-0.01
1994	1.09	1.08	0.01	0.00
1995	0.96	0.95	0.01	0.01
1996	1.15	1.14	0.01	0.02
1997	1.25	1.24	0.01	0.03
1998	1.35	1.34	0.01	0.04
1999	1.39	1.36	0.04	0.08
2000	1.35	1.31	0.03	0.11
2001	1.34	1.32	0.03	0.14
2002	1.67	1.63	0.05	0.18
2003	1.81	1.65	0.16	0.35
2004	1.97	1.65	0.32	0.66
2005	1.90	1.39	0.50	1.17

TABLE D.30
Distribution of Clothes Washers by Type, by Region/Province, 2004 and 2005

Region/Province	Front-Loading Clothes Washers 2004 (%)	Front-Loading Clothes Washers 2005 (%)	Top-Loading Clothes Washers 2004 (%)	Top-Loading Clothes Washers 2005 (%)
Canada	29.2	42.3	70.8	57.7
Atlantic Quebec	22.8	36.2	77.2	63.8
Ontario	27.7	45.4	72.3	54.6
Prairies	28.9	44.9	71.1	55.1
British Colombia and Territories	30.2	48.6	69.8	51.4

TABLE D.31
Distribution of Clothes Washers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005

Region/ Province	<500 kWh/yr 2004 (%)	<500 kWh/yr 2005 (%)	500–599.9 kWh/yr 2004 (%)	500–599.9 kWh/yr 2005 (%)	600–699.9 kWh/yr 2004 (%)	600–699.9 kWh/yr 2005 (%)	700–799.9 kWh/yr 2004 (%)	700–799.9 kWh/yr 2005 (%)	800–899.9 kWh/yr 2004 (%)	800–899.9 kWh/yr 2005 (%)	900–999.9 kWh/yr 2004 (%)	900–999.9 kWh/yr 2005 (%)	>1000 kWh/yr 2004 (%)	>1000 kWh/yr 2005 (%)
Canada	38.2	51.7	16.6	28.3	10.0	7.8	8.3	4.4	10.2	2.4	16.7	5.5	0.0	0.0
Atlantic and Quebec	29.2	44.8	19.9	35.3	8.5	6.6	8.7	4.9	11.6	3.1	22.1	5.3	0.0	0.0
Ontario	40.7	56.8	16.5	23.5	11.6	8.3	6.9	4.1	9.9	1.9	14.3	5.5	0.0	0.0
Prairies	38.0	52.9	16.5	28.1	10.0	7.4	9.1	4.4	12.0	2.2	14.3	4.9	0.0	0.0
British Columbia and Territories	38.8	55.8	11.0	17.9	16.8	12.1	7.4	3.9	5.7	1.7	20.3	8.6	0.0	0.0

TABLE D.32
Distribution of Clothes Washers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	5.8	5.7	94.2	94.3
Atlantic and Quebec	2.0	1.9	98.0	98.1
Ontario	6.4	5.6	93.6	94.4
Prairies	8.5	8.1	91.5	91.9
British Columbia and Territories	18.5	16.7	81.5	83.3

TABLE D.33
Average Annual Unit Energy Consumption of Clothes Washers by Model Year

Model Year	Front-Loading Clothes Washers	Top-Loading Clothes Washers	Total
	(kWh/yr)		
1990	_	_	1218.0
1991	_	_	1197.4
1992	_	_	1175.5
1993	_	_	1094.1
1994	_	_	989.1
1995	_	_	965.9
1996	_	_	948.7
1997	_	_	930.1
1998	_	_	903.3
1999	_	_	859.9
2000	274.2	922.7	838.3
2001	287.0	904.7	810.1
2002	300.6	871.1	779.2
2003	274.8	826.9	708.4
2004	258.4	702.3	572.9
2005	218.8	608.8	443.6

TABLE D.34
Average Annual Unit Energy Consumption of Clothes Washers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	653.0	529.9	568.0	438.4
Atlantic and Quebec	651.1	513.7	629.0	469.8
Ontario	641.0	510.4	550.7	420.7
Prairies	706.3	588.9	556.0	419.1
British Columbia and Territories	590.7	475.6	585.3	428.3

