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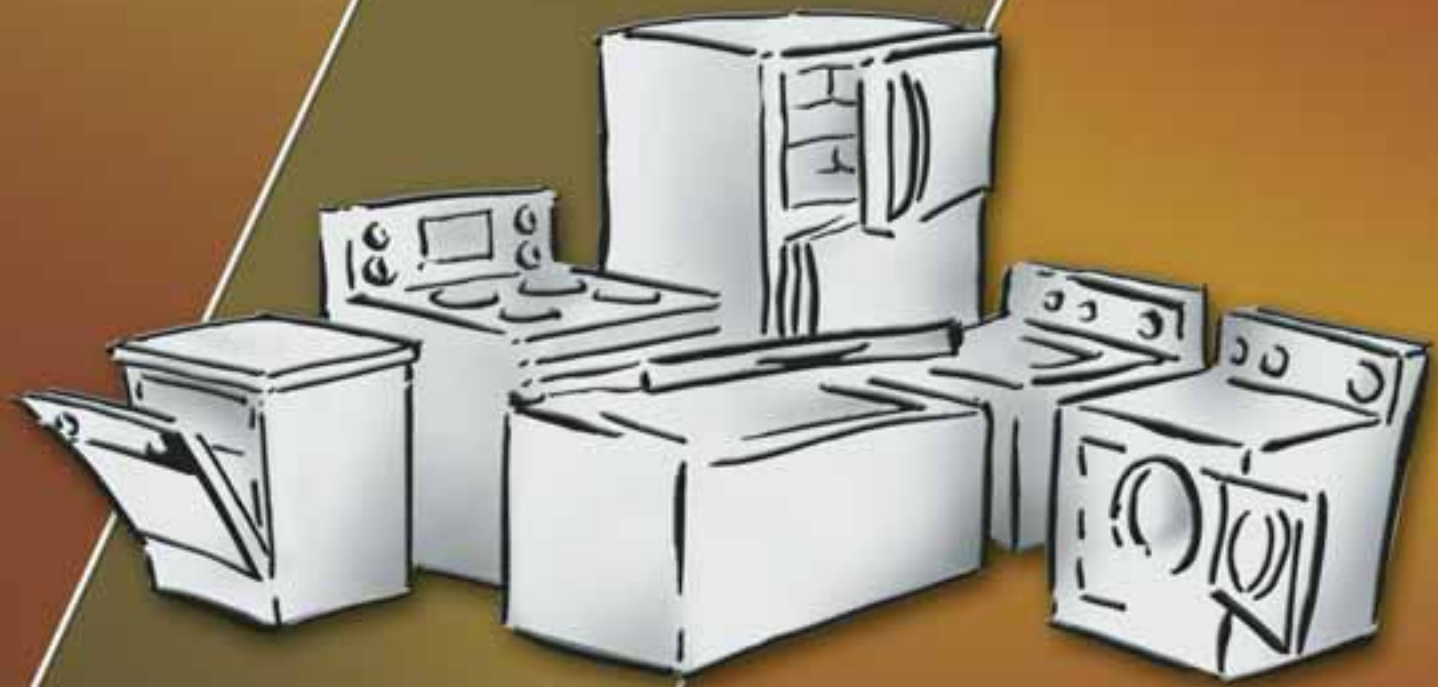
Energy Consumption of Major Household Appliances Shipped in Canada

Trends for 1990-2004

December 2006



Canada

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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 (NEUD) initiative, Natural Resources Canada'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, electric ranges, dishwashers, clothes washers and electric clothes dryers. According to CAMA, these manufacturers represent well over 90 percent of the Canadian market for five of the appliance groups.[1]

Each model's shipments, provided by CAMA, were matched to their associated unit energy consumption (UEC) ratings found in the *EnerGuide Appliance Directory* database (http://oee.nrcan.gc.ca/Publications/infosource/Pub/appliances/index.cfm?attr=4). The annual shipment-weighted average UEC was then calculated for each appliance category. This report details the results of the analysis on the estimated shipment-weighted average UEC, in kilowatt hours per year, of the six major household appliance categories shipped in Canada between 1990 and 2004. 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 fifth in the series of such reports[2] published by the OEE. Readers may observe differences between this report and previous reports. The differences are due to updates, changes in the number of data contributors, new appliance categories/types and a change in the methodology (described later in the report). Also, participating manufacturers have now provided their shipment data broken down by region/province and by channel (retail versus builder), allowing regional analysis for the first time, thereby assisting in monitoring the success of regional programs. For the first report, there were only four data contributors; for this report, there are eight. The OEE plans to publish updated reports at regular intervals. 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 our knowledge of the various aspects of energy consumption with respect to appliances. The data will also enable Natural Resources Canada to develop and fine-tune its programs, designed to support Canadians as they seek to achieve greater energy efficiency and reduce their greenhouse gas emissions.

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

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[1] Information on 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; and the fourth report, 1990–2003 data.

FOREWORD

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HIGHLIGHTS

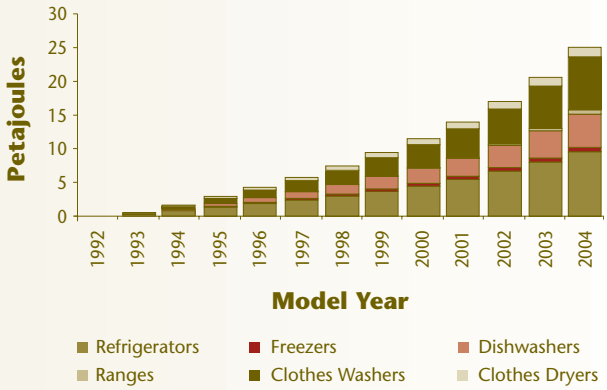
The energy efficiency of almost all major household appliances[3] on the market improved dramatically between 1990 and 2004. Electric ranges were the only exception.[4] Largely responsible for the improvement were the significant research and development activities carried out by appliance manufacturers 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. 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 which 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 2004.

- Total energy savings for the six major appliances shipped in 2004 were calculated at 4.63 PJ[6] (or 1.29 billion kilowatt hours [kWh][7]). This saved consumers an estimated $113.2 million in energy costs in 2004, based on an approximate national average of 8.8 cents/kWh.[8]

- The cumulative energy savings for all major household appliances during the period were 25.16 PJ (or 6.99 billion kWh), the equivalent of a year's energy for about 219 000 households. Dollar savings for the study period were estimated to be $615 million (based on 8.8 cents/kWh).

FIGURE 1
Cumulative Savings for All Major Household Appliances, 1992–2004



[3] Major household appliances include refrigerators, freezers, dishwashers, electric ranges, clothes washers and electric clothes dryers.

[4] There have been no technological breakthroughs in the cooking appliance categories that would affect the energy performance of electric ranges. See the comments of the Association of Home Appliance Manufacturers on the Department of Energy's rulemaking process for appliances at the following Web site: www.aham.org/industry/ht/a/GetDocumentAction/i/15686.

[5] One petajoule (PJ) (1 PJ = 1 x 10^{15} joules) is equivalent to approximately the amount of energy consumed by about 8700 households in one year – assuming each household uses 115 gigajoules (GJ) (1 GJ = 1 x 10^{9} joules) annually (according to the *Energy Use Data Handbook, 1990 and 1998 to 2004*, Ottawa: Natural Resources Canada, August 2006, pp. 22–23.) 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).

[6] 1 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: Natural Resources Canada. *Energy Use Data Handbook, 1990 and 1998 to 2004*, Ottawa, 2006, pp. 42–43. The reader should note that this is a national average.

HIGHLIGHTS

- Among major appliances, refrigerators produced the largest cumulative energy savings, 9.58 PJ (or 2.66 billion kWh) from 1992 to 2004.

- Electric ranges produced the least cumulative energy savings, 0.66 PJ (or 183.33 million kWh) over the period.

- Although this is the first report that contains analysis for retail versus builder shipments by region/province, it was found that, for all major household appliances, shipments to builders in British Columbia and the Territories were higher and those to builders in Quebec were lower than to the other regions. This finding will be further monitored in future reports.

- There were no discernable trends as to whether final retail or builder consumers were choosing more-energy-efficient appliances.

It is important to acknowledge at this point that only upon the disposal[9] of older appliances, such as the second refrigerator in the basement, will energy-efficient products continue to have a significant impact on consumers' energy bills and energy savings. 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 available are not going to be realized. According to the 2003 *Survey of Household Energy Use,*[10] approximately 765 000 Canadian households did not dispose of their previous refrigerator when they acquired a new one.

[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.

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INTRODUCTION

This report outlines changes in the energy use and distribution of major household appliances from 1990 to 2004. 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).

Readers should note that the quantity and profile of new appliances closely reflect Canadian purchases. Most retailers rely on a distribution strategy that responds quickly to consumer demand (just-in-time inventory). In fact, retailers keep inventory as low as possible. For this reason, we believe that the shipment data in this report closely reflect the purchasing behaviour of consumers.

In 2004, Statistics Canada conducted a *Survey of Household Energy Use* (SHEU-2003)[11] on behalf of the Office of Energy Efficiency (OEE) of Natural Resources Canada (NRCan). The survey collected data for 2003 on the energy and physical characteristics of private dwellings in Canada and on the household use of energy resources and, among others, the use of appliances. Some of the findings of SHEU-2003 are related to the analysis and discussions in this report.

Each chapter 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)

Finally, Chapter 7 discusses the overall energy savings achieved from improvements to these appliances.

Appendix A describes the database preparation process conducted by Electro-Federation Canada and the methodology used by the analysts to summarize the data. Specific definitions of the various types of appliances are given in Appendix B. Finally, detailed tables are provided in Appendix C.

The chapter dealing with refrigerators is more detailed than the others. Even though there is much diversity in the types and sizes of refrigerators, we have grouped them together 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, we advise readers to also look further at the analysis of refrigerators by UEC per cubic foot (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.

This latest report also includes some regional/provincial shipment data, as well as retail versus builder (channel) breakdown. Retail shipments include those by Canadian manufacturers to Canadian retailers, government agencies, utilities and other consumers. Builder shipments include those to home builders, motels, governments, trailer manufacturers and property management. Readers should be aware that this 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.

[11] Natural Resources Canada. *2003 Survey of Household Energy Use, Detailed Statistical Report*, Ottawa, 2006.

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). In 2001, Canada officially introduced the ENERGY STAR® initiative, and its international symbol for energy efficiency, for some major household appliances, to help consumers identify products that are among the most energy efficient on the market. For more information on the *Energy Efficiency Regulations*, consult the *Guide to Canada's Energy Efficiency Regulations* found on our Web site at oee.nrcan.gc.ca/regulations. For more information on ENERGY STAR qualified products, visit our Web site at energystar.gc.ca.

Note that even though the MEPS did not come into effect 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 plus U.S. regulations. Since 1992 was the baseline year used in our calculations, in order to ensure that cumulative energy savings were not over-estimated, we have included in this year's analysis a retirement factor to take into account the aging of appliances, based on the life expectancies set out in the *EnerGuide Appliance Directory*.[12] This retirement factor is further explained in the methodology section of this report (Appendix A).

As previously mentioned, largely responsible for the improvement in the energy efficiency of the major household appliances were 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 initiatives authorized under the 1992 *Energy Efficiency Act*, namely, the EnerGuide for Equipment program, and the ENERGY STAR initiative.

For more information on the OEE and its programs, visit the Web site at oee.nrcan.gc.ca.

MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS) AND THE *ENERGY EFFICIENCY REGULATIONS*[13]

Among NRCan's wide range of energy efficiency initiatives are Canada's *Energy Efficiency Regulations*, standards and labelling programs. The *Energy Efficiency Act*, which came into force in 1992, gives the Government of Canada the authority to make and enforce regulations about performance and labelling requirements for energy-using products, including major household appliances, imported into Canada or shipped across provincial or territorial borders.

Following extensive consultations with provincial/territorial governments, affected industries, utilities, environmental groups and others, the first *Energy Efficiency Regulations* came into effect in February 1995. The Regulations refer to national consensus performance standards developed by the Canadian Standards Association, which 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.

[12] Natural Resources Canada. *EnerGuide Appliance Directory 2005*, Ottawa, 2005, p. 13.

[13] Source: Natural Resources Canada. *Improving Energy Performance in Canada, Report to Parliament Under the* Energy Efficiency Act *For the Fiscal Year 2004–2005*, Gatineau, 2005, p. 9.

NRCan regularly amends the Regulations to strengthen the minimum energy performance requirements for prescribed products where the market has been transformed to a higher level of efficiency. In preparing amendments to the Regulations, NRCan analyses the impact of the proposed amendment on society, the economy and the environment. For further information on the *Energy Efficiency Regulations*, please refer to the Web site at oee.nrcan.gc.ca/regulations.

Canada's *Energy Efficiency Act* and *Energy Efficiency Regulations* support a number of labelling initiatives. They 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. Regularly conducted surveys indicate that over 50 percent of Canadians are aware of the EnerGuide label.

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. ENERGY STAR began in the United States, through its Environmental Protection Agency (EPA), and has expanded internationally. The Office of Energy Efficiency 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, joining Australia, New Zealand, Japan and Taiwan. The European Union is now also a signatory of ENERGY STAR.

ENERGY STAR®

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 MEPS increase in stringency.[14]

Refrigerators

The ENERGY STAR level for refrigerators increased in stringency in 2004. Refrigerators must be at least 15 percent more efficient than the MEPS in Canada's *Energy Efficiency Regulations* to qualify for the ENERGY STAR mark. Before 2004, the performance level was 10 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 the consumer 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 mark.

[14] Natural Resources Canada. *EnerGuide Appliance Directory 2005*, Ottawa, 2005.

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

Clothes Washers

The ENERGY STAR level for clothes washers increased in stringency in 2004. Standard-sized 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 L/kWh/cycle to qualify for the ENERGY STAR mark. This energy efficiency level was raised from the 2003 minimum of 35.68 L/kWh/cycle.

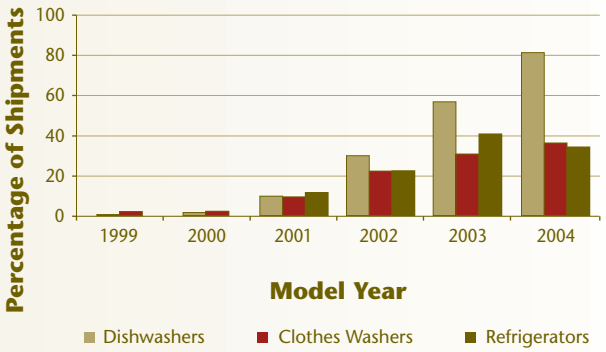
The MEF indicates that the calculation takes into account the amount of energy used by the dryer to remove moisture content. ENERGY STAR qualified clothes washers must have advanced design features that deliver cleaning performance while using less energy and 30 to 50 percent less water. The washer extracts more water from clothes during the spin cycle. This reduces the drying time and saves energy.

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

Penetration Rate[15] of ENERGY STAR Qualified Appliances

Figure 2 demonstrates the penetration rate of ENERGY STAR qualified appliances since they began appearing on the market in early 1999 (influenced by U.S. activity spilling over into Canada). In 2001, Canada officially adopted the ENERGY STAR mark to designate the most energy-efficient appliances. By 2004, 81 percent of all dishwashers, 34 percent of all refrigerators and 36 percent of all clothes washers shipped in Canada were ENERGY STAR qualified products.[16] Possible reasons for the relatively higher penetration rate of ENERGY STAR qualified dishwashers are that so many of them were made available to the consumer and that they were being offered at very affordable prices.[17]

FIGURE 2
ENERGY STAR® Qualified Appliances as a Percentage of Total Shipments in Canada, 1999–2004*



*For greater detail, see Table C.A.1.

Readers will 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. Readers should also note that the penetration rate of ENERGY STAR clothes washers does not take into account the September 1, 2004, regulatory requirement/new testing standard that removed certain clothes washer models from the ENERGY STAR listings. These changes will be reflected in the 2005 data and the next

[15] Percentage of total shipments of each appliance.

[16] These percentages are based on actual figures reported by the CAMA members to the third-party contractor referred to in our Methodology (Appendix A). They differ slightly from those reported in the *2005 Major Appliance Industry Trends and Forecast* statistical reference tool published by Electro-Federation Canada. Please refer to the section entitled "Reporting Methodology – Expansion Factors" (page 9) in that publication for further details.

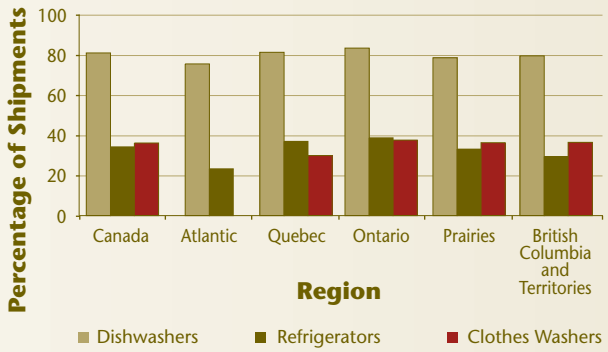
[17] Dishwasher manufacturers were able to meet the specifications a lot more quickly, and the incremental cost to meet ENERGY STAR levels was eventually eliminated. Also, the dishwasher specifications had not changed in quite some time, whereas those for refrigerators and clothes washers had. A revision to increase the stringency of the ENERGY STAR specification for dishwashers will come into effect in January 2007.

report. Since the initiative only recently included freezers, we have not included it in our analysis at this time.

Penetration Rate by Region/Province, 2004

Figure 3 shows the breakdown by region/province for each appliance category covered by the ENERGY STAR initiative in 2004 (excluding freezers). The tendencies remained quite constant throughout the country, with the penetration rate of all three ENERGY STAR appliances being slightly higher in Ontario. Please note that, for confidentiality reasons, we have not shown the rate for clothes washers for the Atlantic provinces.

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



*For greater detail, see Table C.A.2.

THE ROLE OF THE MEMBERS OF THE CANADIAN APPLIANCE MANUFACTURERS ASSOCIATION (CAMA)[18]

Canadian Appliance Manufacturers Association (CAMA) members understand the important role they must play in minimizing the effects household appliances have on the environment. Developing, producing and marketing more-energy-efficient products to aid in reducing consumer energy use and harmful greenhouse gas emissions is just one of these roles. They also acknowledge the importance of recycling and properly disposing of white goods[19] products and their packaging.

The recycling rate for end-of-life appliances in Canada is considered to be relatively high due to the number of municipal recycling initiatives available, as well as to the significant level of valuable materials that comprise most household appliances (e.g. steel, aluminum, copper, zinc, plastics). However, it is difficult to put a number to overall national or regional recovery rates because there is no national mechanism for tracking white goods recovery and recycling. As noted earlier, according to the 2003 *Survey of Household Energy Use*,[20] approximately 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 U.S. 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 the lowering of peak electricity demand, and to cost savings to consumers. The benefit to society of more-efficient appliances will continue as the existing stock of major appliances in Canadian homes is replaced.

