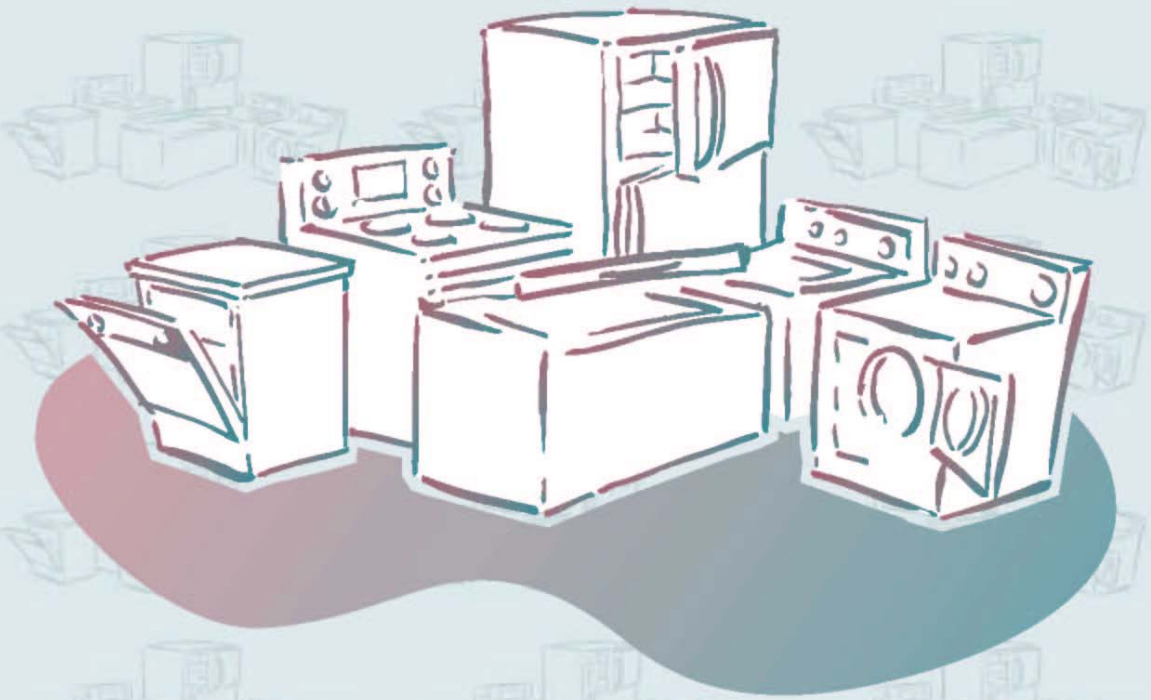
Office of Energy Efficiency
National Energy Use Database

Energy Consumption of Major Household Appliances Shipped in Canada — Trends for 1990–1999

November 2001



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Energy Consumption of Major Household Appliances Shipped in Canada

Trends for 1990–1999

November 2001

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Cat. No. M92-176/2001
ISBN 0-662-66100-1
Aussi disponible en français sous le titre : Consommation d’énergie des gros appareils ménagers expédiés au Canada

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Foreword

In an ongoing effort to improve the monitoring of trends in Canadian energy use, Natural Resources Canada's Office of Energy Efficiency (OEE) 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 the arrangement, key CAMA members agreed to provide 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. These manufacturers represent a large part of the Canadian market for the six appliance groups.

Each model's shipments, provided by CAMA, were matched to their associated unit energy consumption ratings found in the *EnerGuide Appliance Directory* database. The annual shipment-weighted unit energy consumption was then calculated for each appliance category. This report details the results of the analysis on the estimated shipment-weighted average unit energy consumption, in kilowatt hours (kWh) per year, of the six major household appliance categories shipped in Canada between 1990 and 1999. It also provides data on the annual distribution of shipments by unit energy consumption range for the six types of appliances during the same period. This report added an analysis on freezers that was not available in the previous report, which was based on 1990–1997 shipment data.

This is the second in the series of such reports published by the OEE. Readers may observe differences between this report and the previous one. The differences are due to updates and an increase in the number of data contributors. For the first report, there were four data contributors; for this report, data are based on six data contributors. 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 OEE would also like to thank the consulting firms of Chrispen-Roberts Direct Data Ltd. and STATPLUS for their preparation of the database and their advice on data analysis.

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Highlights

Between 1990 and 1999, the energy efficiency of all major household appliances placed on the market, excluding electric ranges, improved dramatically.