TABLE D.35
Annual Energy Savings for Clothes Washers, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements and the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	1.70	1.70	0.00	0.00
1993	1.80	1.67	0.12	0.12
1994	1.94	1.64	0.31	0.43
1995	1.84	1.51	0.33	0.76
1996	1.93	1.56	0.37	1.13
1997	2.14	1.69	0.45	1.58
1998	2.16	1.66	0.50	2.08
1999	2.43	1.78	0.65	2.73
2000	2.50	1.78	0.72	3.45
2001	2.60	1.79	0.81	4.26
2002	2.81	1.87	0.95	5.20
2003	2.92	1.76	1.16	6.32
2004	3.10	1.51	1.59	7.84
2005	3.31	1.25	2.06	9.79

TABLE D.36
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption, by Region/Province, 2004 and 2005

Region/Province	<800 kWh/yr		800–899.9 kWh/yr		900–949.9 kWh/yr		950–999.9 kWh/yr	
	2004	2005	2004	2005	2004	2005	2004	2005
	(%)		(%)		(%)		(%)	
Canada	4.0	6.1	4.4	3.2	75.3	74.1	16.3	16.6
Atlantic and Quebec	1.8	3.7	3.6	2.6	82.1	81.0	12.4	12.7
Ontario	5.9	7.9	6.3	4.7	69.7	69.9	18.1	17.5
Prairies	2.8	4.6	3.4	2.1	74.8	72.9	19.0	20.4
British Columbia and Territories	9.4	14.8	5.5	3.3	65.1	64.6	19.9	17.4

TABLE D.37
Distribution of Electric Clothes Dryers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(%)		(%)	
Canada	6.3	6.1	93.7	93.9
Atlantic and Quebec	2.0	1.9	98.0	98.1
Ontario	7.2	6.4	92.8	93.6
Prairies	8.9	8.5	91.1	91.5
British Columbia and Territories	18.9	17.3	81.1	82.7

TABLE D.38
Average Annual Unit Energy Consumption of Electric Clothes Dryers by Model Year

Model Year	kWh/yr
1990	1102.6
1991	1108.7
1992	983.3
1993	928.5
1994	910.4
1995	909.1
1996	887.4
1997	887.3
1998	900.2
1999	907.5
2000	909.8
2001	916.3
2002	915.6
2003	914.2
2004	911.9
2005	903.8

TABLE D.39
Average Annual Unit Energy Consumption of Electric Clothes Dryers by Channel, by Region/Province, 2004 and 2005

Region/Province	Builder		Retail	
	2004	2005	2004	2005
	(kWh/yr)		(kWh/yr)	
Canada	843.1	832.2	916.5	908.5
Atlantic and Quebec	836.2	827.3	924.1	917.0
Ontario	817.1	796.4	907.7	900.5
Prairies	870.1	865.3	923.6	918.0
British Columbia and Territories	851.3	838.9	892.1	865.2

TABLE D.40
Annual Energy Savings for Electric Clothes Dryers, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements and the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	1.23	1.23	0.00	0.00
1993	1.27	1.20	0.07	0.07
1994	1.31	1.21	0.10	0.17
1995	1.15	1.07	0.09	0.25
1996	1.27	1.15	0.12	0.38
1997	1.39	1.26	0.14	0.51
1998	1.41	1.29	0.12	0.63
1999	1.59	1.47	0.12	0.76
2000	1.64	1.52	0.12	0.88
2001	1.73	1.62	0.12	1.00
2002	1.96	1.82	0.13	1.13
2003	2.02	1.88	0.14	1.27
2004	2.18	2.02	0.16	1.43
2005	2.36	2.17	0.19	1.62

TABLE D.41
Annual Energy Savings for All Major Appliances, 1992–2005

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS (PJ)	Energy Consumed WITH Manufacturers' Improvements and the MEPS (PJ)	Annual Energy Savings (PJ)	Cumulative Energy Savings (with retirement factor) (PJ)
1992	6.30	6.30	0.00	0.00
1993	7.05	6.51	0.55	0.55
1994	7.57	6.45	1.12	1.66
1995	7.09	5.84	1.26	2.92
1996	7.58	6.21	1.37	4.29
1997	8.23	6.72	1.51	5.80
1998	8.75	7.10	1.66	7.46
1999	9.84	7.81	2.03	9.49
2000	9.81	7.73	2.08	11.57
2001	10.15	7.70	2.45	14.02
2002	11.49	8.41	3.08	17.09
2003	11.90	8.25	3.65	20.68
2004	12.88	8.25	4.63	25.16
2005	13.43	7.83	5.60	30.48