[18] Source: Canadian Appliance Manufacturers Association, a division of Electro-Federation Canada, 5800 Explorer Drive, Suite 200, Mississauga ON L4W 5K9 (www.electrofed.com).
[19] Large, durable consumer goods usually finished in white, e.g. refrigerators, clothes washers, dryers.
[20] Natural Resources Canada. *2003 Survey of Household Energy Use, Detailed Statistical Report*, Ottawa, 2006, p. 59.

CAMA and its member companies take environmental issues very seriously and 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
- Condensers, compressors, evaporators, fan motors, door seals, foam insulation.

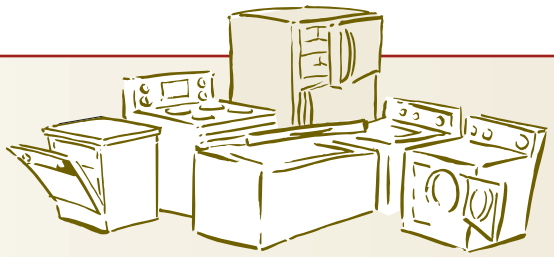
Dishwashers
- Insulation, spray arms, filtering systems, availability of an air-dry cycle.

Electric ranges
- Improvements have been limited, as conventional cooking requires high heat. Improvements in insulation and venting.

Clothes washers
- Sensors, motors, mixing valves, promotion of cold water wash, adding front-loading clothes washers to manufacturers' product lines.

Clothes dryers
- Automatic termination controls eliminating over-drying, more effective water extraction in the washing machine.

1 REFRIGERATORS



Refrigerators are available in various sizes and with a variety of different features, all of which affect energy consumption. This is why EnerGuide groups refrigerators according to type and size, enabling you to compare the energy consumption of similar models. 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, with top-mounted freezer, without through-the-door ice service and all-refrigerators[21] with automatic defrost

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

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

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

Type 7 Refrigerator-freezers with automatic defrost, with 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

TABLE 1.1
Refrigerator Market, 2004

	Market Share (%)
Type of Refrigerator	
1	0.0
2	0.0
3	66.4
4	1.9
5	15.5
6	0.1
7	11.0
11	4.5
12	0.0
13	0.5
14	0.0
15	0.0
	100.0
Through-the-Door Ice Service	11.0
Type of Freezer*	
Top-mounted	67.0
Side-mounted	12.9
Bottom-mounted	15.5
Without freezer	4.5
	100.0

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

Type 13 Compact refrigerator-freezers with automatic defrost and with top-mounted freezer as well as compact all-refrigerator models with automatic defrost

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

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

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

1.1 2004 Market Snapshot

In 2004, as in all studied years since 1990, Type 3 refrigerators (those with top-mounted freezers and automatic defrost) were by far the most popular type in Canada, accounting for 66.4 percent of all refrigerators shipped on the Canadian market. The shipment-weighted average annual unit energy consumption (UEC) of all refrigerators shipped in 2004 was 478 kilowatt hours (kWh). The most popular size category, 16.5 to 18.4 cubic feet (cu. ft.), accounted for 39 percent of the market.

As noted earlier, the ENERGY STAR® level for refrigerators increased in stringency in 2004. Over 34 percent of the refrigerator models on the market that year qualified for ENERGY STAR, exceeding the minimum energy performance standards (MEPS) by at least 15 percent. This proportion, however, is down from the previous year (40.7 percent), likely due to these more stringent specifications.

There has been a substantial improvement in the energy efficiency of refrigerators since 1990. By 2004, 82.6 percent of refrigerators consumed less than 30 kWh/cu. ft./yr., even though a trend toward larger refrigerators had emerged.

Refrigerators with a volume between 16.5 and 18.4 cu. ft. remained the most popular, on average accounting for 39.2 percent of the market in 2004. From 1990 to 2004, 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 23.5 percent. In 1990, refrigerators larger than 16.4 cu. ft. consumed on average more than 1000 kWh of electricity per year. By 2004, 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 627 kWh of electricity per year.

1.2 Distribution of Shipments

1.2.1 Distribution by Type

TABLE 1.2
Distribution of Refrigerators by Type[22]

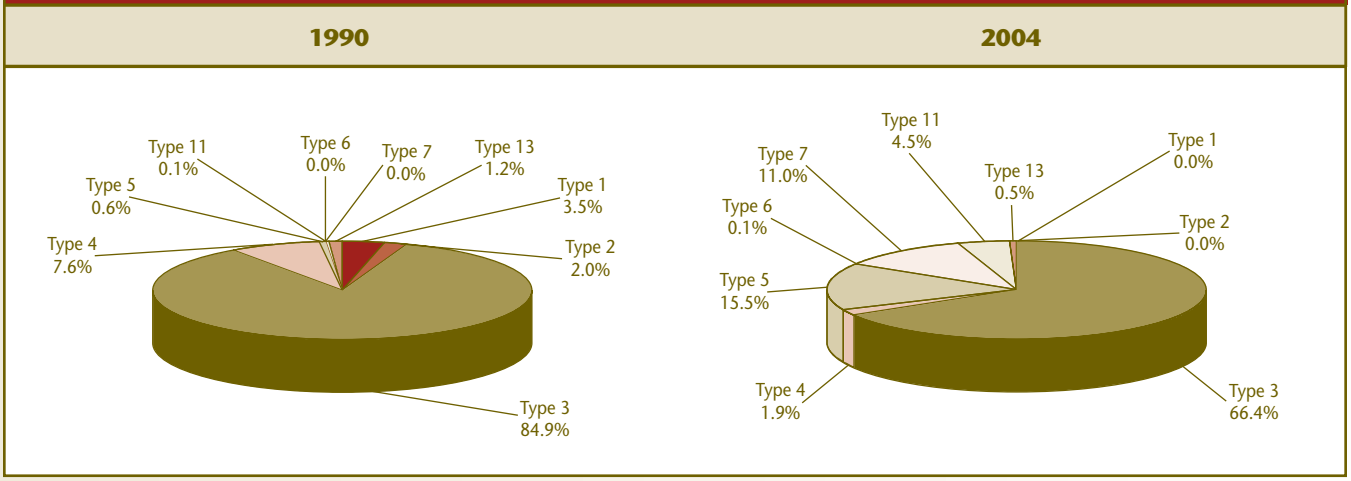
Model Year	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 11	Type 13
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1990	3.5	2.0	84.9	7.6	0.6	0.0	0.0	0.1	1.2
1991	3.1	0.3	84.3	9.0	0.8	0.0	0.3	0.3	2.0
1992	2.1	0.4	85.4	7.5	0.3	0.0	3.5	0.1	0.6
1993	1.1	0.6	85.5	6.8	0.7	0.0	4.2	0.1	0.9
1994	0.6	0.7	85.1	4.9	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
Average Annual Change	**0.2%**	**0.1%**	**1.3%**	**0.4%**	**1.1%**	**0.0%**	**0.8%**	**0.3%**	**0.1%**

Although Type 3 refrigerators were consistently the most shipped model between 1990 and 2004, their market share declined from 84.9 to 66.4 percent of all refrigerators shipped.

It would seem that there is an increasing trend towards refrigerators with bottom-mounted freezer (Type 5). They did not have a significant market share in 1990; but, with the steady increase in popularity for these refrigerators, they accounted for 15.5 percent of the market in 2004. Also, refrigerators with side-mounted freezer and through-the-door ice service (Type 7) remained quite popular, accounting for 11.0 percent of the market in 2004. Out of these two increasingly popular refrigerator types (5 and 7), Type 5 is generally more energy efficient (see Table C.7 in Appendix C). Types 1, 2, 4 and 6 had almost disappeared from the market by 2004.

[22] Data on Types 12, 14 and 15 are available, but because the values are so low, they were not included in the analysis.

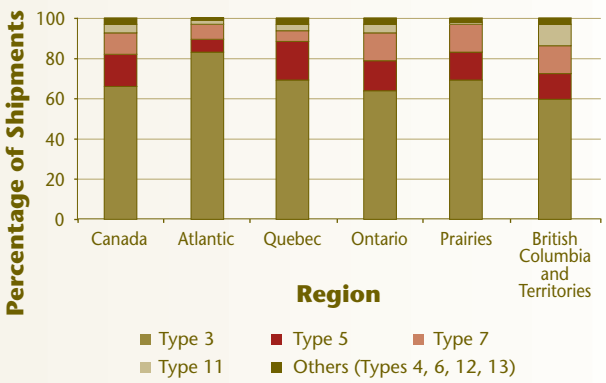
FIGURE 1.1
Distribution of Refrigerators by Type for 1990 and 2004



1.2.2 Distribution by Type, by Region/Province

As previously mentioned, Type 3 refrigerators (those with top-mounted freezers and automatic defrost) remained the most shipped model in 2004, with the national average being at 66.4 percent. Figure 1.2 illustrates the distribution of the various types of refrigerators throughout the regions/provinces. Type 3 refrigerators were most popular in the Atlantic provinces, whereas Type 5 (those with bottom-mounted freezers and automatic defrost) were more popular in Quebec (18.8 percent), Ontario and the western provinces (13 to 14 percent). Type 7 (those with side-mounted freezers, automatic defrost, and through-the-door ice service) were also more popular in Ontario and the western provinces (13 to 14 percent).

FIGURE 1.2
Distribution of Refrigerators by Type, by Region/Province, 2004*



*For greater detail, see Table C.1.

1.2.3 Distribution by Volume

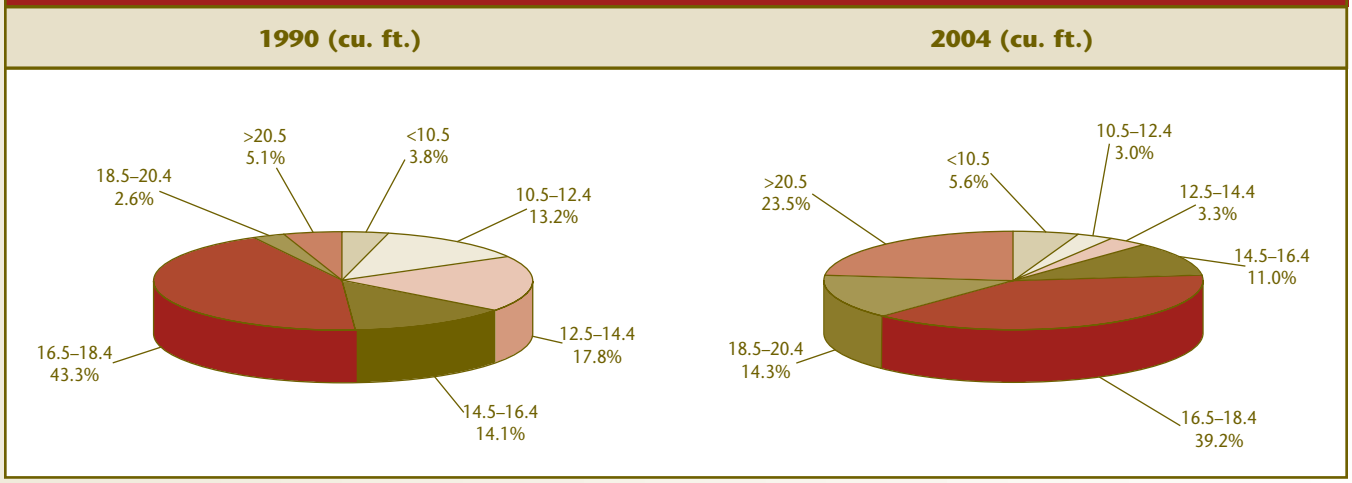
TABLE 1.3
Distribution of Refrigerators by Volume

Model Year	Volume (cu. ft.)						
	<10.5	10.5–12.4	12.5–14.4	14.5–16.4	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
Average Annual Change	0.1%	0.7%	1.0%	0.2%	0.3%	0.8%	1.3%

Refrigerators with a volume between 16.5 and 18.4 cu. ft. remained the most popular, on average accounting for 39.2 percent of the market in 2004. However, a trend toward larger refrigerators had emerged. From 1990 to 2004, 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 23.5 percent. The market share of refrigerators with a capacity greater than 16.5 cu. ft. increased steadily during the study period. This is also evidenced in the findings of the *2003 Survey of Household Energy Use*[23] where over 61 percent of households possessed a main refrigerator larger than 16.5 cu. ft.

[23] Natural Resources Canada. *2003 Survey of Household Energy Use, Detailed Statistical Report*, Ottawa, 2006, Table 5.1, p. 57.

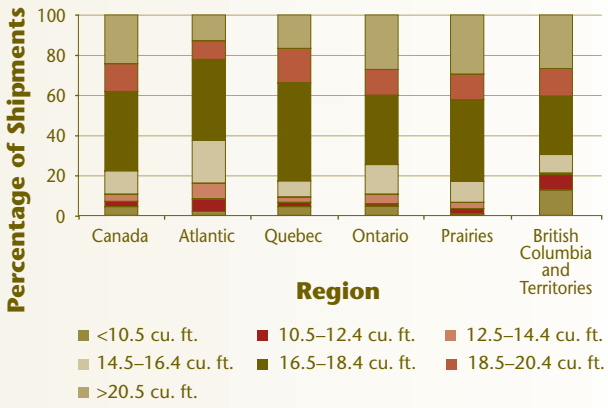
FIGURE 1.3
Distribution of Refrigerators by Volume for 1990 and 2004



1.2.4 Distribution by Volume, by Region/Province

Figure 1.4 demonstrates that refrigerators between 16.5 and 18.4 cu. ft. were the most popular nationally in 2004, although there were slightly more of those between 14.5 and 16.4 cu. ft. shipped to the Atlantic provinces during that year compared to the other regions. This chart also shows that British Columbia and the Territories received more shipments of smaller refrigerators (under 12.5 cu. ft.) than the other regions/provinces (12.7 percent compared to 4.3 percent nationally). Ontario and the western provinces and territories seemed to favour the largest refrigerators (those over 20.5 cu. ft.).

FIGURE 1.4
Distribution of Refrigerators by Volume, by Region/Province, 2004*



*For greater detail, see Table C.2.

FIGURE 1.5
Distribution of Refrigerators by Volume, by Channel, 2004

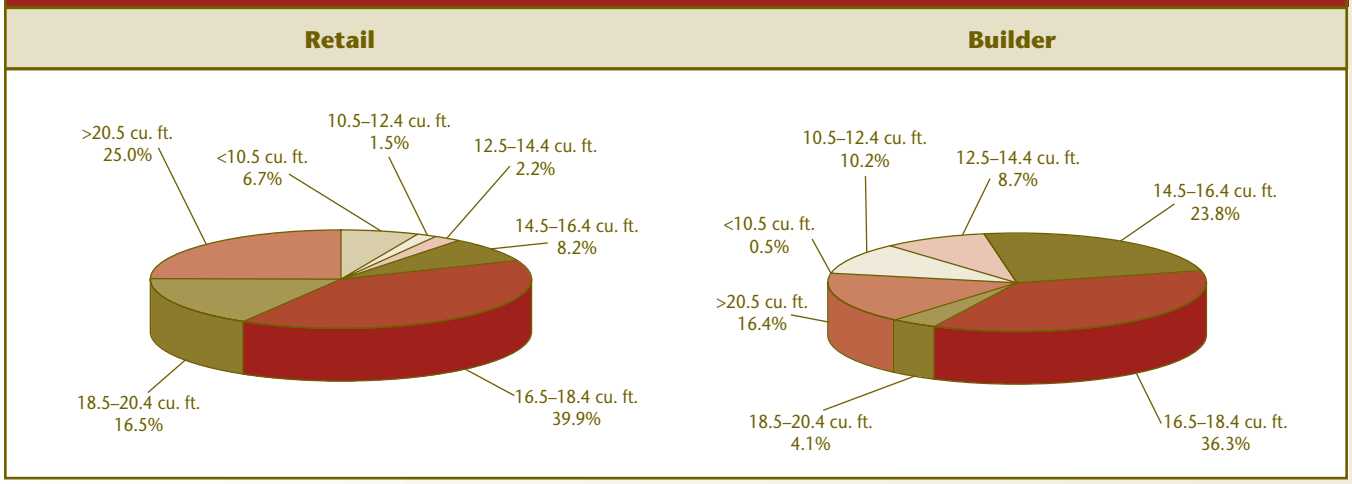


Figure 1.5 compares the national breakdown of the distribution of refrigerators for the retail and builder trade. Although the most popular size of refrigerator in both cases was that between 16.5 and 18.4 cu. ft., retail shipments of refrigerators over 18.4 cu. ft. were higher (41.5 percent) than those shipped for the builder trade (20.5 percent). This chart also shows that builder shipments of refrigerators between 14.5 and 16.4 cu. ft. were higher (23.8 percent) than those shipped for retail sales (8.2 percent).

The channel (retail versus builder) data also showed that retail shipments of refrigerators under 10.5 cu. ft. were quite high in British Columbia and the Territories (19.4 percent compared to 6.7 percent nationally). Similarly, retail shipments of refrigerators between 14.5 and 16.4 cu. ft. were higher in the Atlantic provinces (22 percent compared to 8.2 percent nationally). Shipments of refrigerators between 10.5 and 12.4 cu. ft. to the builder trade were somewhat higher in the Atlantic provinces and Quebec (20.2 percent and 23.4 percent, respectively, compared to 10.2 percent nationally). Shipments of the largest refrigerators (those over 20.5 cu. ft.) to the builder trade were highest in the Prairies and British Columbia and the Territories (23.4 percent and 29 percent, respectively, compared to 16.4 nationally). For greater detail, see Tables C.3 and C.4 in Appendix C.