- The shipment-weighted average annual unit energy consumption of refrigerators decreased by 31 percent.
- The shipment-weighted average annual unit energy consumption of freezers decreased by 46 percent.[1]
- The shipment-weighted average annual unit energy consumption of dishwashers decreased by 38 percent.
- The shipment-weighted average annual unit energy consumption of clothes washers decreased by 29 percent.
- The shipment-weighted average annual unit energy consumption of electric clothes dryers decreased by 18 percent.

The significant research and development carried out by the appliance manufacturers, and the minimum energy performance standards contained in the *Energy Efficiency Regulations* and the EnerGuide for Equipment Program (both authorized under the 1992 *Energy Efficiency Act*), are largely responsible for bringing about these improvements.

[1] Note that the 1990 figures do not include all contributors.

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Introduction

This report outlines changes in the energy use and distribution of major household appliances from 1990 to 1999. It is based on the shipments 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).

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. For more information on the *Energy Efficiency Regulations*, consult the *Guide to Canada's Energy Efficiency Regulations* (ISBN 0-662-26948-9, Catalogue No. M92-98/1998E) or visit our Web site at http://oee.nrcan.gc.ca/regulations/home_page.cfm.

Readers should also 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. In fact, retailers keep inventory as low as possible ("just in time" inventory). For this reason, we believe that the shipment data given in this report closely reflect the purchasing behaviour of consumers.

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) and electric clothes dryers (Chapter 6). Given the diversity of types and sizes of refrigerators, the chapter dealing with refrigerators is more detailed.

No analysis on average "Energy Consumption by Model Year" was undertaken for refrigerators. Refrigerators are classified by many types and sizes. It seemed inappropriate to group these types and sizes together to calculate the "Average Energy Consumption."

It should also be noted that, even though the minimum energy performance standards did not come into effect until 1995, all sections dealing with "Energy Savings" used 1992 as baseline measures. This is because market forces such as the regulations in the U.S. and the impending regulations expected from the *Energy Efficiency Act* of 1992 showed that impact on energy efficiency improvement began almost immediately after the Act came into force.

Specific definitions of the various types of appliances are given in Appendix B.

1 Refrigerators

1.1 1999 Market Snapshot

In 1999, as in all previous years since 1990, Type 3 refrigerators were by far the most popular type of refrigerator in Canada, accounting for 84 percent of all refrigerators shipped on the Canadian market. Type 3 is defined as 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. The shipment-weighted average annual unit energy consumption of all refrigerators shipped in 1999 was 660 kWh. The most popular size category, 16.5–18.4 cu. ft., accounted for 47 percent of the market.

Table 1.1. Refrigerator Market, 1999

	Market Share
Type of Refrigerator* (%)	
1	0.4
2	0.0
3	83.8
4	2.5
5	5.0
6	0.4
7	7.8
Through-the-Door Ice Service (%)	8.3
Type of Freezer (%)	
Top-mounted	84.2
Side-mounted	10.4
Bottom-mounted	5.0

*For definitions of types of refrigerators, see Appendix B.

Figure 1.1. Type 3 Refrigerator Models Available in 1999

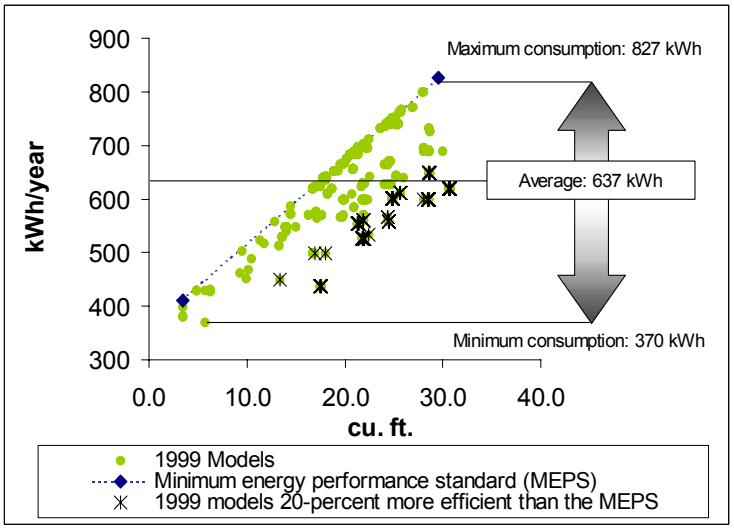


Figure 1.1 presents the energy consumption of Type 3 models shipped on the market in 1999, compared to the *minimum energy performance standard (MEPS)* that was implemented in 1995. All manufacturers met, and some even exceeded, the MEPS. Among the available 1999 Type 3 models, 9 percent achieved energy efficiency levels that were at least 20 percent better than the MEPS. In 1999, the shipment-weighted average annual unit energy consumption of Type 3 refrigerators was 637 kWh per year.