1.2.5 Distribution by Average Annual Unit Energy Consumption per Cubic Foot

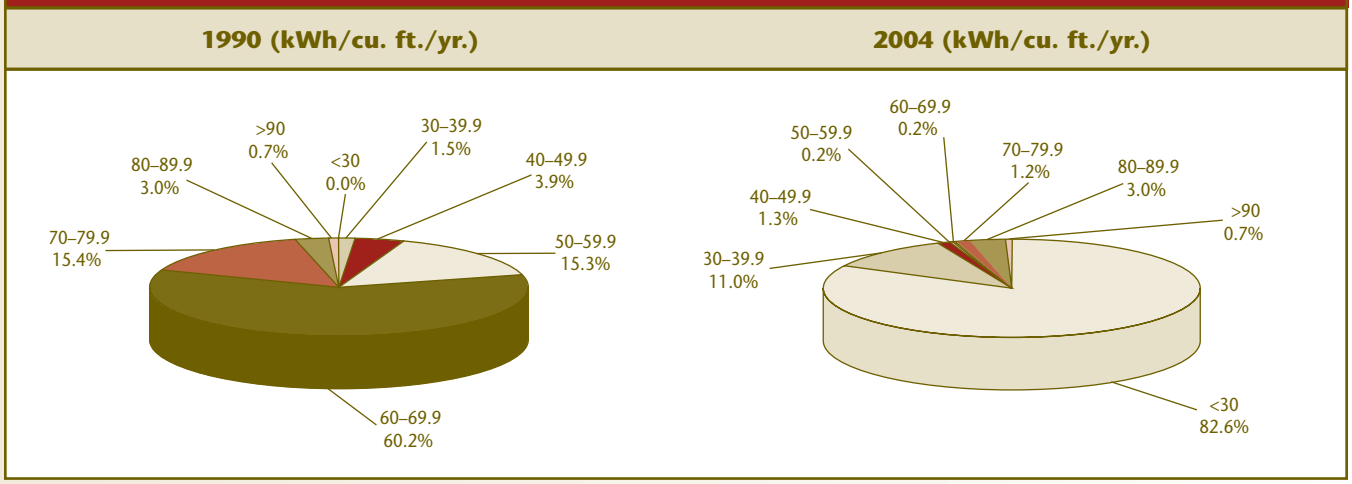
Refrigerators are becoming more efficient, thanks largely to the ongoing efforts of manufacturers, the MEPS and the amendment to the MEPS in 2001. It is interesting to note in Table 1.4 and Figure 1.6 that, since this amendment to the MEPS, which occurred in 2001, there has been a substantial improvement in the energy efficiency of refrigerators. By 2004, 82.6 percent of refrigerators consumed less than 30 kWh/cu. ft./yr., even though there was a definite trend towards larger capacity, as illustrated in Table 1.3.

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

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

Model Year	kWh/cu. ft./yr.							
	<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
Average Annual Change	5.9%	0.7%	0.2%	1.1%	4.3%	1.0%	0.0%	0.0%

FIGURE 1.6
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot for 1990 and 2004



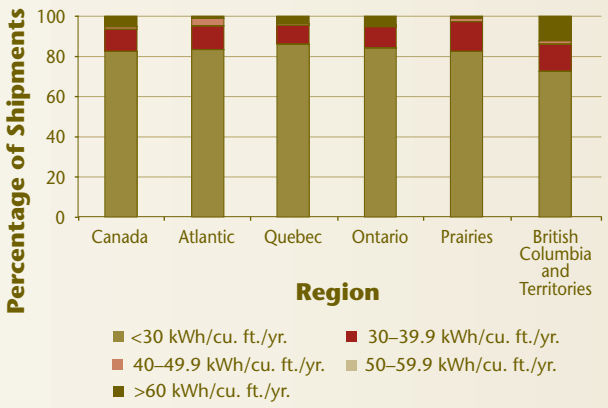
1.2.6 Distribution by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province

In 2004, 82.6 percent of all refrigerators shipped in Canada consumed less than 30 kWh/cu. ft. Figure 1.7 shows that consumers in British Columbia and the Territories had a slight preference towards more energy-intensive refrigerators in 2004, compared with the rest of the country; 27.4 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 1.11).

1.2.7 Distribution by Channel, by Region/Province

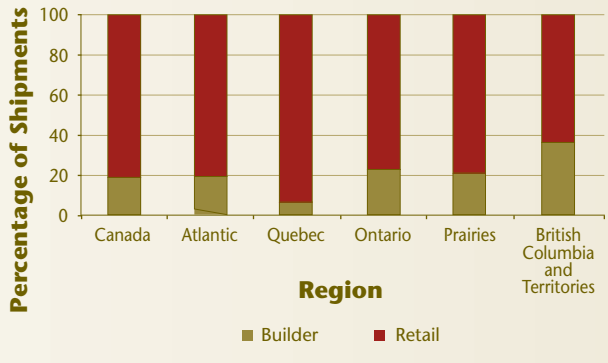
Figure 1.8 demonstrates the proportion of refrigerators shipped for retail sales[24] versus those shipped for builder sales.[25] It shows that, for Canada as a whole, approximately 81.4 percent of all refrigerators were categorized as retail shipments, whereas 18.6 percent of them were tagged as builder shipments. The chart also outlines the differences in this proportion for the regions/provinces, with the Atlantic provinces and British Columbia and the Territories having a substantially larger builder representation than the rest of the country. Shipments of refrigerators to builders in Quebec were relatively low (6.3 percent) compared to the rest of the country.

FIGURE 1.7
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004*



*For greater detail, see Table C.5.

FIGURE 1.8
Distribution of Refrigerators by Channel, by Region/Province, 2004*



*For greater detail, see Table C.6.

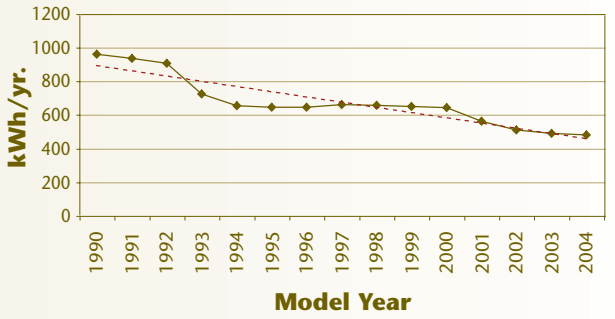
[24] Retail sales include those by Canadian manufacturers and importers and/or their branches and distributors to Canadian retailers, government agencies, utilities and other consumers, but do not include sales to branches or to other Canadian Appliance Manufacturers Association member companies.
[25]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

1.3 Energy Consumption

1.3.1 Average Annual Unit Energy Consumption by Model Year

As mentioned earlier, even though there is much diversity in types and sizes of refrigerators, we have grouped them all together to calculate the average UEC for all refrigerators by model year (see Figure 1.9). Overall, the UEC decreased by 478.5 kWh during the study period. Readers should note the significant decrease in UEC from 2000 to 2004 (161.8 kWh/yr.), which coincides with the 2001 amendment to the MEPS. For analysis of the distribution of refrigerators by average annual UEC by type, see Table C.7 in Appendix C. Because size is so important in such analysis, we advise the readers to also look further at the distribution of refrigerators by average annual UEC per cubic foot by volume (Table C.8 in Appendix C).

FIGURE 1.9
Average Annual Unit Energy Consumption of Refrigerators by Model Year*



*For greater detail, see Table C.7.

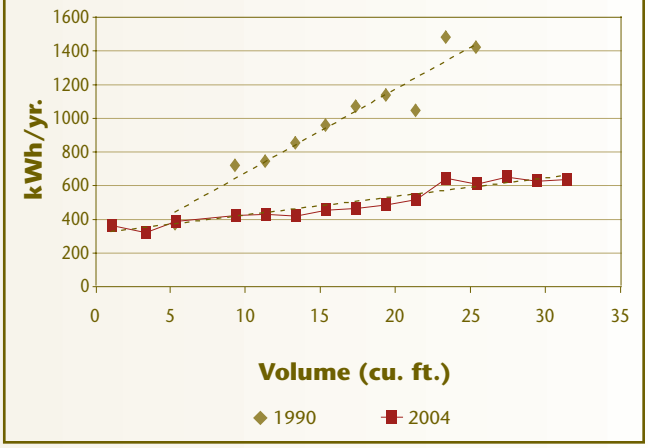
1.3.2 Average Annual Unit Energy Consumption by Volume

The energy performance of refrigerators improved remarkably between 1990 and 2004. As illustrated in Figure 1.10, the larger the volume, the greater the decrease in average annual UEC. The average annual UEC of refrigerators with volumes below 5 cu. ft. remained relatively unchanged during the period.

In 1990, refrigerators larger than 16.4 cu. ft. consumed on average more than 1000 kWh of electricity per year. By 2004, 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 627 kWh of electricity per year.

The gap between the average annual UEC of the largest and smallest units narrowed between 1990 and 2004. When the period began, the difference between the average annual UEC of the largest and smallest units was over 1000 kWh. By 2004, with manufacturers improving the energy efficiency of larger models, the difference had shrunk to about 275 kWh.

FIGURE 1.10
Average Annual Unit Energy Consumption of Refrigerators by Volume*



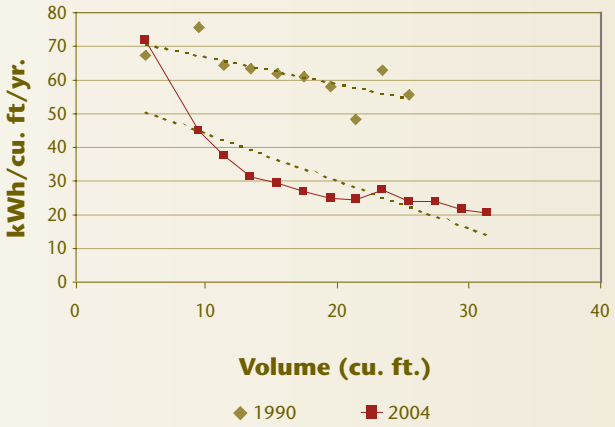
*For greater detail, see Table C.8.

The trend in the average annual UEC of refrigerators, on a per-cubic-foot basis, is consistent with the above findings. Figure 1.11 shows that larger models consume less energy per cubic foot than smaller ones.

1.3.3 Average Annual Unit Energy Consumption by Channel, by Region/Province, 2004

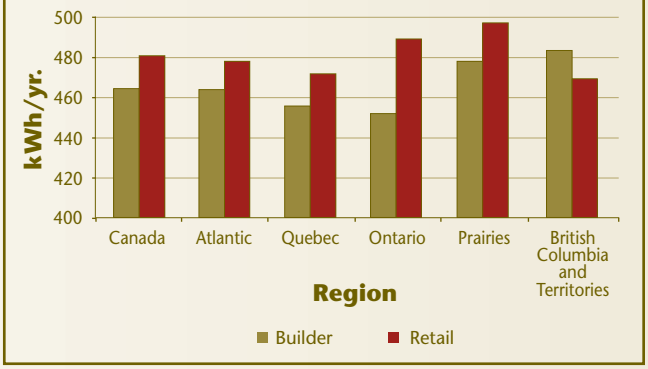
Figure 1.12 demonstrates the breakdown of the average annual UEC of refrigerators by shipments for retail purposes and for the builder trade, by region/province. It shows that in most regions, the average annual UEC was higher for those refrigerators tagged for retail shipments. Retail refrigerators are generally larger and therefore consume more total energy. This chart also shows that, in British Columbia and the Territories, the average annual UEC was higher for those refrigerators shipped to the builder trade. This is in part due to the fact that builders in this region provided their clients with larger refrigerators (those over 16.50 cu. ft.) compared to the builders in the rest of the country. The chart also shows that the average annual UEC of retail shipments to Ontario and the Prairies were somewhat higher than the national average, yet those in Quebec were lower (see Tables C.3 and C.4 in Appendix C). All three of these regions had more shipments of refrigerators over 16.50 cu. ft., but Quebec seemed to have a tendency towards more energy-efficient types (i.e. Type 5 as opposed to Type 7).

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



*For greater detail, see Table C.9.

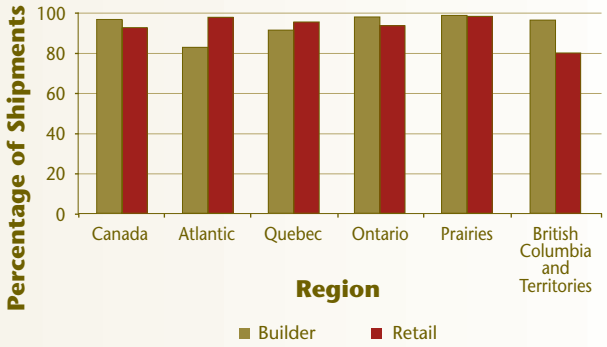
FIGURE 1.12
Average Annual Unit Energy Consumption of Refrigerators by Channel, by Region/Province, 2004*



*For greater detail, see Table C.10.

Figure 1.13 outlines the percentage of retail and builder shipments of refrigerators throughout the country consuming less than 40 kWh/cu. ft./yr. It is important to note that, nationally, builder shipments were slightly more energy efficient than retail shipments, most likely due to the fact that builders may have supplied more basic models, with less options. Builder shipments in the Atlantic provinces and Quebec were somewhat less energy efficient than retail shipments, probably due to the higher percentage of small (10.5 to 14.4 cu. ft.), more energy-intensive refrigerators shipped to that region. The percentage of builder refrigerators consuming less than 40 kWh/cu. ft./yr. was slightly higher in British Columbia and the Territories, most likely due to the fact that the builders in this region were not only supplying their clients with larger models, they were also more energy-efficient models.

FIGURE 1.13
Distribution of Refrigerators Consuming Less Than 40 kWh/cu. ft./yr., 2004*



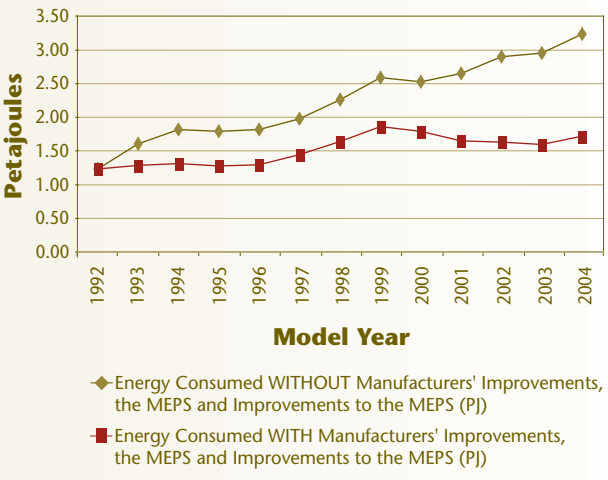
*For greater detail, see Table C.11.

1.4 Energy Savings

During the study period, the following factors contributed to significant decrease in the average annual UEC of refrigerators: manufacturers' improvements in the general energy efficiency of refrigerators, the MEPS and an amendment to improve the energy efficiency levels of the MEPS in 2001, the EnerGuide for Equipment Program and the ENERGY STAR® initiative. Had it not been for these factors, the average annual UEC would have been much higher. Figure 1.14 shows how much energy refrigerators might have consumed annually between 1992 and 2004 without these factors (top line) and how much energy actually was consumed by refrigerators during those years (bottom line).

The divergence of the two lines in Figure 1.14 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 market forces, such as the regulations expected from the Act plus U.S. regulations.

FIGURE 1.14
Energy Savings for Refrigerators, 1992–2004*

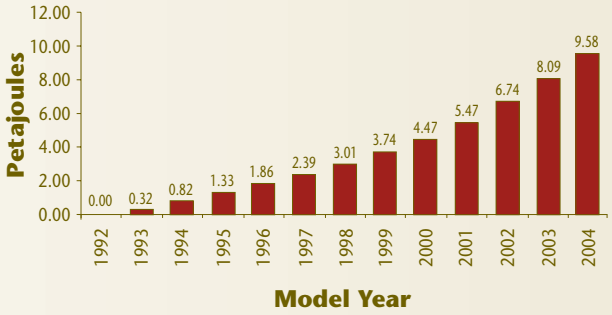


*For greater detail, see Table C.12.

The average annual energy savings for refrigerators were estimated to be 0.8 petajoules (PJ) between 1993 and 2004. (No savings were expected in 1992.) This indicates that, on average, refrigerators consumed about 0.8 PJ less annually than they would have without the factors described above.

Cumulative energy savings for refrigerators are shown in Figure 1.15 and in Table C.12. Readers should note that the recent increase in annual energy savings coincides with the 2001 amendment to the MEPS and the change to the ENERGY STAR specification. The largest annual savings occurred in 2004, when refrigerators consumed about 1.51 PJ less than they otherwise would have. They reached a total savings of 9.58 PJ in 2004, taking into account the life expectancy factor of refrigerators (this calculation is explained further in Appendix A – Methodology).

FIGURE 1.15
Cumulative Energy Savings for Refrigerators, 1992–2004*



*For greater detail, see Table C.12.

1.5 Refrigerators Summary

Type 3 refrigerators (refrigerator-freezers with top-mounted freezer and automatic defrost) remained the most popular type in Canada (66.4 percent of the market in 2004), although their market share has declined since 1990, when they represented 84.9 percent of the market. Shipments of refrigerators with bottom-mounted freezer (Type 5) continued to rise in popularity in 2004 and refrigerators with side-mounted freezer and through-the-door ice service (Type 7) remained quite popular.

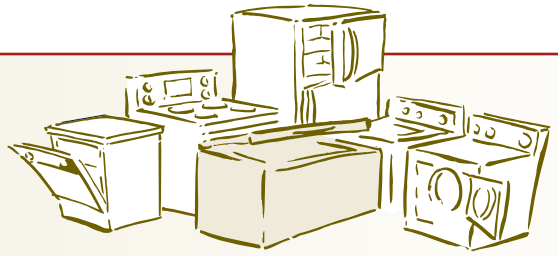
Of the refrigerators shipped in 2004, 34.2 percent were ENERGY STAR® qualified. This proportion is lower than the previous year (40.7 percent), due to the introduction of more stringent specifications for refrigerators in 2004 in order for them to qualify for the ENERGY STAR mark.

The most popular size category of refrigerators was 16.5 to 18.4 cu. ft., although there is a growing trend for those over 20.5 cu. ft. (23.5 percent of the total market). Refrigerators, however, are becoming more efficient – from 2000 to 2004, the market share of refrigerators requiring less than 30 kWh per cu. ft. increased from 12.2 to 82.6 percent. As mentioned earlier in this chapter, the larger the volume capacity of refrigerators, the greater the decrease in their average annual UEC.

On average, 81.4 percent of all refrigerators were categorized as retail shipments, whereas 18.6 percent of them were tagged as builder shipments. The Atlantic provinces and British Columbia and the Territories had a substantially larger share of builder shipments than the rest of the country, whereas Quebec had a somewhat lower builder share.

The average annual energy savings for refrigerators were estimated to be 0.8 PJ between 1992 and 2004, with total energy savings for that period reaching 9.58 PJ (2.66 billion kWh). Dollar savings for refrigerators, for the study period, were estimated to be $234.2 million (calculated at 8.8 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 noted earlier, because of restrictions in the market information available, the freezer shipment data are not as comprehensive as they are 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 2004 Market Snapshot

Type 10 freezers were the most popular in 2004, accounting for 45.5 percent of all freezers shipped in Canada. Their shipment-weighted average annual unit energy consumption (UEC) was 344 kilowatt hours (kWh).

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

The energy efficiency of freezers improved steadily between 1990 and 2004. In 1990, almost all freezers required more than 50 kWh per year to freeze each cubic foot of space. With steady improvements in energy efficiency, by 2004, 77.7 percent of all freezers required less than 40 kWh per year to freeze each cubic foot of space.

2.2 Distribution of Shipments

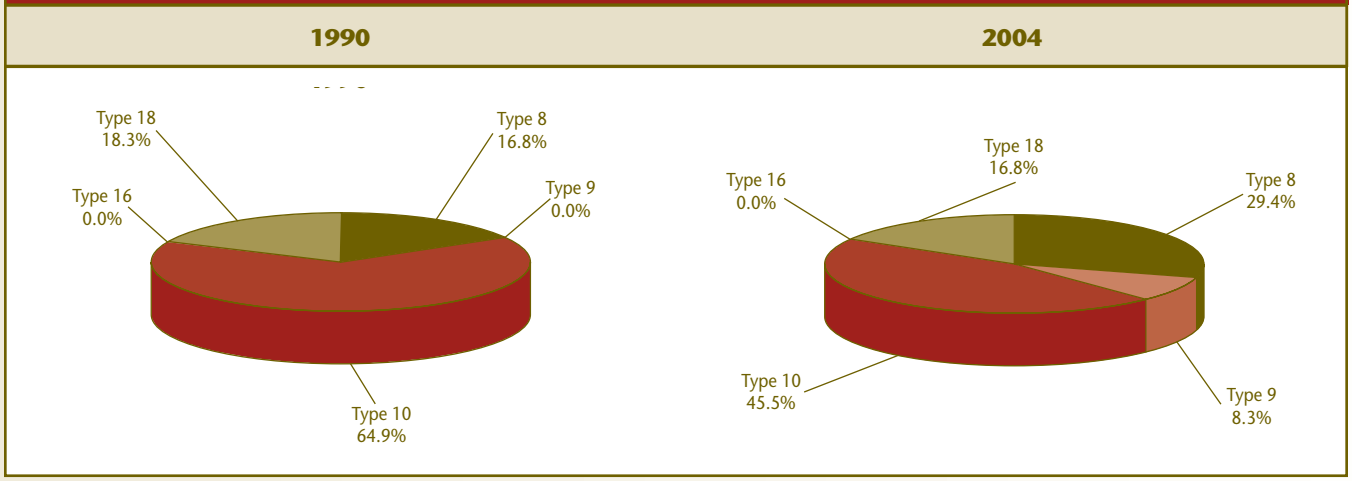
2.2.1 Distribution by Type

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	19.5	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
Average Annual Change	0.9%	0.6%	1.4%	0.0%	0.1%

Type 10 (chest) freezers have dominated the freezer market in Canada throughout the study period. However, the market share of chest freezers (Types 10 and 18) declined from 83.2 to 62.3 percent during those years. Conversely, upright freezers (Types 8 and 9) gained a 20.9 percent increase in market share between 1990 and 2004. They accounted for 37.7 percent of the market in 2004. Unfortunately, Types 8 and 9 freezers are less energy efficient than Type 10 freezers.

FIGURE 2.1
Distribution of Freezers by Type for 1990 and 2004

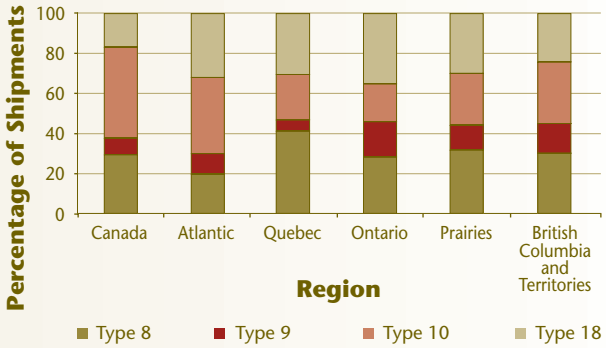


2.2.2 Distribution by Type, by Region/Province

Figure 2.2 shows that, although Type 10 freezers were the most popular type on average nationally, some regions favoured different types. For example, 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*,[26] showing that upright freezers were popular in Quebec. Also, the table shows that upright freezers are less popular in the Atlantic provinces, as also demonstrated in Figure 2.2.

Type 10 freezers remained the most energy-efficient freezers on the market, followed by Type 8.

FIGURE 2.2
Distribution of Freezers by Type, by Region/Province, 2004*



*For greater detail, see Table C.13.

[26] Natural Resources Canada. *2003 Survey of Household Energy Use, Detailed Statistical Report*, Ottawa, 2005, p. 69.

2.2.3 Distribution by Average Annual Unit Energy Consumption per Cubic Foot

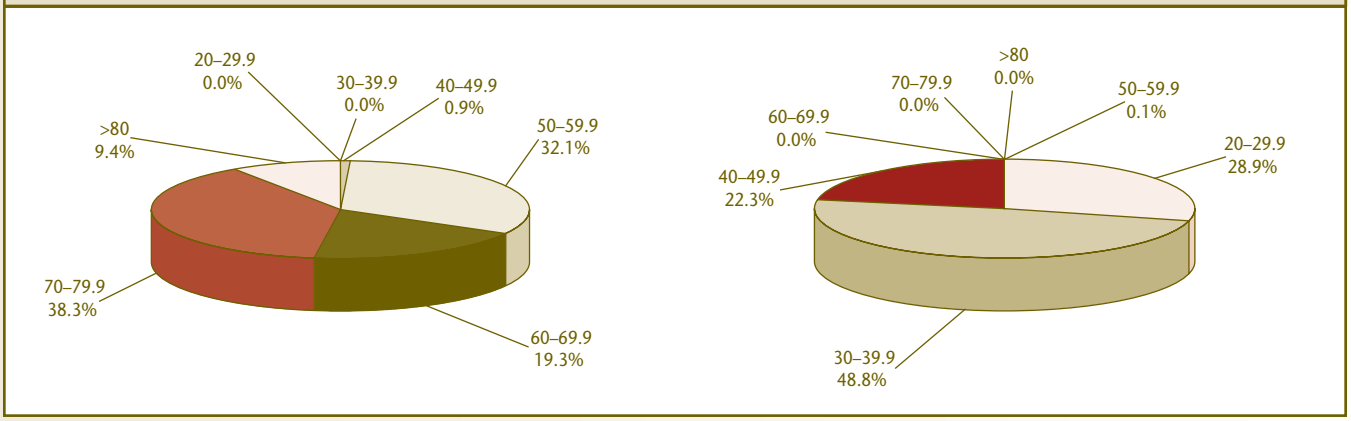
TABLE 2.2
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot

Model Year	kWh/cu. ft./yr.						
	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
Average Annual Change	2.1%	3.5%	1.5%	2.3%	1.4%	2.7%	0.7%

The energy efficiency of freezers improved steadily between 1990 and 2004. In 1990, almost all freezers required more than 50 kWh per year to freeze each cubic foot (cu. ft.) of space. With steady improvements in energy efficiency, thanks largely to the 2001 amendment to the minimum energy performance standards (MEPS), by 2004, 77.7 percent of all freezers required less than 40 kWh per year to freeze each cubic foot of space.

At the beginning of the study period, freezers with an average annual UEC between 70 and 79.9 kWh per cu. ft. per year dominated the market, accounting for 38.3 percent of the market. By comparison, freezers in 2004 most commonly consumed between 30 and 39.9 kWh per cu. ft. annually.

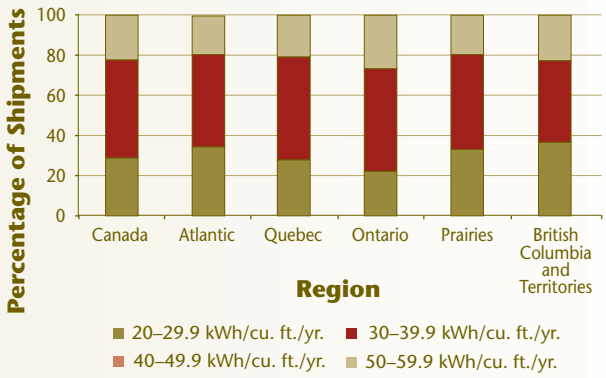
FIGURE 2.3
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot for 1990 and 2004



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

Figure 2.4 demonstrates that nationally, in 2004, freezers most commonly consumed between 30 and 39.9 kWh per cu. ft. However, the Atlantic provinces, the Prairies, and British Columbia and the Territories seemed to favour freezers consuming less than 30 kWh per cu. ft. These regions had a higher percentage of chest freezers (Type 10), which are less energy intensive.

FIGURE 2.4
Distribution of Freezers by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004*

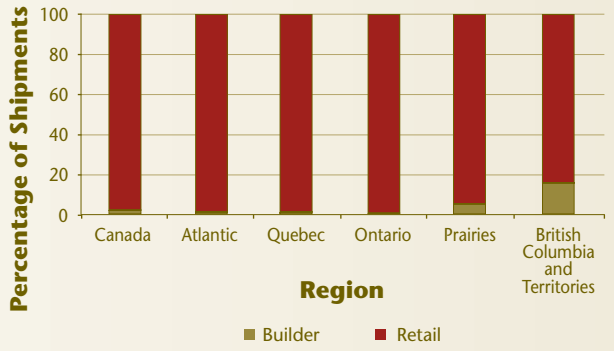


*For greater detail, see Table C.14.

2.2.5 Distribution by Channel, by Region/Province

Figure 2.5 illustrates the proportion of freezers shipped for retail sales versus those shipped for the building trade. It shows that, for Canada as a whole, approximately 98.2 percent of all freezers were categorized as retail shipments, whereas only 1.8 percent were tagged for builder shipments. The chart also outlines the differences in this proportion for the regions/provinces, with the western ones having a somewhat larger builder shipment representation that the rest of the country (5 percent for the Prairies and 15.5 percent for British Columbia and the Territories).

FIGURE 2.5
Distribution of Freezers by Channel, by Region/Province, 2004*



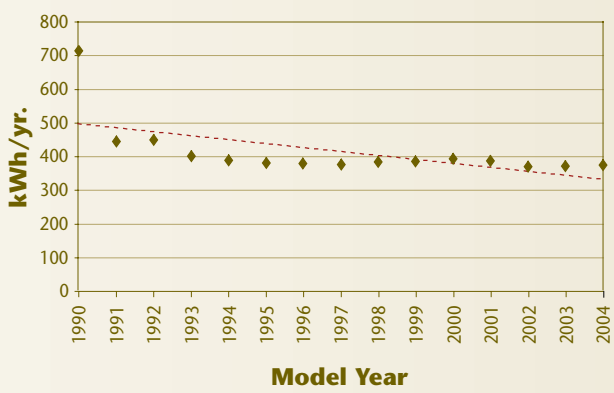
*For greater detail, see Table C.15.

2.3 Energy Consumption

2.3.1 Average Annual Unit Energy Consumption by Model Year

Freezers became significantly more energy efficient between 1990 and 2004. As Figure 2.6 shows, the average annual UEC decreased significantly in 1991 and then decreased gradually until 1997. After 1997, the average annual UEC held steady. Overall, the average annual UEC decreased by 47.8 percent, or 341 kWh, during the study period.

FIGURE 2.6
Average Annual Unit Energy Consumption of Freezers by Model Year*



*For greater detail, see Table C.16.

2.4 Energy Savings

It is estimated that annual freezer energy consumption was slightly lower between 1993 and 2004 than it would have been without the MEPS, the amendment to the MEPS in 2001[27] and a general improvement in energy efficiency.

As with refrigerators, the difference between the two lines in Figure 2.7 represents the incremental annual energy savings.

The average annual energy savings for freezers were estimated to be 0.06 petajoules (PJ) from 1993 to 2004. (No savings were expected for 1992.)

The largest annual energy savings occurred in 2004 when freezers consumed about 0.08 PJ less than they otherwise might have. This increase coincides with the introduction of freezers into the ENERGY STAR® initiative and the 2001 amendment to the MEPS.

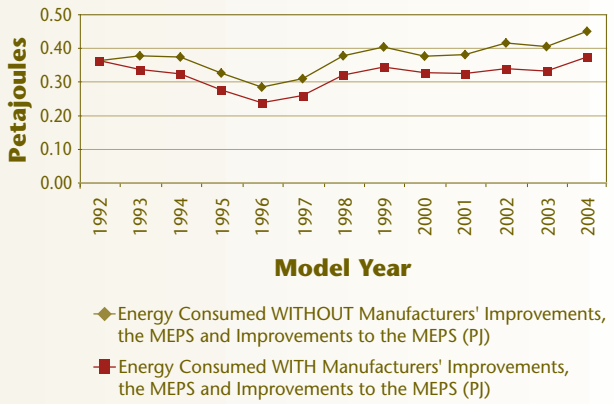
Cumulative energy savings grew steadily between 1992 and 2004 to reach 0.68 PJ in 2004. These energy savings are shown in Figure 2.8.

2.5 Freezers Summary

Type 10 freezers (chest freezers) continued to be the most popular type in 2004 (45.5 percent of the market), although Types 8 and 9 (upright freezers with manual and automatic defrost) grew in popularity, accounting for 37.7 percent of the market.

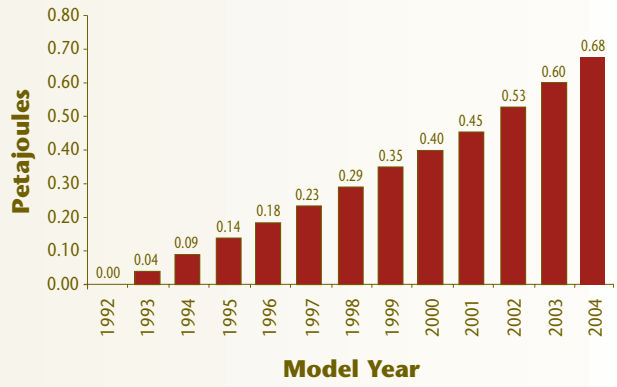
The energy efficiency of freezers improved steadily between 1990 and 2004 – by 2004, 99.9 percent of all freezers required less than 50 kWh per year to freeze each cubic foot of space; whereas in 1990, almost all freezers required more than 50 kWh per year. The average annual energy savings for freezers were estimated to be 0.06 PJ between 1993 and 2004, with total energy savings for that period reaching 0.68 PJ (188.89 million kWh). Dollar savings for freezers, for the study period, were estimated to be $16.6 million (calculated at 8.8 cents/kWh).

FIGURE 2.7
Energy Savings for Freezers, 1992–2004*



*For greater detail, see Table C.17.

FIGURE 2.8
Cumulative Energy Savings for Freezers, 1992–2004*



*For greater detail, see Table C.17.

[27] The effective date for freezers was July 1, 2001.

3 DISHWASHERS

3.1 2004 Market Snapshot

The shipment-weighted average annual unit energy consumption (UEC) of dishwashers in 2004 was 457 kilowatt hours (kWh). Nearly 81 percent of the standard models on the market that year – that is, those with an exterior width of more than 56 centimetres – qualified for ENERGY STAR®, exceeding the minimum energy performance standards (MEPS) by at least 25 percent.

Between 1990 and 2004, the energy performance of dishwashers improved remarkably. The average annual UEC decreased by about 55 percent, or 569 kWh, during the period.

3.2 Distribution of Shipments

3.2.1 Distribution by Average Annual Unit Energy Consumption

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.

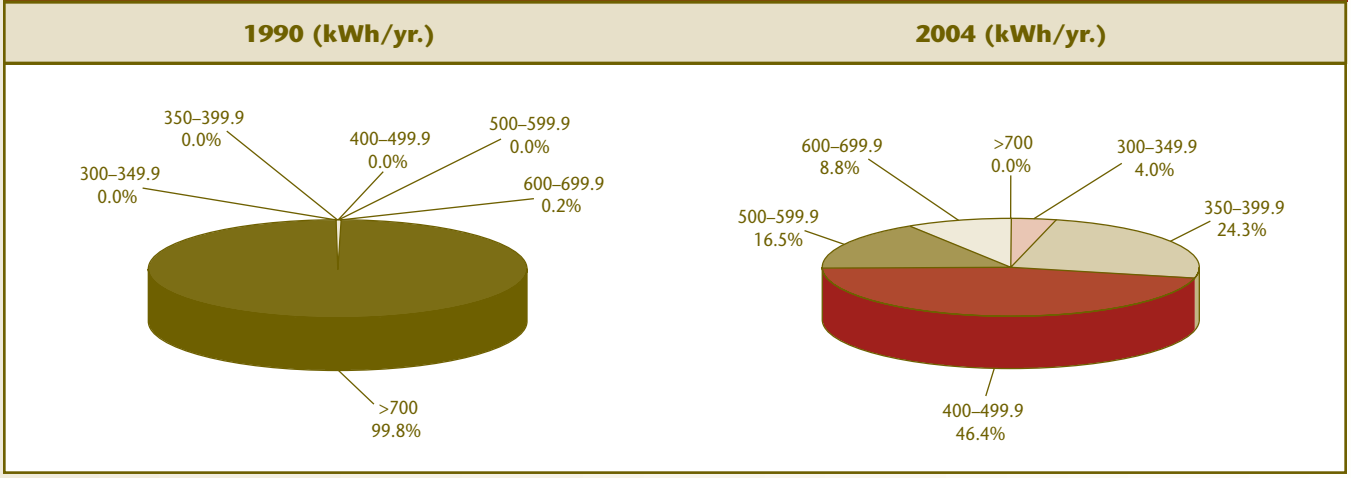
By 2004, nearly all dishwashers consumed less than 700 kWh annually, with 74.7 percent consuming less than 500 kWh annually. Improvement in efficiency from 2003 to 2004 may be attributable to the 2004 amendment to the MEPS.

TABLE 3.1
Distribution of Dishwashers by Average Annual Unit Energy Consumption

Model Year	kWh/yr. 300–349.9	350–399.9	400–499.9	500–599.9	600–699.9	>700
	%	%	%	%	%	%
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
Average Annual Change	0.3%	1.7%	3.3%	1.2%	0.6%	7.1%

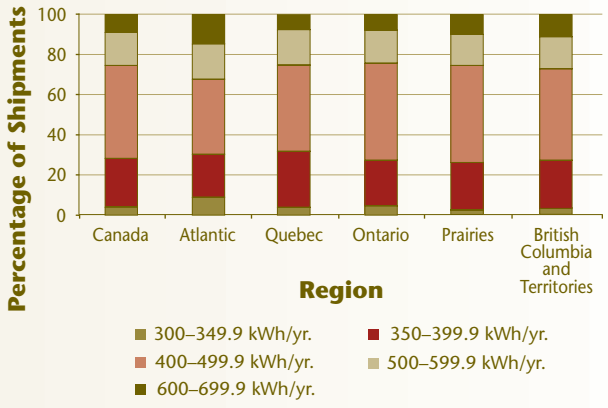
3.2.2 Distribution by Average Annual Unit Energy Consumption, by Region/Province

FIGURE 3.1
Distribution of Dishwashers by Average Annual Unit Energy Consumption for 1990 and 2004



In 2004, 74.7 percent of all dishwashers shipped in Canada consumed less than 500 kWh. Figure 3.2 shows that although there were minor fluctuations in consumption figures throughout the country, there were similar tendencies from one region to another.