1.2 Distribution of Shipments

1.2.1 Distribution by Type

Table 1.2. Distribution of Refrigerators by Type

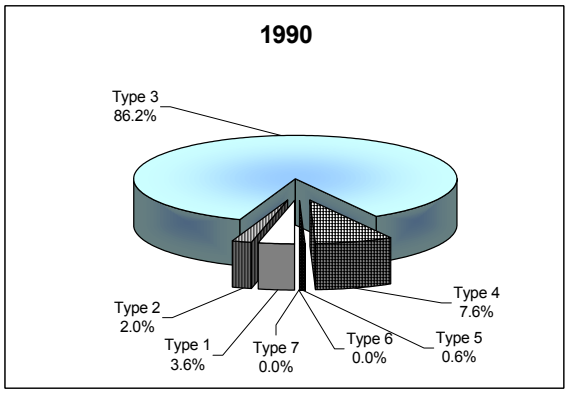
Model Year	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1990	3.6	2.0	86.2	7.6	0.6	0.0	0.0
1991	3.4	0.3	86.3	9.0	0.8	0.0	0.3
1992	2.2	0.4	86.1	7.8	0.3	0.0	3.2
1993	1.2	0.6	86.4	6.9	0.7	0.0	4.2
1994	1.9	0.7	86.1	4.9	2.0	0.1	4.3
1995	2.1	0.6	85.8	4.6	1.6	0.1	5.2
1996	0.6	0.5	85.4	4.5	2.2	0.1	6.7
1997	0.2	0.1	86.3	3.9	1.1	0.0	8.3
1998	0.7	0.0	81.6	3.5	6.4	0.3	7.4
1999	0.4	0.0	83.8	2.5	5.0	0.4	7.8
Average Annual Change	**0.4%**	**0.2%**	**0.3%**	**0.6%**	**0.5%**	–	**0.9%**

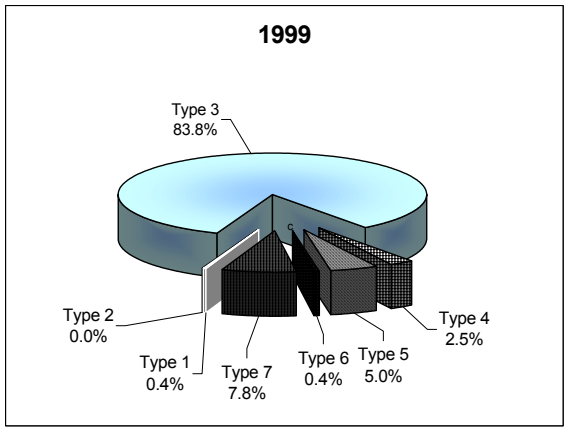
Figure 1.2. Distribution of Refrigerators by

Although Type 3 refrigerators were consistently the most shipped model between 1990 and 1999, their market share declined from 86.2 to 83.8 percent of all refrigerators shipped on the market (Table 1.2).

Types 1, 2 and 4 also experienced a decrease in their market shares between 1990 and 1999 (from a combined 13.2 to 2.9 percent). Type 5 and Type 7 refrigerators increased in popularity.

The shipments of refrigerators with through-the-door ice service (Types 6 and 7) also rose during the same period. They did not have a significant market share in 1990. By 1999, they accounted for 8.2 percent of the market. There was also a 4.4-percent increase in refrigerators with bottom-mounted freezers (Type 5) between 1990 and 1999.