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

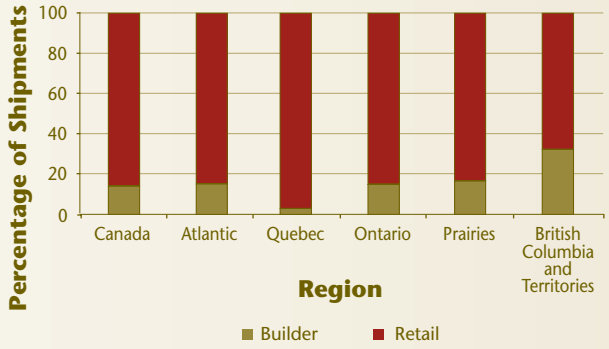


*For greater detail, see Table C.18.

3.2.3 Distribution by Channel, by Region/Province

Figure 3.3 demonstrates the proportion of dishwashers shipped for retail sales versus those shipped for the building trade. It shows that, for Canada as a whole, approximately 85.7 percent of all dishwashers were shipped for retail sales, whereas 14.3 percent were tagged for builder shipments. The chart also outlines the differences in this proportion for the regions/provinces, with British Columbia and the Territories showing a substantially larger builder shipment representation (32.2 percent) than the rest of the country, whereas builder shipments in Quebec were considerably lower (3.0 percent). These findings are similar to those outlined for refrigerators (Figure 1.8).

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



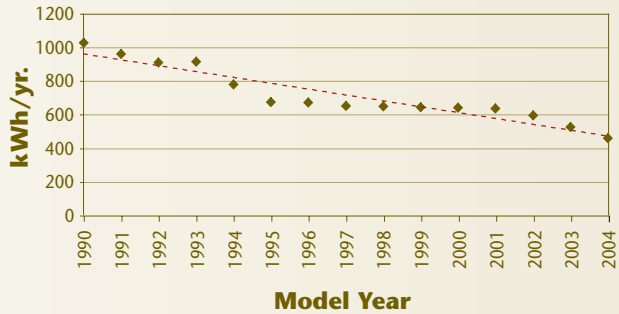
*For greater detail, see Table C.19.

3.3 Energy Consumption

3.3.1 Average Annual Unit Energy Consumption by Model Year

Between 1990 and 2004, the energy performance of dishwashers improved remarkably. As Figure 3.4 shows, the average annual UEC decreased by about 55 percent, or 569 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 at that point in time. In 2004, the average annual UEC reached 456.8 kWh, a decrease of 214 kWh, or 32 percent, from the 1995 level, partly due to the 2004 amendment to the MEPS.

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

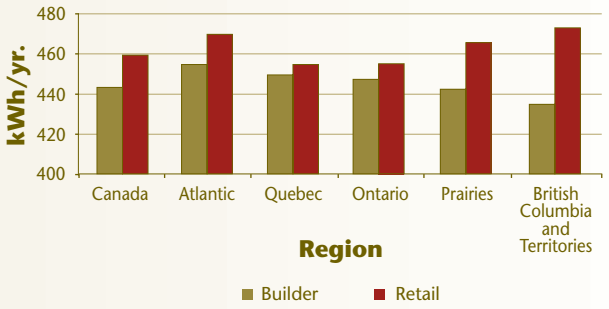


*For greater detail, see Table C.20.

3.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province, 2004

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. It shows that the average annual UEC was higher for those dishwashers tagged for retail sales, especially in British Columbia and the Territories, where the average annual UEC for retail shipments was 472.6 kWh/yr. compared with 434.6 kWh/yr. for builder shipments. The difference may be due to builders purchasing more energy-efficient models, or to the extra options/features included with the dishwashers tagged for retail sales.

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



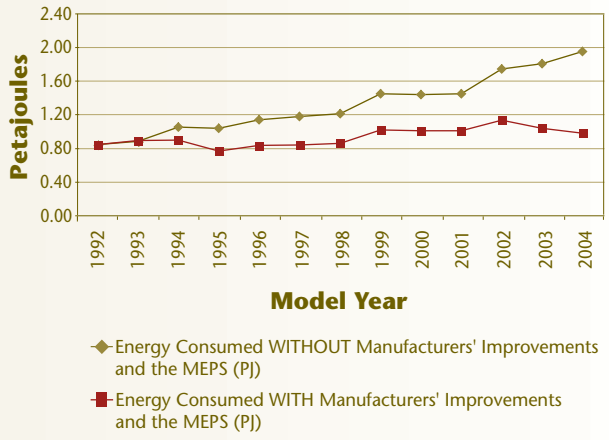
*For greater detail, see Table C.21.

3.4 Energy Savings

Figure 3.6 shows how much energy dishwashers might have consumed annually between 1992 and 2004 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 0.42 petajoules (PJ) from 1993 to 2004. (No savings were expected for 1992.) The largest annual energy savings occurred in 2004, when dishwashers consumed 0.97 PJ less than they otherwise might have. This increase in energy savings is due, in part, to the 2004 amendment to the MEPS.

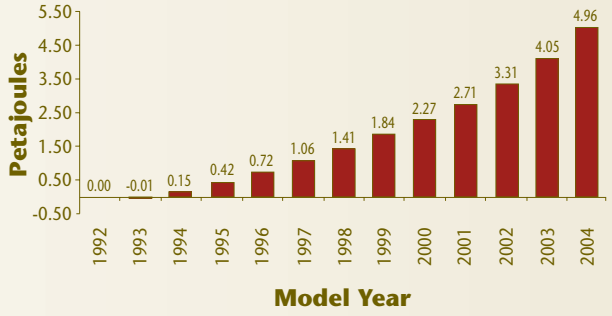
FIGURE 3.6
Energy Savings for Dishwashers, 1992–2004*



*For greater detail, see Table C.22.

The cumulative energy savings for dishwashers are shown in Figure 3.7. Energy savings between 2000 and 2004 amounted to 2.69 PJ or 747.22 million kWh. Cumulative energy savings for the study period reached a total of 4.96 PJ in 2004, taking into account the life expectancy factor of dishwashers (this calculation is explained further in Appendix A – Methodology). The reader should note that this change to our methodology affected only slightly the previous energy savings calculations for 2002 and 2003.

FIGURE 3.7
Cumulative Energy Savings for Dishwashers, 1992–2004*



*For greater detail, see Table C.22.

3.5 Dishwashers Summary

The energy efficiency of dishwashers improved steadily between 1990 and 2004 – by 2004, nearly all dishwashers consumed less than 700 kWh annually, with 74.7 percent consuming less than 500 kWh; whereas in 1990, almost all dishwashers (99.8 percent) consumed more than 700 kWh per year.

Of the dishwasher models available in 2004, 81.0 percent were ENERGY STAR® products.

Approximately 85.7 percent of all dishwashers were shipped for retail sales, whereas 14.3 percent were tagged for builder shipments. British Columbia and the Territories had a substantially larger share of builder shipments (32.3 percent) than the rest of the country, whereas Quebec had a somewhat lower share (3.0 percent).

The average annual energy savings for dishwashers were estimated to be 0.42 PJ between 1993 and 2004, with total energy savings for that period reaching 4.96 PJ (1.38 billion kWh). Dollar savings for dishwashers, for the study period, were estimated to be $121.2 million (calculated at 8.8 cents/kWh).

4 ELECTRIC RANGES

4.1 2004 Market Snapshot

In 2004, 58 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 622 kilowatt hours (kWh), compared with 694 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 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.[28]

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

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
Average Annual Change	2.5%	2.5%

4.2 Distribution of Shipments

4.2.1 Distribution by Type

In 1990, self-cleaning electric ranges accounted for less than one quarter (22.9 percent) of all electric ranges available on the market. By 2004, self-cleaning ranges had increased in popularity, with market share increasing to 57.7 percent. This represents a 35 percent increase since 1990, or an annual growth rate of 2.5 percent.

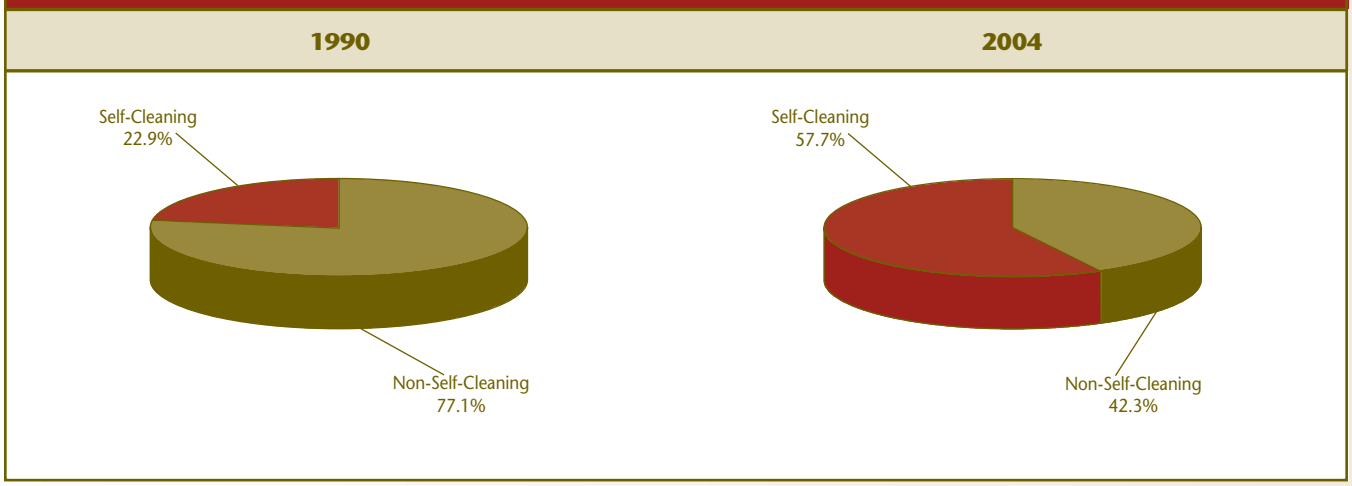
In contrast, the market share of electric ranges that were not self-cleaning decreased by 35 percent, dropping from 77.1 percent in 1990 to 42.3 percent in 2004.

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

In 1990, the electric ranges that dominated the market (73.2 percent) consumed between 750 and 850 kWh per year. In 2004, the market share of electric ranges in these categories fell to 31.5 percent.

[28] Natural Resources Canada, *EnerGuide Appliance Directory 2005*, Ottawa, 2005, p. 144.

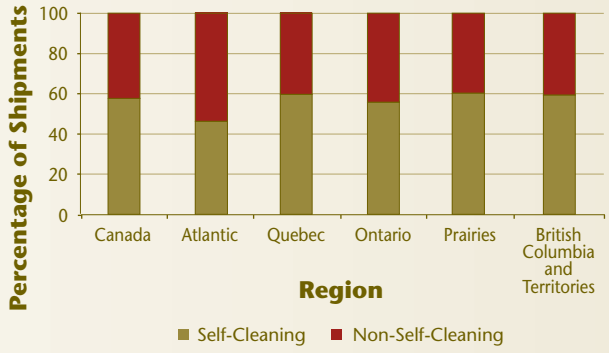
FIGURE 4.1
Distribution of Electric Ranges by Type for 1990 and 2004



4.2.2 Distribution by Type, by Region/Province

As previously mentioned, self-cleaning ranges have substantially increased their market share during the study period, with the national average in 2004 being at 57.7 percent. Figure 4.2 demonstrates the proportion of self-cleaning versus non-self-cleaning throughout the country. The Atlantic provinces had fewer shipments of self-cleaning electric ranges (46.3 percent) compared with the rest of the country.

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



*For greater detail, see Table C.23.

4.2.3 Distribution by Average Annual Unit Energy Consumption

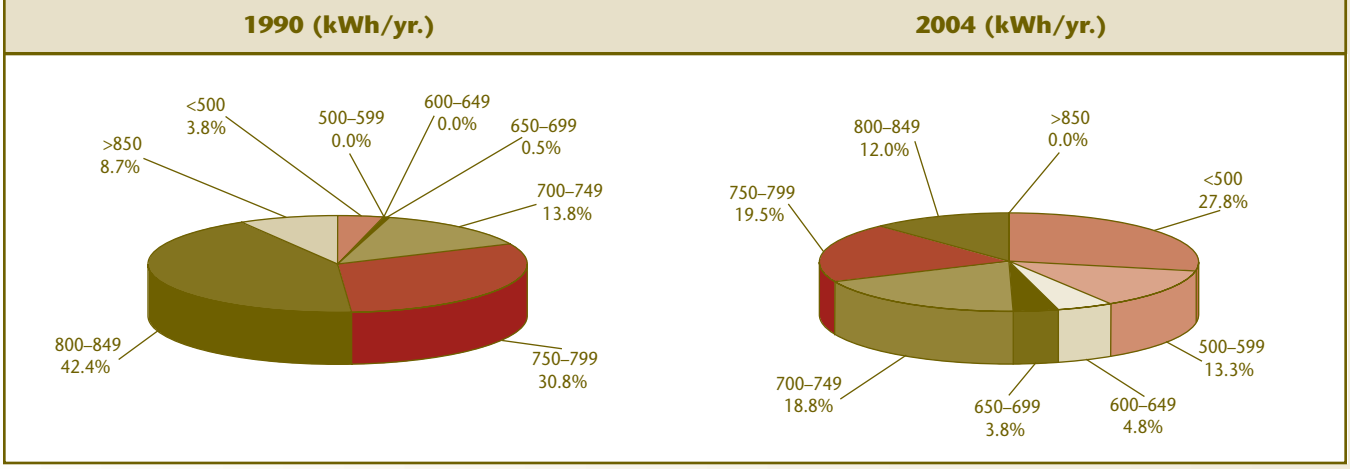
TABLE 4.2
Distribution of Electric Ranges by Average Annual Unit Energy Consumption

Model Year	kWh/yr. <500	500–599.9	600–649.9	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
Average Annual Change	1.7%	0.9%	0.3%	0.2%	0.4%	0.8%	2.2%	0.6%

In 1990, the electric ranges that dominated the market (73.2 percent) consumed between 750 and 850 kWh per year. In 2004, the market share of electric ranges in these categories fell to 31.5 percent. By 2003, there was also a considerable increase in market share of electric ranges that consumed less than 600 kWh, reaching 41.1 percent in 2004. This is most likely due to a new testing method and energy consumption standard introduced in October 2003.[29]

[29] Natural Resources Canada. *EnerGuide Appliance Directory, 2005*, Ottawa, 2005, p. 144.

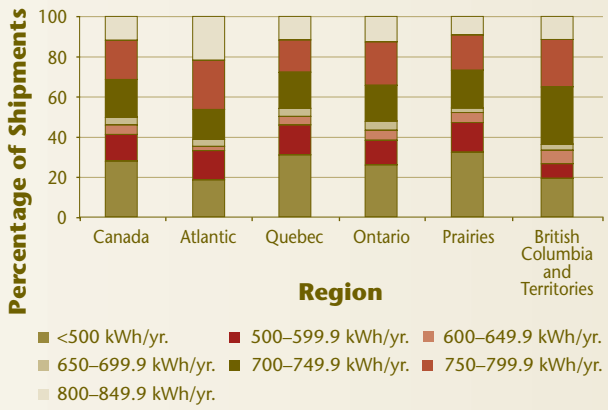
FIGURE 4.3
Distribution of Electric Ranges by Average Annual Unit Energy Consumption for 1990 and 2004



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

In 2004, 41.1 percent of all electric ranges shipped in Canada consumed less than 600 kWh/yr. Figure 4.4 shows that the percentage of these shipments was slightly higher in Quebec (45.9 percent) and the Prairies (47.0 percent). The Atlantic provinces (61.4 percent) and British Columbia and the Territories (63.8 percent) seemed to favour more energy-intensive ranges (those consuming more than 700 kWh/yr.).

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

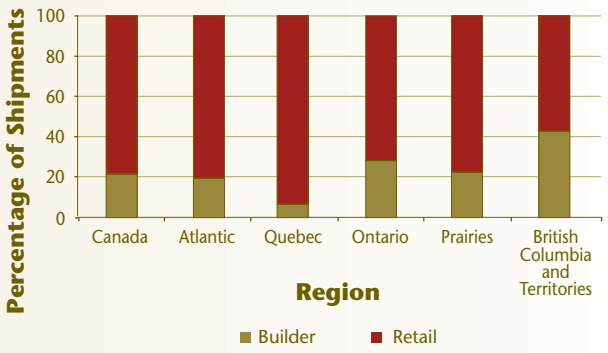


*For greater detail, see Table C.24.

4.2.5 Distribution by Channel, by Region/Province

Figure 4.5 illustrates the proportion of electric ranges shipped for retail sales versus those shipped for the building trade. It shows that, for Canada as a whole, approximately 78.5 percent of all electric ranges were categorized as retail shipments, whereas 21.5 percent were tagged for builder shipments. The chart also outlines the differences in this proportion for the regions/provinces, with, once again, British Columbia and the Territories having a larger builder shipment representation and Quebec having a smaller builder shipment representation than the rest of the country. As evidenced with the previous appliances, more builders in British Columbia and the Territories provided the appliances for their home buyers compared to builders in the rest of the country. Our data also show that, on average, 37 percent of builder shipments were self-cleaning ranges, which are more energy efficient than regular ranges, although in British Columbia and the Territories, this proportion was 48 percent.

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



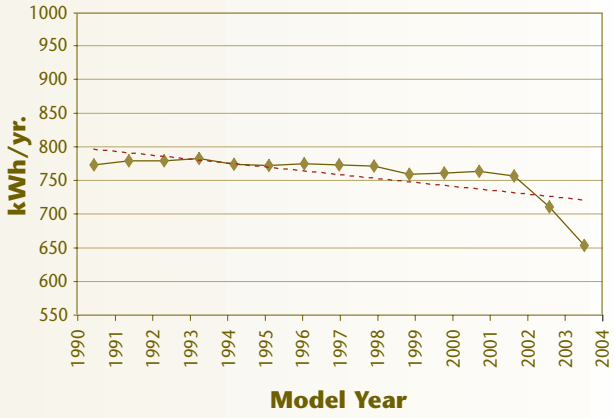
*For greater detail, see Table C.25.

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 1 percent, or 9 kWh. However, in 2003 and 2004, the average annual UEC decreased substantially, 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. This decrease may not reflect any improvement in energy efficiency of those models.