1.2.2 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	1.6	13.6	6.8	13.4	38.7	12.5	13.5
1997	0.3	11.5	7.2	12.7	40.1	12.7	15.4
1998	0.7	10.1	7.7	11.5	45.7	11.0	13.3
1999	0.4	8.6	7.0	11.0	47.0	10.6	15.4
Average Annual Change	**0.4%**	**0.5%**	**1.2%**	**0.3%**	**0.4%**	**0.9%**	**1.1%**

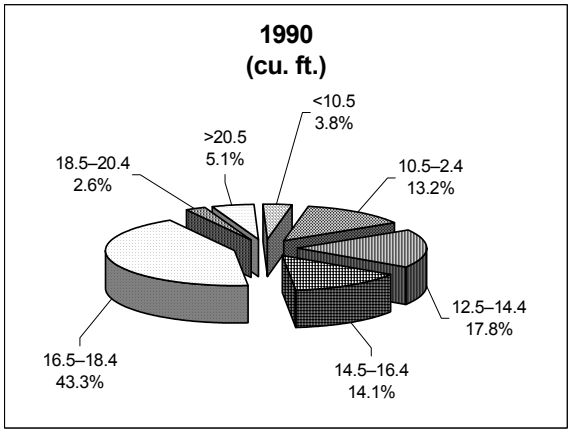
Figure 1.3. Distribution of Refrigerators by Volume for 1990 and 1999

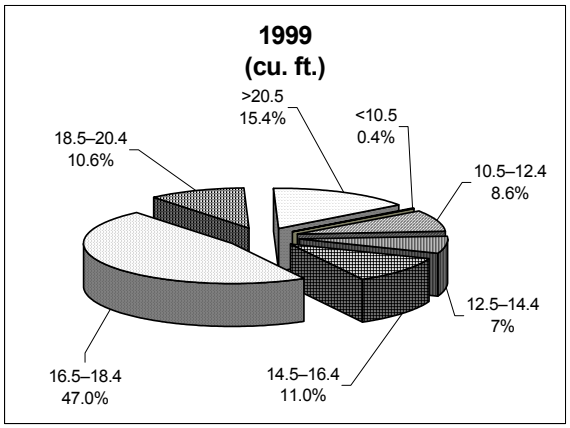
From 1990 to 1999, there was a trend toward the purchase of larger refrigerators. The market share of refrigerators with a volume of 16.4 cu. ft. or less decreased, while the market share of refrigerators with a volume of 16.5 cu. ft. or more increased.

Refrigerators with a volume between 16.5 and 18.4 cu. ft. were consistently the most popular. On average, they accounted for 43.5 percent of the market share from 1990 to 1999.

At the same time, the market share of the largest refrigerators (those with a volume of 20.5 cu. ft. and greater) more than tripled – rising from 5.1 to 15.4 percent. The market share of refrigerators with volumes ranging from 18.5 to 20.4 cu. ft. also increased significantly – from 2.6 percent in 1990 to 10.6 percent in 1999.

In contrast, all refrigerators measuring 16.4 cu. ft. or less decreased their market share by a total of 21.9 percent from the years 1990 to 1999.





1.2.3 Distribution by Annual Unit Energy Consumption Per Cubic Foot

Table 1.4. Distribution of Refrigerators by Annual Unit Energy Consumption

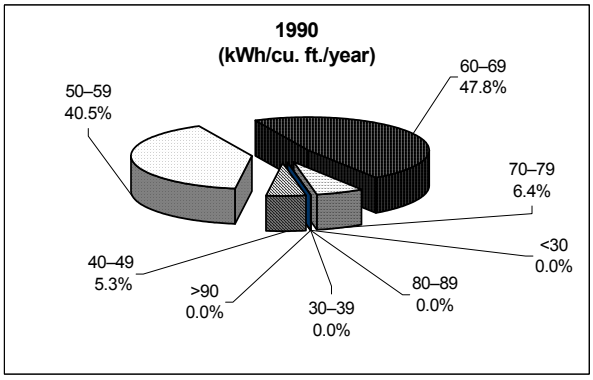
Model Year	kWh/cu. ft./year							
	<30	30–39	40–49	50–59	60–69	70–79	80–89	>90
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1990	0.0	0.0	5.3	40.5	47.8	6.4	0.0	0.0
1991	0.0	2.6	5.6	60.0	26.6	5.1	0.0	0.0
1992	0.0	0.1	7.8	75.1	17.0	0.0	0.0	0.0
1993	0.0	12.6	77.5	8.0	1.8	0.0	0.0	0.0
1994	0.0	60.1	36.9	0.0	1.9	0.0	0.0	1.1
1995	0.0	57.0	39.5	0.0	1.8	0.0	0.0	1.6
1996	0.0	61.4	37.2	0.0	1.0	0.0	0.0	0.4
1997	0.2	63.1	36.5	0.0	0.2	0.0	0.0	0.0
1998	1.5	59.5	38.3	0.0	0.0	0.0	0.0	0.6
1999	1.7	65.3	32.7	0.0	0.0	0.0	0.0	0.3
Average Annual Change	0.2%	7.2%	3.0%	4.5%	5.3%	0.7%	–	–

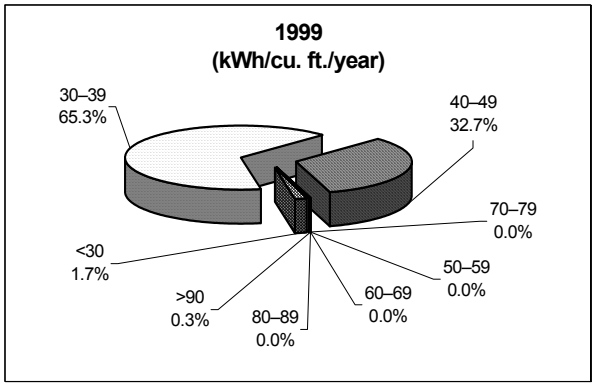
Figure 1.4. Distribution of Refrigerators by Annual Unit Energy Consumption

Due to the ongoing efforts of manufacturers and the *Energy Efficiency Regulations* introduced in 1995, refrigerators are becoming more efficient. From 1990 to 1999, the market share of refrigerators requiring less than 49 kWh per cu. ft. increased from 5.3 to 99.6 percent.

The greatest increase in market share was observed in refrigerators that used between 30 and 39 kWh per cu. ft. per year. Refrigerators in this range of energy consumption virtually did not exist in 1990, but they grew to account for 65.2 percent of the market in 1999, when they became the most dominant model.

In 1990, refrigerators requiring more than 50 kWh per cu. ft. per year were the most dominant, accounting for 88.3 percent of the market. Since 1994, virtually no refrigerators required more than 50 kWh per cu. ft. per year to operate.





1.2.4 Distribution by Volume for Type 3 Refrigerators

Table 1.5. Distribution of Type 3 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	1.5	14.2	19.6	16.2	44.6	0.5	3.4
1991	2.4	16.1	10.8	16.5	48.3	2.8	3.2
1992	0.8	12.6	10.3	22.7	45.6	5.4	2.6
1993	1.0	9.2	7.6	19.2	52.2	8.1	2.7
1994	1.2	11.0	7.8	19.0	53.2	6.4	1.4
1995	1.1	16.4	7.8	17.5	46.1	8.7	2.4
1996	0.5	15.9	7.9	15.7	45.2	10.6	4.2
1997	0.0	13.4	8.4	14.8	46.4	10.0	7.1
1998	0.0	12.3	9.4	14.1	49.8	8.7	5.7
1999	0.0	10.3	8.4	13.1	51.9	9.6	6.7
Average Annual Change	0.2% ↓	0.4% ↓	1.2% ↓	0.3% ↓	0.8% ↑	1.0% ↑	0.4% ↑

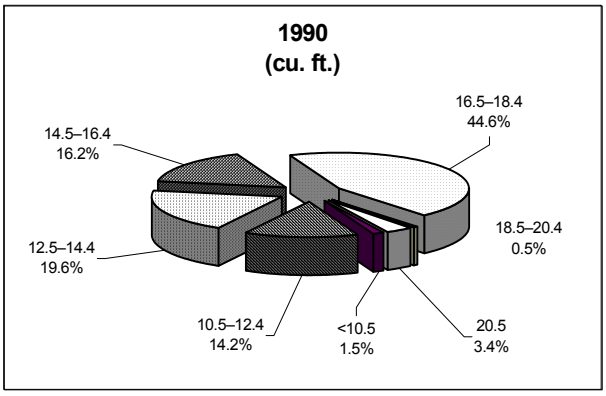
Figure 1.5. Distribution of Type 3 Refrigerators by Volume for 1990 and 1999

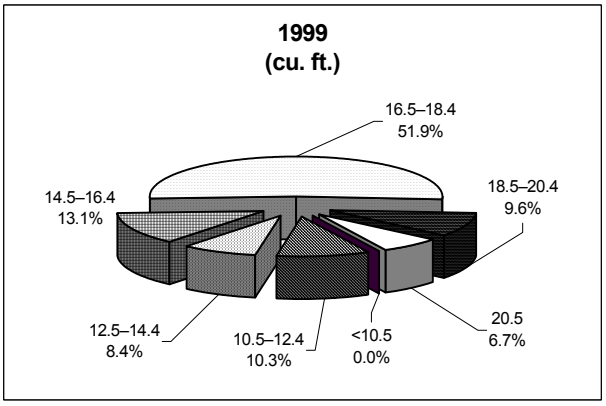
More in-depth analyses were performed on Type 3 refrigerators since they consistently dominated the market share (85 percent). As shown in Section 1.2.2, Canadian consumers are moving toward buying larger refrigerators. This trend is also true for Type 3 refrigerators.