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

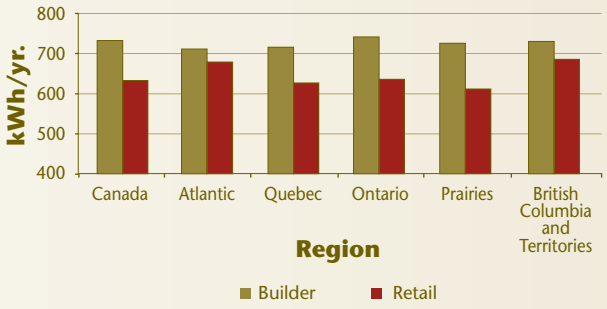


*For greater detail, see Table C.26.

4.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province, 2004

Figure 4.7 demonstrates the breakdown of average annual UEC of electric ranges by retail versus builder shipments, by region/province. It shows that, in all regions, the average annual UEC was lower for retail shipments than for builder shipments. It also shows that, in the Atlantic provinces and British Columbia and the Territories, the average annual UEC of the retail shipments were higher than the national average, partly due to a larger market share of non-self-cleaning models (Atlantic) and more energy-consuming models (British Columbia and Territories).

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



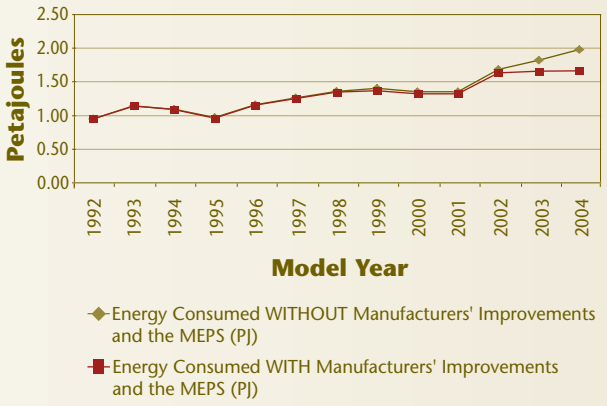
*For greater detail, see Table C.27.

4.4 Energy Savings

Electric ranges were the only appliances that did not experience a notable decline in energy consumption following the introduction of the MEPS in 1995.

Figure 4.8 shows how much energy might have been consumed by electric ranges without the MEPS or technological improvements (top line) and how much energy they actually consumed (bottom line). Graphically, the gap between the two lines represents annual energy savings – on average 0.06 petajoules (PJ) per year.

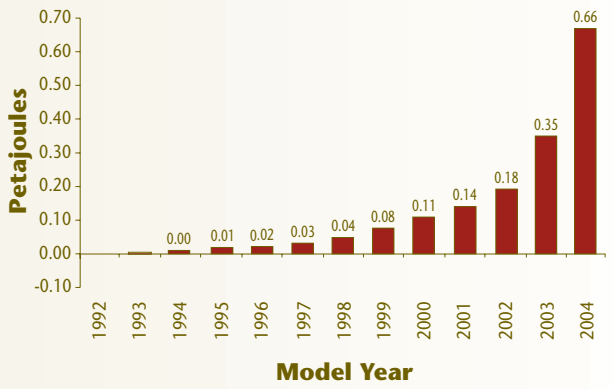
FIGURE 4.8
Energy Savings for Electric Ranges, 1992–2004*



*For greater detail, see Table C.28.

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 in 2003 and 2004 due to a new testing method and energy consumption standard introduced in October 2003. Savings reached a total of 0.66 PJ in 2004.

FIGURE 4.9
Cumulative Energy Savings for Electric Ranges, 1992–2004*



*For greater detail, see Table C.28.

4.5 Electric Ranges Summary

By 2004, self-cleaning ranges increased in popularity by 35 percent, with market share increasing to 57.7 percent. In 2004, the shipment-weighted average annual UEC for self-cleaning ranges was 622 kWh, compared with 694 kWh for regular electric ranges.

By 2004, 38.3 percent of electric ranges consumed between 700 and 799 kWh per year and 41.1 percent of them consumed less than 600 kWh; whereas before 1992, those that dominated the market consumed between 800 and 849 kWh (42 percent).

Approximately 78.5 percent of all electric ranges were shipped for retail sales, whereas 21.5 percent were tagged for builder shipments. British Columbia and the Territories had a substantially larger builder shipment representation (42.8 percent) than the rest of the country, whereas Quebec had a somewhat lower share (6.6 percent).

Electric ranges were the only appliances that did not experience a notable decline in energy consumption following the introduction of the MEPS in 1995. Cumulative energy savings grew slowly but steadily between 1994 and 2002, as annual energy savings began to accrue. The savings increased substantially in 2003 and 2004 due to a new testing method and energy consumption standard introduced in October 2003. Total energy savings for the study period reached 0.66 PJ (183.33 million kWh). Dollar savings for electric ranges, for the study period, were estimated to be $16.1 million (calculated at 8.8 cents/kWh).

5 CLOTHES WASHERS

5.1 2004 Market Snapshot

In 2004, 29 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 258 kilowatt hours (kWh), compared with 702 kWh for top-loading ones.

As noted earlier, the ENERGY STAR® level for standard clothes washes increased in stringency in 2004. Over 36 percent of the standard models on the market that year qualified for ENERGY STAR, exceeding the minimum energy performance standards (MEPS) by at least 36 percent and having a modified energy factor (MEF) of at least 40.21 L/kWh/cycle.[30]

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
Average Annual Change	**4.5%**	**4.5%**

5.2 Distribution of Shipments

5.2.1 Distribution by Type

Although front-loading washers have been in use for many years – most often in commercial laundries, appliance manufacturers have more recently developed new models of front-loading washers, which are designed for domestic use. Overall, front-loading clothes washers are more energy efficient, using about 40 percent less water per load and 50 percent less energy than top-loading washers.[31]

Table 5.1 demonstrates the increase in popularity of front-loading models versus traditional top-loading ones since 2001 (the first year that shipment data for front-loading clothes washers were available), with market share increasing to 29.2 percent in 2004. This represents a 13.5 percent increase since 2001, or an annual growth rate of 4.5 percent.

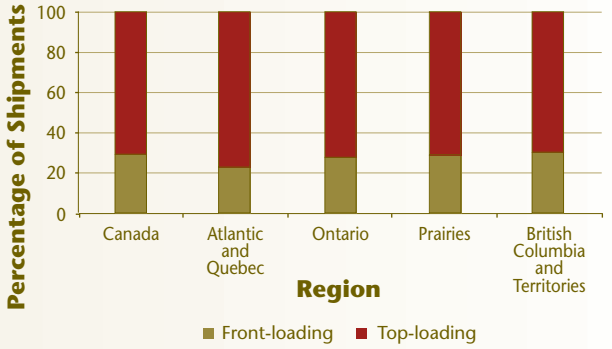
In 1990, 98.2 percent of the clothes washers shipped used more than 800 kWh per year. By 2004, 64.8 percent of all clothes washers consumed less than 700 kWh. This significant improvement is partly due to the 2004 amendment to the MEPS (announced in 2003), and the increase in popularity of front-loading models.

[30] Natural Resources Canada. *EnerGuide Appliance Directory 2005*, Ottawa, 2005, p. 192.
[31] Ibid.

5.2.2 Distribution by Type, by Region/Province

As reported previously, front-loading clothes washers have steadily increased their market share since 2001, with the national average in 2004 being 29.2 percent. Figure 5.1 demonstrates that the regional percentages of front- versus top-loading washers did not vary significantly from the national results. The Atlantic provinces and Quebec had a slightly lower (22.8 percent) share of front-loading models. For confidentiality reasons, we have grouped the Atlantic provinces and Quebec together for this analysis.

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



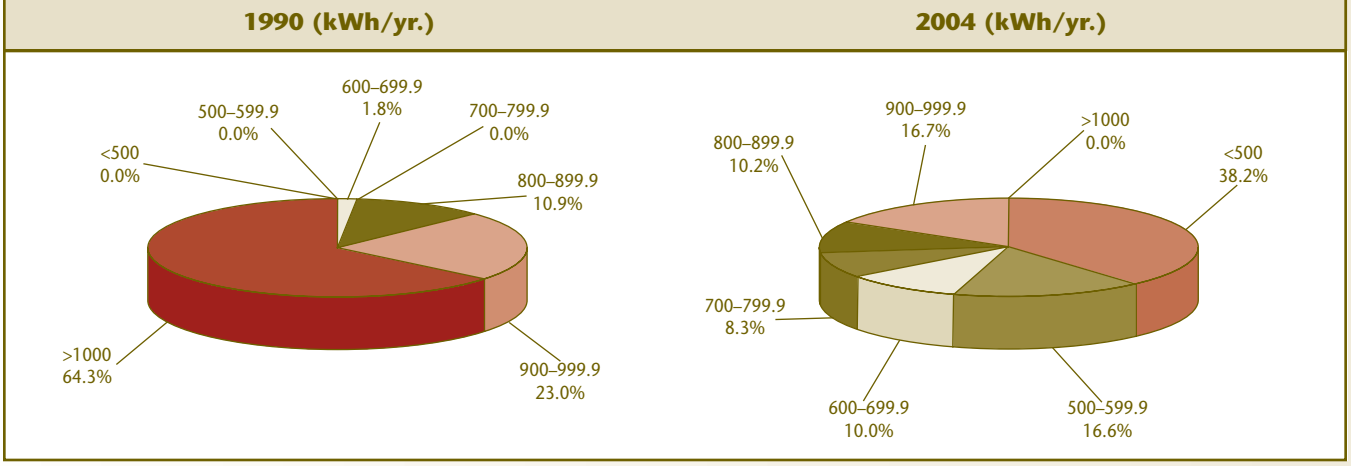
*For greater detail, see Table C.29.

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	800–899.9	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
Average Annual Change	2.7%	1.2%	0.6%	0.6%	0.0%	0.5%	4.6%

FIGURE 5.2
Distribution of Clothes Washers by Average Annual Unit Energy Consumption for 1990 and 2004

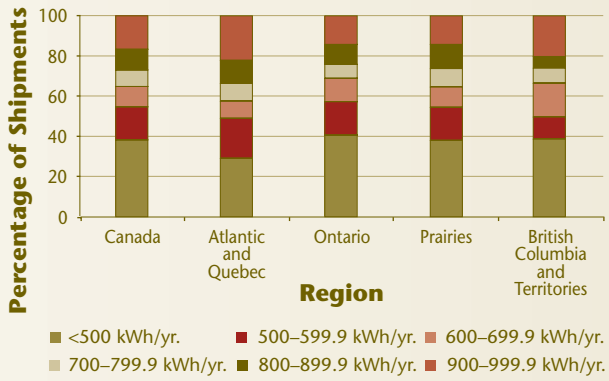


As shown in Table 5.2, the energy consumption of clothes washers improved significantly during the study period. In 1990, 98.2 percent of the clothes washers shipped used more than 800 kWh per year. By 2004, 64.8 percent of all clothes washers consumed less than 700 kWh (compared to 33.0 percent in 2003). This significant improvement is partly due to the 2004 amendment to the MEPS (announced in 2003), and the increase in popularity of front-loading models.

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

In 2004, 64.8 percent of all clothes washers shipped in Canada consumed less than 700 kWh. Figure 5.3 shows the distribution tendencies throughout the regions/provinces. Ontario and the Prairies had the lowest market share of clothes washers consuming more than 900 kWh/yr. The Atlantic provinces and Quebec had the lowest market share of those consuming less than 500 kWh/yr. However, based on findings in the SHEU-03,[32] 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. Even though these regions had relatively less energy-efficient clothes washers, they seemed to have more energy-efficient clothes washing habits than other regions.

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



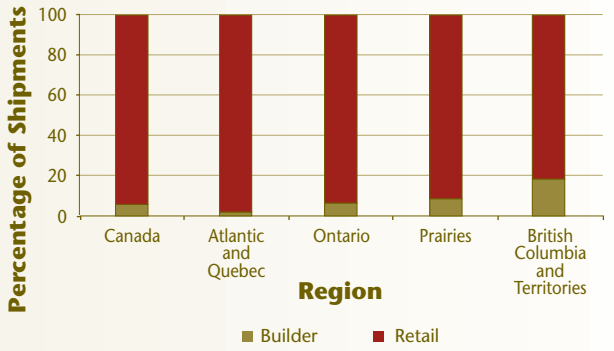
*For greater detail, see Table C.30.

[32] Natural Resources Canada. *2003 Survey of Household Energy Use, Summary Report*, Chart 43, Ottawa, 2006, p. 23.

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. It shows that, on average, approximately 94.2 percent of all clothes washers were shipped for retail sales, versus 5.8 percent for builders. The chart also shows British Columbia and the Territories having a slightly larger share of builder shipments than the rest of the country. Our data also show that, on average, 18 percent of builder shipments were front-loading clothes washers, although in British Columbia and the Territories, this proportion was 39 percent.

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



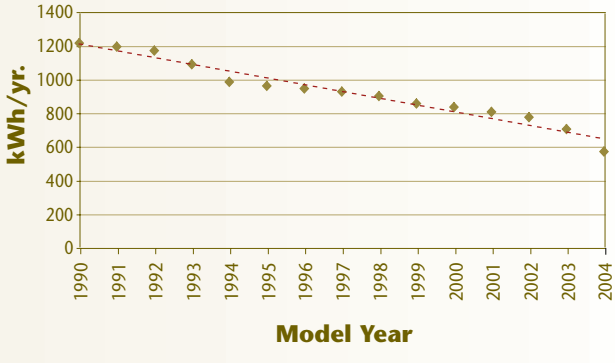
*For greater detail, see Table C.31.

5.3 Energy Consumption

5.3.1 Average Annual Unit Energy Consumption by Model Year

Between 1990 and 2004, the average annual UEC of clothes washers improved remarkably. As Figure 5.5 shows, the average annual UEC decreased by 645 kWh, or about 53 percent. The significant decrease in average annual UEC from 2002 to 2004 (over 200 kWh/yr.) coincided with the 2004 amendment to the MEPS (officially announced in 2003). Another amendment to the MEPS is expected in 2007, which will most likely cause manufacturers to increase the efficiencies of their clothes washers in anticipation of this amendment.

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

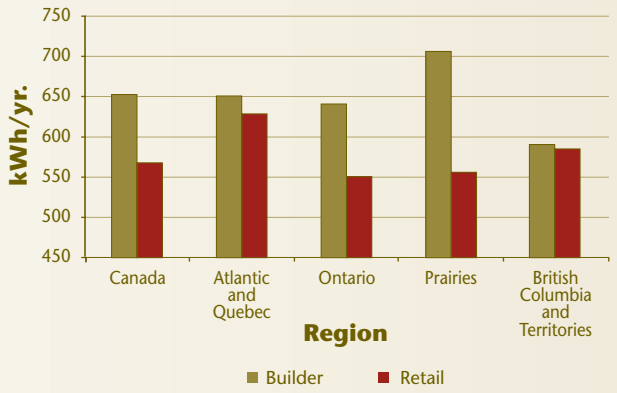


*For greater detail, see Table C.32.

5.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province, 2004

Figure 5.6 demonstrates the breakdown of the average annual UEC of clothes washers by shipments for retail purposes and for the builder trade, by region/province. It shows that, in all regions, the average annual UEC was lower for retail than for builder shipments. The builders in British Columbia and the Territories seemed to provide their clients 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 provide the largest percentage of front-loading clothes washers, which are more energy efficient than top-loading models. Retail shipments in Ontario and the Prairies were slightly more energy efficient than the national average; those in the Atlantic provinces and Quebec were less energy efficient than those in the other regions.

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



*For greater detail, see Table C.33.

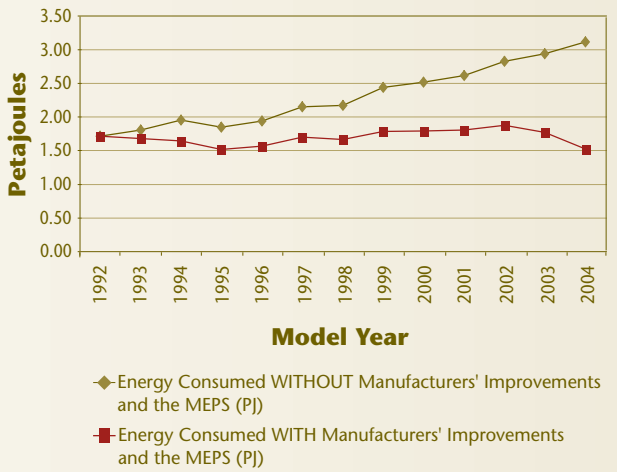
5.4 Energy Savings

It is estimated that the annual energy consumption for clothes washers was significantly lower from 1993 to 2004 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 improved technology (top line), and 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 0.66 petajoules (PJ) more per year. The largest annual energy savings occurred in 2004 (when the amendment to the MEPS came into force), when clothes washers consumed about 1.59 PJ less than they otherwise might have.

FIGURE 5.7
Energy Savings for Clothes Washers, 1992–2004*



*For greater detail, see Table C.34.

The cumulative energy savings for clothes washers are shown in Figure 5.8. Energy savings between 2000 and 2004 amounted to 4.39 PJ or 1.22 billion kWh. Accrued energy savings reached 7.84 PJ in 2004, taking into account the life expectancy factor of clothes washers (this calculation is explained further in Appendix A – Methodology). The reader should note that this change to our methodology affected only slightly the previous energy savings calculations for 2002 and 2003.

5.5 Clothes Washers Summary

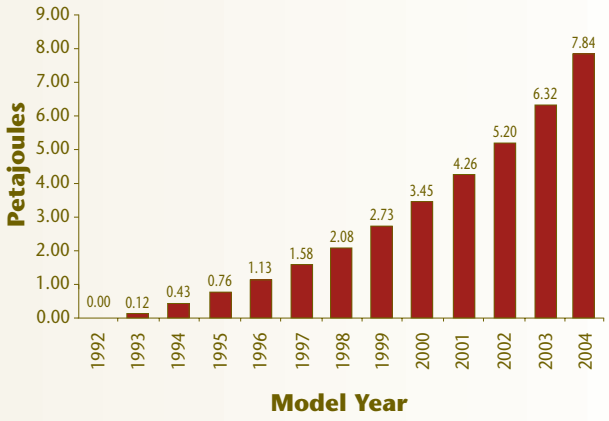
The energy efficiency of clothes washers improved steadily between 1990 and 2004 – by 2004, almost all clothes washers consumed less than 1000 kWh per year; whereas in 1990, well over half (64.3 percent) consumed more than 1000 kWh per year. There was a substantial increase in popularity of the more energy-efficient 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 from 13.5 percent to 29.2 percent in 2004.

Of the clothes washer models available in 2004, 36.2 percent were ENERGY STAR® products.

Approximately 94.2 percent of all clothes washers were shipped for retail sales, whereas 5.8 percent were tagged for builder shipments. British Columbia and the Territories had a substantially larger builder shipment representation (18.5 percent), and the Atlantic provinces and Quebec had a somewhat smaller builder shipment representation (2.0 percent) than the rest of the country.

The average annual energy savings for clothes washers were estimated to be 0.66 PJ between 1993 and 2004, with total energy savings for that period reaching 7.84 PJ (2.18 billion kWh). Dollar savings for clothes washers, for the study period, were estimated to be $191.6 million (calculated at 8.8 cents/kWh).

FIGURE 5.8
Cumulative Energy Savings for Clothes Washers, 1992–2004*



*For greater detail, see Table C.34.

6 ELECTRIC CLOTHES DRYERS

6.1 2004 Market Snapshot

In 2004, the shipment-weighted average annual unit energy consumption (UEC) of all electric clothes dryers was 912 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 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

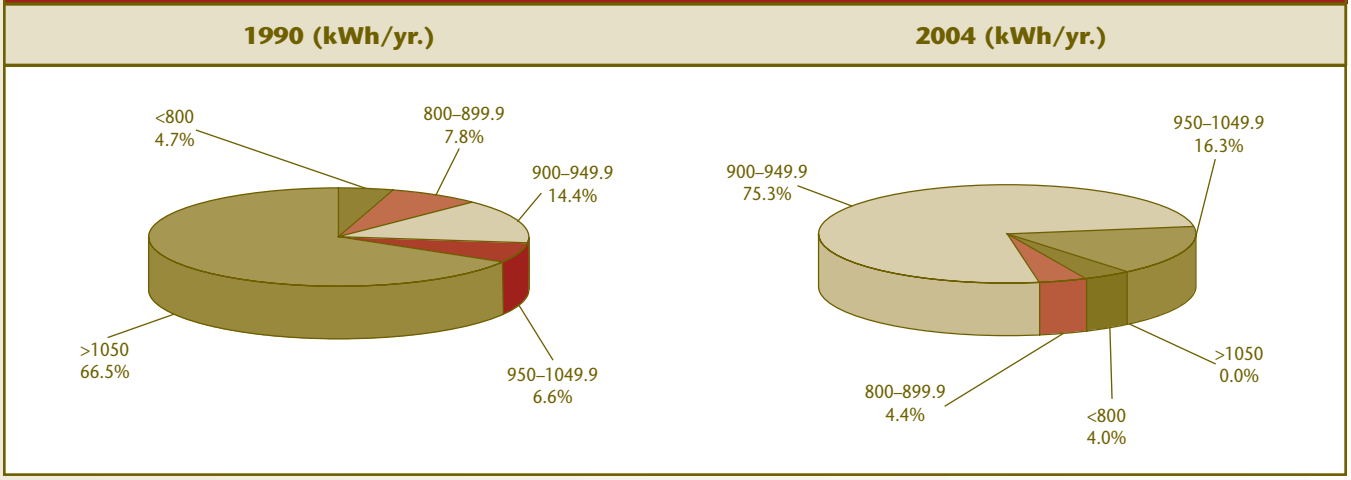
6.2.1 Distribution by Average Annual Unit Energy Consumption

Between 1990 and 2004, electric clothes dryers exhibited steady improvements in energy efficiency. The consumption level of over 1050 kWh per year, which dominated the market (66.5 percent) in 1990, had almost disappeared by 2004. In 2004, 75.3 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	kWh/yr. <800	800–899.9	900–949.9	950–999.9	1000–1049.9	>1050
	%	%	%	%	%	%
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
Average Annual Change	0.0%	↓ 0.2%	↑ 4.3%	↑ 1.2%	↓ 0.5%	↓ 4.8%

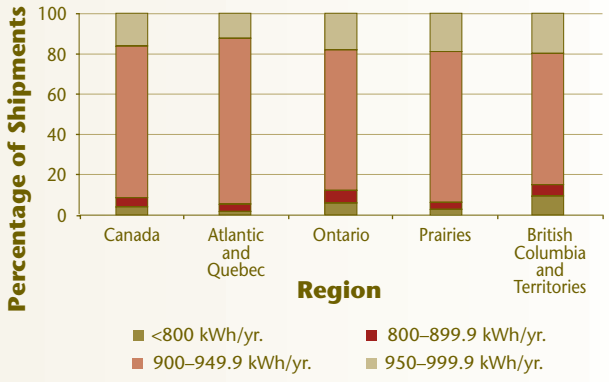
FIGURE 6.1
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption for 1990 and 2004



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

In 2004, 75.3 percent of all electric clothes dryers shipped in Canada consumed between 900 and 949 kWh. Figure 6.2 shows that Ontario and British Columbia and the Territories had a slight tendency towards lower-energy-consuming dryers (under 900 kWh/yr.). For confidentiality reasons, we have grouped the Atlantic provinces and Quebec together for this analysis. Although this chart reflects that the Atlantic provinces and Quebec favoured slightly more-energy-consuming dryers, Chart 45 in the SHEU-03[33] publication shows that over 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.

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



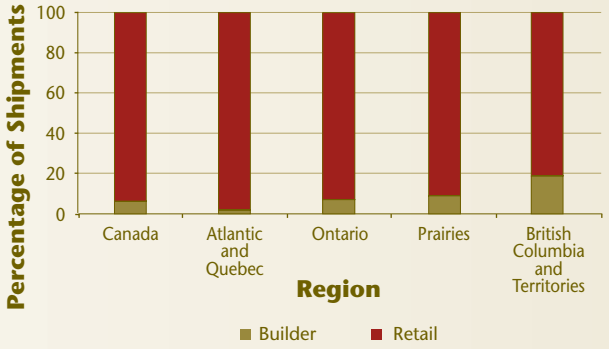
*For greater detail, see Table C.35.

[33] Natural Resources Canada. *2003 Survey of Household Energy Use, Summary Report*, Ottawa, 2006, p. 23.

6.2.3 Distribution by Channel, by Region/Province

Figure 6.3 demonstrates the proportion of electric clothes dryers shipped for retail sales versus those shipped for the building trade. It shows that, for Canada as a whole, approximately 93.7 percent of all electric clothes dryers were shipped for retail sales, whereas 6.3 percent were tagged for builder shipments. As with all other major appliances outlined in this report, British Columbia and the Territories had a larger builder shipment representation (18.9 percent) than the national average. The Atlantic provinces and Quebec had a smaller builder shipment representation (2 percent) than the rest of the country.

FIGURE 6.3
Distributions of Electric Clothes Dryers by Channel, by Region/Province, 2004*



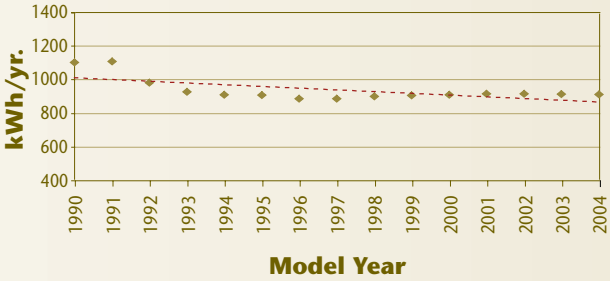
*For greater detail, see Table C.36.

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 2004 is illustrated in Figure 6.4. It shows a decrease in the average annual UEC of 191 kWh, or about 17.3 percent. This figure and Table C.37 show a significant improvement from 1991 to 1993, when the average annual UEC decreased from 1109 to 929 kWh – an impressive 180 kWh, or 16 percent. After 1993, the average annual UEC remained relatively constant.

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



*For greater detail, see Table C.37.

6.3.2 Average Annual Unit Energy Consumption by Channel, by Region/Province, 2004

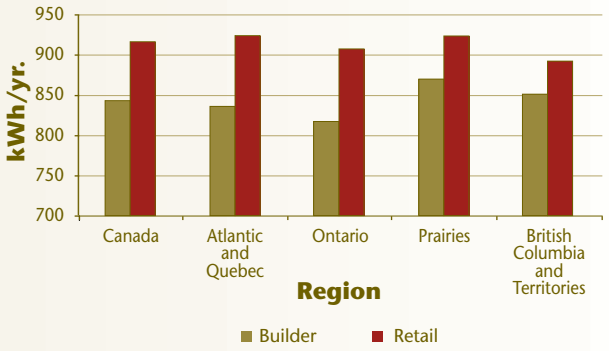
Figure 6.5 demonstrates the breakdown of the average annual UEC of electric clothes dryers by shipments for retail purposes and for the builder trade, by region/province. It shows that, in all regions, the average annual UEC was higher for retail shipments than for builder shipments. The average annual UEC for builder shipments was lowest in Ontario (817.1 kWh/yr.); the average annual UEC for retail shipments was lowest in British Columbia and the Territories (892.1 kWh/yr.).

6.4 Energy Savings

It is estimated that from 1993 to 2004, 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).

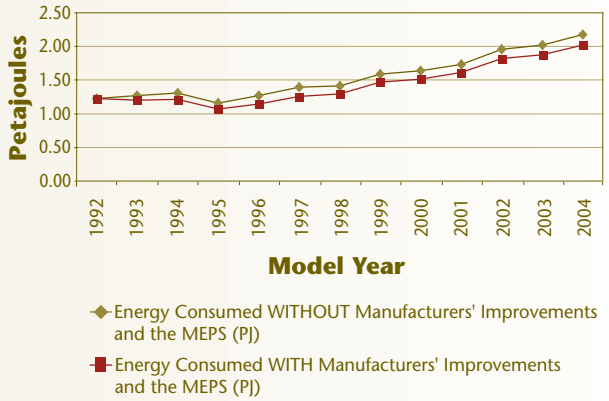
Graphically, the gap between the two lines represents incremental annual energy savings – on average, 0.12 petajoules (PJ) per year. The largest annual energy savings occurred in 2004, when electric clothes dryers consumed 0.16 PJ less than they otherwise might have.

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



*For greater detail, see Table C.38.

FIGURE 6.6
Energy Savings for Electric Clothes Dryers, 1992–2004*



*For greater detail, see Table C.39.

The cumulative energy savings for electric clothes dryers are shown in Figure 6.7. Savings grew steadily between 1992 and 2004, as annual energy savings began to accrue. They reached a total of 1.43 PJ in 2004.

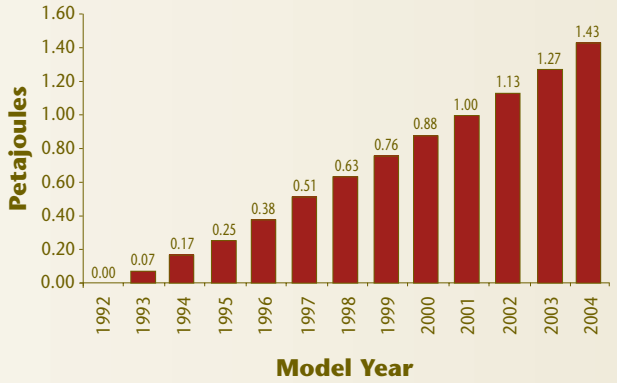
6.5 Electric Clothes Dryers Summary

The energy efficiency of clothes dryers improved steadily between 1990 and 2004 – by 2004, 83.7 percent of all clothes dryers consumed less than 1000 kWh per year; whereas in 1990, well over half (66.5 percent) consumed more than 1050 kWh per year.

Approximately 93.7 percent of all electric clothes dryers were shipped for retail sales, whereas 6.3 percent were tagged for builder shipments. Once again, British Columbia and the Territories had a substantially larger builder shipment representation (18.9 percent) than the rest of the country.

The average annual energy savings for clothes dryers were estimated to be 0.12 PJ between 1993 and 2004, with total energy savings for that period reaching 1.43 PJ (397.22 million kWh). Dollar savings for electric clothes dryers, for the study period, were estimated to be $35.0 million (calculated at 8.8 cents/kWh).

FIGURE 6.7
Cumulative Energy Savings for Electric Clothes Dryers, 1992–2004*



*For greater detail, see Table C.39.

7 SUMMARY OF HOUSEHOLD APPLIANCES

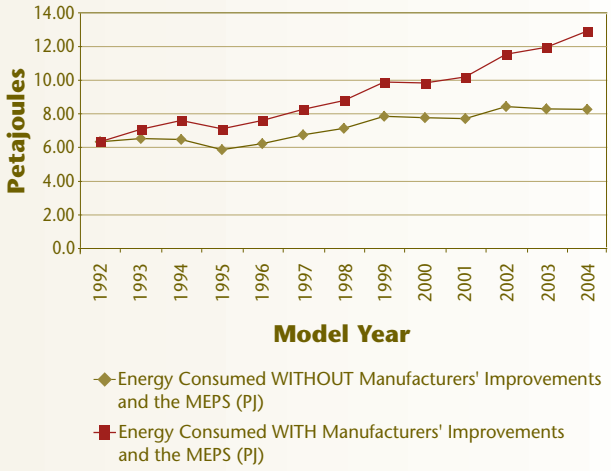
7.1 Total Energy Savings

Annual energy consumption for all major household appliances during the study period was reduced likely as a result of the following factors: an increase in general energy efficiency due to technological improvements by the manufacturers, the implementation of and amendments to the minimum energy performance standards (MEPS), the EnerGuide labelling initiative, the ENERGY STAR® initiative, and the various incentives and rebates offered by the federal, provincial/territorial, municipal governments and the utilities. Figure 7.1 shows the estimated annual energy consumption of major appliances between 1992 and 2004 without these factors, as well as how much energy was actually consumed by major appliances in 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 U.S. regulations.

The average annual energy savings for major appliances were estimated to be 2.10 petajoules (PJ) between 1993 and 2004. (No savings were expected in 1992.) This indicates that, on average, major appliances consumed about 2.10 PJ less per year than they would have without the contributing factors.

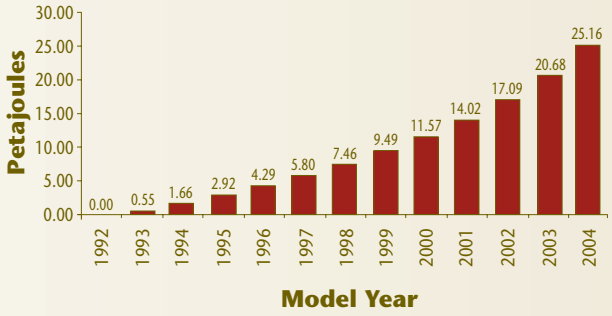
FIGURE 7.1
Energy Savings for All Major Appliances, 1992–2004*



*For greater detail, see Table C.40.

The largest annual energy savings occurred in 2004, when major appliances consumed about 4.63 PJ less than they otherwise would have. Cumulative energy savings for major appliances are shown in Figure 7.2 and Table C.40. Since the energy saved in any given year accrues over time, cumulative energy savings grew steadily between 1992 and 2004. They reached a total savings of 25.16 PJ (6.99 billion kWh) in 2004 (taking into account the life expectancy factor of the various appliances), the equivalent of a year's energy for about 219 000 households. It is estimated that these energy savings resulted in approximately $615 million in savings for consumers, calculated at 8.8 cents/kWh.[34]

FIGURE 7.2
Cumulative Energy Savings for All Major Appliances, 1992–2004*



*For greater detail, see Table C.40.

[34] Source: Natural Resources Canada. *Energy Use Data Handbook, 1990 and 1998 to 2004*, Ottawa, 2006, pp. 42–43.

APPENDIX A METHODOLOGY

A.1 Data Preparation

A.1.1 Introduction

In an ongoing effort 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 members of the Canadian Appliance Manufacturers Association (CAMA) in 1996, as part of the National Energy Use Database (NEUD) initiative.

Under this agreement, CAMA members contributed their annual shipment data for six appliance categories – refrigerators, freezers, electric ranges, dishwashers, clothes washers and electric clothes dryers – for analysis. 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 (EFC), chosen by CAMA, as the third party to receive the data.

For the collection of 2004 data, the manufacturers agreed to provide data on their shipments by province/region and by distribution channel (builder versus retailer) where possible. This has allowed a more detailed analysis of the distribution and the energy efficiency of the appliances and their energy efficiency.

The following sections describe the database preparation process conducted by EFC.

The data presented in this report combine shipment figures from the major appliance manufacturers in Canada with the energy use information contained 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 total energy consumption represented by all shipments of that model within each year. Then they aggregated these figures by province/region and channel as well as for the whole of Canada to provide the data presented in this report. They produced separate aggregated data for ENERGY STAR® models, where appropriate.

The analysts used standard database and spreadsheet software to assemble the data, manipulated them as required and passed them to NRCan for analysis and report generation. For the reporting stages, they stripped all data of any information that could identify the manufacturer or the model number.

A.1.2 Manufacturers' Data

NRCan sent initial letters to the appliance manufacturers, requesting annual shipment data for each model of refrigerator, freezer, electric range, dishwasher, clothes washer and electric clothes dryer on the Canadian market from 1990 to 2004. When the project began in 1996, only three manufacturers provided shipment data. The number of data contributors increased to eight in 2004, covering the vast majority of appliance models sold in Canada. NRCan is approaching additional manufacturers in order to improve the coverage for future data collection.

Manufacturers sent the data in various electronic and printed formats. EFC converted the electronic data to a common database format. The analysts key-edited the printed reports and then converted them to the same format.

The data consisted of the appliance type, model number and number of shipments (by province/region and channel, where possible, for 2004 data onwards) in each year. Manufacturers supplied individual files for each year. As each

manufacturer provided data in a different format, the analysts harmonized and amalgamated the files to produce a single file for all models, 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.1.3 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 was used to identify which models were listed as ENERGY STAR.

A.1.4 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 gave the shipment-weighted total energy consumption for that model. Each appliance category (e.g. refrigerator, dishwasher) and type and size category (as defined in the EnerGuide books, e.g. type 7 refrigerators, self-cleaning ranges, front-loading clothes washers) was then subtotalled so that the average consumption could be worked out.

The *EnerGuide Appliance Directory* shows the basic model numbers available on the Canadian market. Many slight model variants have the same energy rating, so the listings use symbols (such as * and #) to indicate model families. As some model numbers have additional prefixes or suffixes to indicate features (e.g. colour, door-swing) that do not affect energy use, there were relatively few direct 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 on 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 the manufacturer's.

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.

A number of 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 the identification of these models and the verification of energy ratings and types.

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

A.1.5 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 energy rating of the model by the number of shipments for the year. This yielded the shipment-weighted total energy used by 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 x 683 = 3 577 554 kWh. This aggregate figure and the shipment figures were added together as necessary to provide totals for appliance and type and size category as appropriate for each appliance type. Separate aggregated data were provided for ENERGY STAR models. All these aggregate figures were given by province/region and channels as well as Canada-wide.