Between 1990 and 1999, the most dominant size of Type 3 refrigerators was between 16.5 and 18.4 cu. ft. Their market share fluctuated during this period, ranging from 44.6 to 51.9 percent.

At the same time, the market share of Type 3 refrigerators with volumes greater than 18.5 cu. ft. increased by 12.4 percent, from 3.9 to 16.3 percent.

In contrast, smaller Type 3 refrigerators (less than 10.5 cu. ft.) had all but disappeared by 1999.

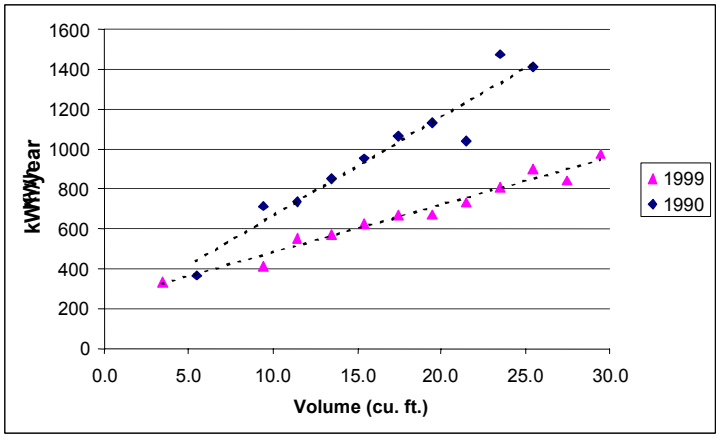




1.3 Energy Consumption

1.3.1 Average Annual Unit Energy Consumption by Volume

Figure 1.6. Average Annual Unit Energy Consumption of Refrigerators by Volume*



*For greater detail, see Table C.1.

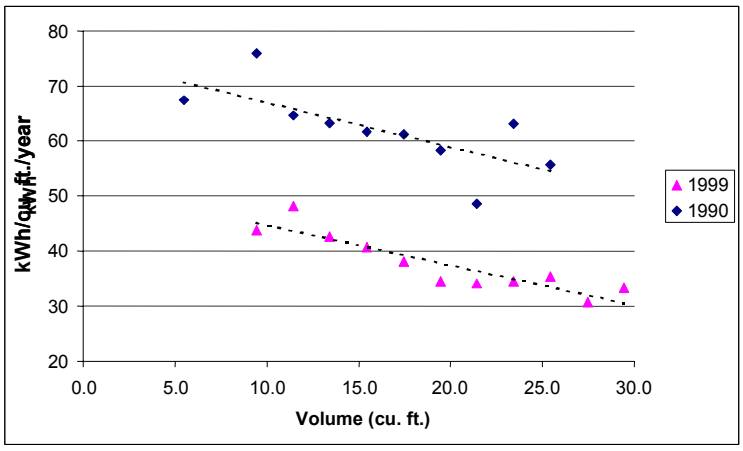
Between 1990 and 1999, the energy performance of refrigerators improved remarkably. As illustrated in Figure 1.6, the larger the volume, the greater the decrease in average annual unit energy consumption. The average annual unit energy consumption of refrigerators with volumes below 8.5 cu. ft. remained relatively unchanged during the period.

In 1990, refrigerators with volumes greater than 16.5 cu. ft. consumed on average more than 1000 kWh of electricity per year (see Table C.1 on page 40). By 1999, the largest units consumed, on average, only 978 kWh of electricity per year.

In 1999, the gap narrowed between the average annual unit energy consumption of the largest and smallest units, relative to 1990. In 1990, the difference between the average annual unit energy consumption of the largest and smallest units was about 1000 kWh. By 1999, that difference shrank to about 650 kWh as a result of manufacturers improving the energy efficiency of larger models.

1.3.2 Average Annual Unit Energy Consumption Per Cubic Foot

Figure 1.7. Average Annual Unit Energy Consumption Per Cubic Foot of Refrigerators by Volume*



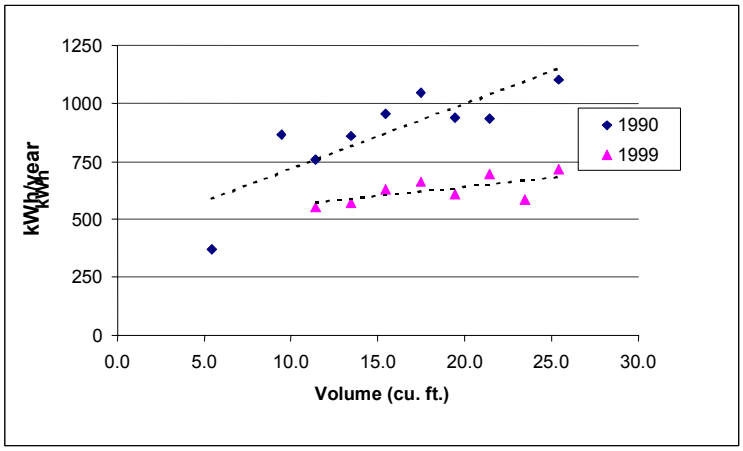
*For greater detail, see Table C.2.

The trend in the average annual unit energy consumption of refrigerators, on a per-cubic-foot basis, is consistent with the above findings. As shown in Figure 1.7, larger models consume less energy per cubic foot than smaller ones.

This was the case for both 1990 and 1999. The most marked difference is that 1999 models, on average, consumed 22 kWh per cu. ft. less than 1990 models of equal volume.

1.3.3 Average Annual Unit Energy Consumption by Volume for Type 3 Refrigerators

Figure 1.8. Average Annual Unit Energy Consumption of Type 3 Refrigerators by Volume*



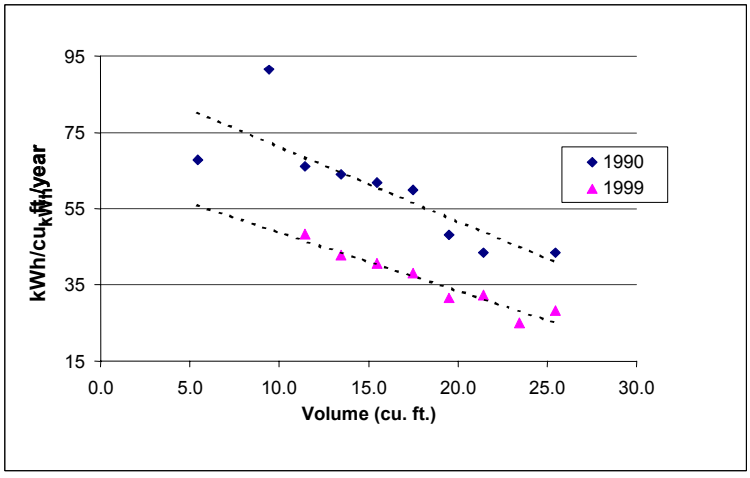
*For greater detail, see Table C.3.

Figure 1.8 illustrates a trend for Type 3 refrigerators that is similar to that observed for the overall refrigerator market. For Type 3 refrigerators, the larger the unit, the greater the decrease in average annual unit energy consumption between 1990 and 1999 models.

While all units over 10.5 cu. ft. consumed on average more than 750 kWh of electricity per year in 1990, no unit in 1999 consumed on average more than 750 kWh per year. In fact, all Type 3 refrigerators consumed, on average, between 550 and 720 kWh in 1999.

1.3.4 Average Annual Unit Energy Consumption Per Cubic Foot for Type 3 Refrigerators

Figure 1.9. Average Annual Unit Energy Consumption Per Cubic Foot of Type 3 Refrigerators by Volume*



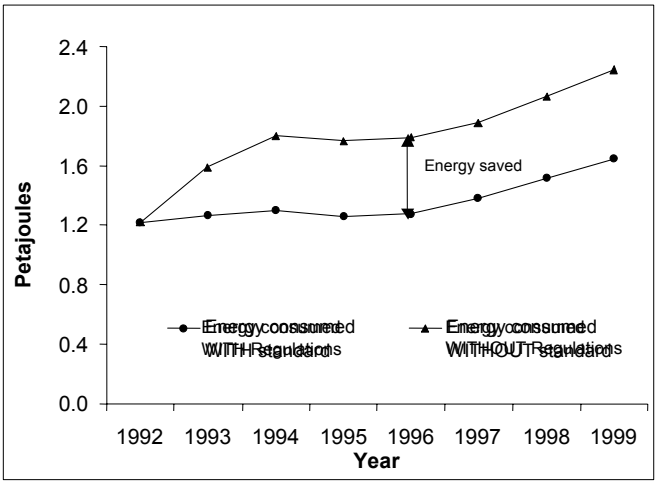
*For greater detail, see Table C.4.