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

Calculating the incremental energy savings for each appliance type involved a three-step process:

1. Baseline levels of energy consumption were estimated for each appliance type for each year between 1990 and 2004. For all appliances, baseline levels of energy consumption reflected our 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, we assumed the following:

- Without the implementation of Canada's *Energy Efficiency Regulations* and general energy efficiency improvements made by manufacturers, the unit energy consumption 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 2004 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 plus U.S. regulations.

2. "Actual" or current levels of consumption for all appliances were calculated in an identical fashion. The average annual unit energy consumption 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.

Since 1992 was the baseline year used in our calculations, we included in this year's analysis a retirement function to take into account the aging of the appliances, based on the life expectancies set out in the 2005 *EnerGuide Appliance Directory*.[35]

The method for calculating the cumulative energy savings for each appliance type changed slightly for this report, in order to avoid overestimating the actual energy savings. It 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. The reader should note that this change to our methodology affected only slightly the previous energy savings calculations for earlier years (dishwashers and clothes washers for 2002 and 2003).

This calculation was a four-step process.

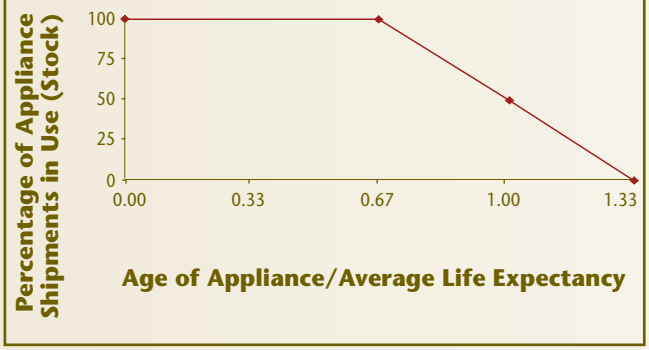
1. The average life expectancy of each appliance type was assumed to be the industry average reported in the 2005 *EnerGuide Appliance Directory*:
   a. refrigerators – 17 years
   b. freezers – 21 years
   c. electric ranges – 18 years
   d. dishwashers – 13 years
   e. clothes washers – 14 years
 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

[35] Natural Resources Canada. *EnerGuide Appliance Directory 2005*, Ottawa, 2005, p. 13.

This retirement function is demonstrated in the following chart.

FIGURE A.1
Retirement Function for Aging Appliances

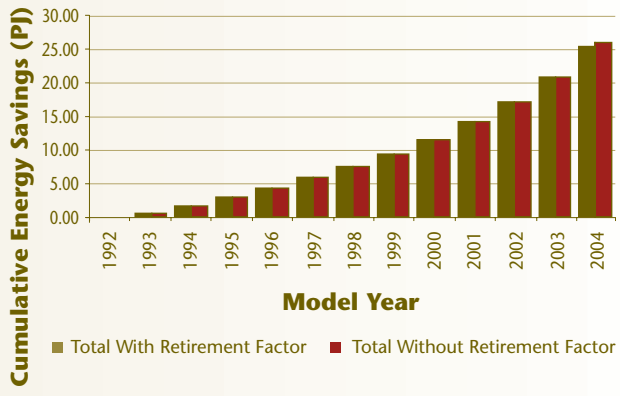


3. The rate of retirement was applied to the annual shipments of each appliance type to estimate the total stock of appliances in use for each year since our baseline year of 1992.

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 make up the stock by the incremental unit energy savings for each corresponding year.

As noted below, this new function only slightly changed energy savings calculations for previous years (dishwashers and clothes washers for 2002 and 2003). The following chart demonstrates the changes.

FIGURE A.2
Energy Savings for All Appliances With and Without Retirement Factor



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-loaded, 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 or greater

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

Electric Range

A consumer product utilizing 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

a) free-standing appliances equipped with one or more surface elements and one or more ovens;
b) built-in appliances equipped with one or more surface elements and one or more ovens;
c) built-in appliances equipped with one or more ovens and no surface elements;
d) wall-mounted appliances equipped with one or more ovens and no surface elements; or
e) counter-mounted appliances equipped with one or more surface elements and no ovens;

but do *not* include the following:

f) microwave cooking appliances;
g) portable appliances designed for an electrical supply of 120 volts; or
h) household appliances with one or more tungsten-halogen heating elements.

Freezer

An appliance designed (i) for the extended storage of food frozen at an average temperature of –17.8°C (0°F) or lower; (ii) with the inherent capability for freezing food; and (iii) with a minimum freezing capability of 2 kilograms/100 litres/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 2004, 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 at or below –17.8°C (0°F). The refrigerator with a freezer compartment is capable of maintaining simultaneously an average freezer temperature ≤–15°C (5°F) and an average fresh food compartment temperature ≥ 0°C ≤ 5°C (≥ 32°F ≤ 41°F).

In 2004, refrigerators as per 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, with top-mounted freezer and without through-the-door ice service, as well as all refrigerators without freezers but with automatic defrost
Type 4 Refrigerator-freezers with automatic defrost, with side-mounted freezer and without through-the-door ice service
Type 5 Refrigerator-freezers with automatic defrost, with bottom-mounted freezer and without through-the-door ice service
Type 6 Refrigerator-freezers with automatic defrost, with top-mounted freezer and with through-the-door ice service
Type 7 Refrigerator-freezers with automatic defrost, with side-mounted freezer and with 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 with top mounted freezer and compact all-refrigerators[36] with automatic defrost
Type 14 Compact refrigerator-freezers with automatic defrost with side-mounted freezer
Type 15 Compact refrigerator-freezers with automatic defrost with 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.

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

APPENDIX C TABLES

TABLE C.A.1
ENERGY STAR® Qualified Appliances as a Percentage of Total Shipments in Canada, 1999–2004

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

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

Region	Dishwashers	Refrigerators	Clothes Washers
	(%)	(%)	(%)
Canada	81.0	34.2	36.2
Atlantic	75.4	23.3	–
Quebec	81.3	36.9	29.9
Ontario	83.3	38.6	37.6
Prairies	78.4	33.0	36.2
British Columbia and Territories	79.5	29.3	36.4

TABLE C.1
Distribution of Refrigerators by Type, by Region/Province, 2004

Region	Type 3	Type 5	Type 7	Type 11	Others (Types 4, 6, 12, 13)
	%	%	%	%	%
Canada	66.4	15.5	11.0	4.5	2.5
Atlantic	83.2	6.4	8.0	1.1	1.3
Quebec	69.5	18.8	6.1	3.2	2.5
Ontario	64.5	14.6	13.8	3.9	3.3
Prairies	69.2	13.6	14.4	0.5	2.3
British Columbia and Territories	59.6	13.6	13.2	11.0	2.7

TABLE C.2
Distribution of Refrigerators by Volume, by Region/Province, 2004

	Volume (cu. ft.)						
Region	<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.
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Canada	4.3	2.6	3.6	11.7	39.5	14.0	24.2
Atlantic	1.9	6.4	7.8	21.4	40.3	9.4	12.9
Quebec	4.3	2.0	2.8	8.0	48.9	17.3	16.7
Ontario	4.4	1.3	4.7	14.8	34.6	12.9	27.3
Prairies	0.6	2.8	3.0	10.5	40.8	12.7	29.6
British Columbia and Territories	12.7	7.6	0.8	9.3	29.1	13.8	26.7

TABLE C.3
Distribution of Refrigerators for Retail Shipments by Volume, by Region/Province, 2004

Region	Volume (cu. ft.)						
	<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.
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Canada	6.7	1.5	2.2	8.2	39.9	16.5	25.0
Atlantic	1.2	3.1	6.5	22.0	41.7	10.9	14.7
Quebec	4.5	0.6	2.5	7.0	49.5	18.4	17.5
Ontario	5.7	0.4	1.8	9.1	35.7	15.3	32.0
Prairies	0.7	0.9	3.1	8.9	39.7	15.4	31.2
British Columbia and Territories	19.4	2.8	0.7	10.3	24.2	17.2	25.4

TABLE C.4
Distribution of Refrigerators for Builder Shipments by Volume, by Region/Province, 2004

Region	Volume (cu. ft.)						
	<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.
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Canada	0.5	10.2	8.7	23.8	36.3	4.1	16.4
Atlantic	4.9	20.2	13.2	18.9	34.6	3.2	5.1
Quebec	0.3	23.4	7.6	22.2	40.2	0.7	5.5
Ontario	0.1	4.5	14.7	34.5	30.8	4.6	10.9
Prairies	0.3	9.9	2.7	17.0	44.8	1.9	23.4
British Columbia and Territories	0.8	16.2	0.9	7.6	37.9	7.6	29.0

TABLE C.5
Distribution of Refrigerators by Average Annual Unit Energy Consumption per Cubic Foot, by Region/Province, 2004

Region	<30 kWh/cu. ft./yr.	30–39.9 kWh/cu. ft./yr.	40–49.9 kWh/cu. ft./yr.	50–59.9 kWh/cu. ft./yr.	>60 kWh/cu. ft./yr.
	%	%	%	%	%
Canada	82.6	11.0	1.3	0.2	5.0
Atlantic	83.3	11.9	3.7	0.0	1.1
Quebec	86.1	9.2	0.9	0.0	3.7
Ontario	84.1	10.7	0.8	0.0	4.4
Prairies	82.5	14.9	1.6	0.0	1.1
British Columbia and Territories	72.6	13.5	1.6	0.0	12.3

TABLE C.6
Distribution of Refrigerators by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	18.6	81.4
Atlantic	19.1	80.9
Quebec	6.3	93.7
Ontario	22.5	77.5
Prairies	20.8	79.2
British Columbia and Territories	36.1	63.9

TABLE C.7
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	768.6	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	682.6	496.0	554.0	619.8	321.3	419.0	356.7	–	–	477.7

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

Model Year	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
	(cu. ft.)															
	(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

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

Model Year	cu. ft. 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	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

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

Region	Builder	Retail
	(kWh/yr.)	
Canada	464.3	480.7
Atlantic	463.8	477.8
Quebec	455.6	471.7
Ontario	451.9	489.0
Prairies	477.8	497.1
British Columbia and Territories	483.3	469.2

TABLE C.11
Distribution of Refrigerators Consuming Less Than 40 kWh/cu. ft./yr., 2004

Region	Builder	Retail
	%	%
Canada	96.9	92.8
Atlantic	83.0	98.0
Quebec	91.6	95.6
Ontario	98.2	93.8
Prairies	98.9	98.4
British Columbia and Territories	96.6	80.2

TABLE C.12
Energy Savings for Refrigerators, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements, the MEPS and Improvements to the MEPS	Energy Consumed WITH Manufacturers' Improvements, the MEPS and Improvements to the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.13
Distribution of Freezers by Type, by Region/Province, 2004

Region	Type 8	Type 9	Type 10	Type 18
	%	%	%	%
Canada	29.4	8.3	45.5	16.8
Atlantic	19.8	10.2	38.0	32.0
Quebec	41.3	5.6	22.7	30.4
Ontario	28.2	17.8	18.9	35.1
Prairies	31.7	12.6	25.9	29.8
British Columbia and Territories	30.0	15.0	30.8	24.1

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

Region	20–29.9 kWh/cu. ft./yr.	30–39.9 kWh/cu. ft./yr.	40–49.9 kWh/cu. ft./yr.	50–59.9 kWh/cu. ft./yr.
	%	%	%	%
Canada	28.9	48.8	22.3	0.1
Atlantic	34.3	46.0	19.3	0.3
Quebec	27.9	51.3	20.7	0.1
Ontario	22.2	51.1	26.6	0.1
Prairies	33.2	47.3	19.5	0.0
British Columbia and Territories	36.7	40.6	22.6	0.1

TABLE C.15
Distribution of Freezers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	1.8	98.2
Atlantic	0.9	99.1
Quebec	0.9	99.1
Ontario	0.5	99.5
Prairies	5.0	95.0
British Columbia and Territories	15.5	84.5

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

Model Year	Type 8	Type 9	Type 10	Type 18	Total
			(kWh/yr.)		
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

TABLE C.17
Energy Savings for Freezers, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements, the MEPS and Improvements to the MEPS	Energy Consumed WITH Manufacturers' Improvements, the MEPS and Improvements to the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.18
Distribution of Dishwashers by Average Annual Unit Energy Consumption, by Region/Province, 2004

Region	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.
	(%)	(%)	(%)	(%)	(%)
Canada	4.0	24.3	46.4	16.5	8.8
Atlantic	9.0	21.3	37.6	17.6	14.5
Quebec	4.0	28.0	43.0	17.7	7.5
Ontario	4.6	22.7	48.5	16.4	7.8
Prairies	2.7	23.5	48.5	15.5	9.8
British Columbia and Territories	3.4	24.1	45.6	16.1	10.9

TABLE C.19
Distribution of Dishwashers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	14.3	85.7
Atlantic	15.3	84.7
Quebec	3.0	97.0
Ontario	15.1	84.9
Prairies	16.7	83.3
British Columbia and Territories	32.3	67.7

TABLE C.20
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

TABLE C.21
Average Annual Unit Energy Consumption of Dishwashers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(kWh/yr.)	
Canada	443.0	459.1
Atlantic	454.4	469.4
Quebec	449.2	454.3
Ontario	447.0	454.7
Prairies	442.1	465.2
British Columbia and Territories	434.6	472.6

TABLE C.22
Energy Savings for Dishwashers, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS	Energy Consumed WITH Manufacturers' Improvements and the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.23
Distribution of Electric Ranges by Type, by Region/Province, 2004

Region	Self-Cleaning	Non-Self-Cleaning
	%	%
Canada	57.7	42.3
Atlantic	46.3	53.7
Quebec	59.6	40.4
Ontario	55.7	44.3
Prairies	60.3	39.7
British Columbia and Territories	59.3	40.7

TABLE C.24
Distribution of Electric Ranges by Average Annual Unit Energy Consumption, by Region/Province, 2004

Region	<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.
	%	%	%	%	%	%	%
Canada	27.8	13.3	4.8	3.8	18.8	19.5	12.0
Atlantic	18.4	14.6	2.3	3.3	14.9	24.6	22.0
Quebec	30.9	15.0	4.1	4.1	18.1	16.0	11.8
Ontario	25.9	12.3	5.0	4.6	17.8	21.7	12.7
Prairies	32.3	14.7	5.0	2.3	18.8	17.8	9.1
British Columbia and Territories	19.3	7.1	6.8	3.0	28.6	23.6	11.6

TABLE C.25
Distribution of Electric Ranges by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	21.5	78.5
Atlantic	19.5	80.5
Quebec	6.6	93.4
Ontario	28.2	71.8
Prairies	22.6	77.4
British Columbia and Territories	42.8	57.2

TABLE C.26
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

TABLE C.27
Average Annual Unit Energy Consumption of Electric Ranges by Channel, by Region/Province, 2004

Region	Builder	Retail
	(kWh/yr.)	
Canada	730.9	631.3
Atlantic	709.5	677.8
Quebec	714.3	625.9
Ontario	739.5	634.6
Prairies	724.1	610.2
British Columbia and Territories	728.7	684.2

TABLE C.28
Energy Savings for Electric Ranges, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS	Energy Consumed WITH Manufacturers' Improvements and the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.29
Distribution of Clothes Washers by Type, by Region/Province, 2004

Region	Front-Loading	Top-Loading
	%	%
Canada	29.2	70.8
Atlantic and Quebec	22.8	77.2
Ontario	27.7	72.3
Prairies	28.9	71.1
British Columbia and Territories	30.2	69.8

TABLE C.30
Distribution of Clothes Washers by Average Annual Unit Energy Consumption, by Region/Province, 2004

Region	<500 kWh/yr.	500–599.9 kWh/yr.	600–699.9 kWh/yr.	700–799.9 kWh/yr.	800–899.9 kWh/yr.	900–999.9 kWh/yr.	>1000 kWh/yr.
	%	%	%	%	%	%	%
Canada	38.2	16.6	10.0	8.3	10.2	16.7	0.0
Atlantic and Quebec	29.2	19.9	8.5	8.7	11.6	22.1	0.0
Ontario	40.7	16.5	11.6	6.9	9.9	14.3	0.0
Prairies	38.0	16.5	10.0	9.1	12.0	14.3	0.0
British Columbia and Territories	38.8	11.0	16.8	7.4	5.7	20.3	0.0

Table C.31
Distribution of Clothes Washers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	5.8	94.2
Atlantic and Quebec	2.0	98.0
Ontario	6.4	93.6
Prairies	8.5	91.5
British Columbia and Territories	18.5	81.5

TABLE C.32
Average Annual Unit Energy Consumption of Clothes Washers by Model Year

Model Year	Front-Loading	Top-Loading	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	288.09	912.96	859.9
2000	274.23	922.66	838.3
2001	286.96	904.65	810.1
2002	300.55	871.06	779.2
2003	274.77	826.94	708.4
2004	258.41	702.31	572.9

TABLE C.33
Average Annual Unit Energy Consumption of Clothes Washers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(kWh/yr.)	
Canada	653.0	568.0
Atlantic and Quebec	651.1	629.0
Ontario	641.0	550.7
Prairies	706.3	556.0
British Columbia and Territories	590.7	585.3

TABLE C.34
Energy Savings for Clothes Washers, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS	Energy Consumed WITH Manufacturers' Improvements and the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.35
Distribution of Electric Clothes Dryers by Average Annual Unit Energy Consumption, by Region/Province, 2004

Region	<800 kWh/yr.	800–899.9 kWh/yr.	900–949.9 kWh/yr.	950–999.9 kWh/yr.
	(%)	(%)	(%)	(%)
Canada	4.0	4.4	75.3	16.3
Atlantic and Quebec	1.8	3.6	82.1	12.4
Ontario	5.9	6.3	69.7	18.1
Prairies	2.8	3.4	74.8	19.0
British Columbia and Territories	9.4	5.5	65.1	19.9

TABLE C.36
Distribution of Electric Clothes Dryers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(%)	(%)
Canada	6.3	93.7
Atlantic and Quebec	2.0	98.0
Ontario	7.2	92.8
Prairies	8.9	91.1
British Columbia and Territories	18.9	81.1

TABLE C.37
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

TABLE C.38
Average Annual Unit Energy Consumption of Electric Clothes Dryers by Channel, by Region/Province, 2004

Region	Builder	Retail
	(kWh/yr.)	
Canada	843.1	916.5
Atlantic and Quebec	836.2	924.1
Ontario	817.1	907.7
Prairies	870.1	923.6
British Columbia and Territories	851.3	892.1

TABLE C.39
Energy Savings for Electric Clothes Dryers 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS	Energy Consumed WITH Manufacturers' Improvements and the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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

TABLE C.40
Energy Savings for All Major Appliances, 1992–2004

Model Year	Energy Consumed WITHOUT Manufacturers' Improvements and the MEPS	Energy Consumed WITH Manufacturers' Improvements and the MEPS	Annual Energy Savings	Cumulative Energy Savings (with retirement factor)
	(PJ)	(PJ)	(PJ)	(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