The trend in the average annual unit energy consumption of Type 3 refrigerators, on a per-cubic-foot basis, is consistent with the trend for the market as a whole. As shown in Figure 1.9, larger models consume less energy per cubic foot than smaller models.

This was the case for both 1990 and 1999. The most marked difference was that 1999 models, on average, consumed 18 kWh per cu. ft. less than 1990 models of equal volume.

1.4 Energy Savings

Figure 1.10. Annual Energy Savings by Refrigerators,1992–1999*

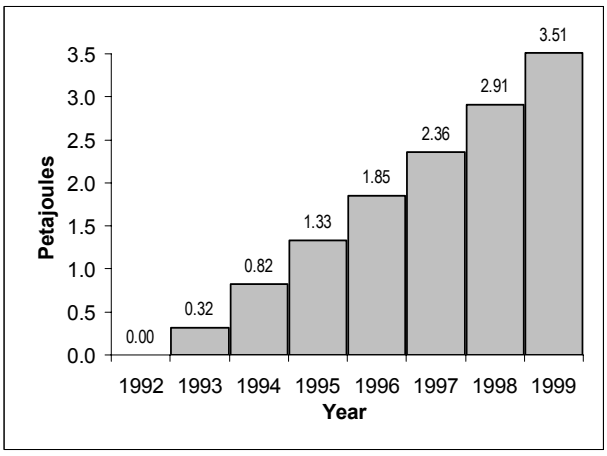


*For greater detail, see Table C.5.

It is estimated that annual refrigerator energy consumption was significantly less than it *would have been*, had manufacturers not improved the general energy efficiency of refrigerators and had the 1995 *Energy Efficiency Regulations* never been introduced. Figure 1.10 depicts the difference between how much energy refrigerators were likely to have consumed annually if manufacturers did not comply with the Regulations ("Energy consumed WITHOUT Regulations"), and how much energy refrigerators actually consumed because manufacturers improved technology from 1992 to 1999 and met the MEPS ("Energy consumed WITH Regulations").

Graphically, the difference between the two lines in Figure 1.10 represents the incremental annual energy savings that resulted from manufacturers meeting the MEPS enacted in 1995. Market forces such as the regulations in the U.S. and the impending regulations expected from the 1992 *Energy Efficiency Act* showed that the impact on energy efficiency improvement began in 1992. For this reason, the calculation of energy savings is based on data from 1992 onward.

Figure 1.11. Cumulative Energy Savings by Refrigerators, 1992–1999*



*For greater detail, see Table C.5.

The average annual energy savings for refrigerators were estimated to be 0.5 petajoules (PJ) between 1993 and 1999. (No savings were expected in 1992.) This indicates that, on average, refrigerators consumed about 0.5 PJ less annually than they would have, had manufacturers neither met the MEPS set out in the *Energy Efficiency Regulations* nor improved appliance technology since 1992.

The largest annual energy savings occurred in 1999, when refrigerators consumed about 0.6 PJ less than they otherwise would have. Cumulative energy savings for refrigerators are shown in Figure 1.11 and Table C.5 on page 42. Since the energy saved in any given year accrues over time, cumulative energy savings grew steadily between 1992 and 1999. They reached a maximum of 3.51 PJ in 1999.

2 Freezers

2.1 1999 Market Snapshot

In 1999, Type 10 freezers were the most popular type and the most energy efficient in Canada. They accounted for 76 percent of all freezers shipped on the 1999 Canadian market, and their shipment-weighted average annual unit energy consumption was 338 kWh. Most of the freezers available on the market in 1999 are at the MEPS (Figures 2.1, 2.2, 2.3). Type 10 freezers are defined as chest freezers and all other freezers not defined as Type 8 (upright freezers with manual defrost) or Type 9 (upright freezers with automatic defrost).

Figure 2.1. Type 10 Freezer Models Available in 1999

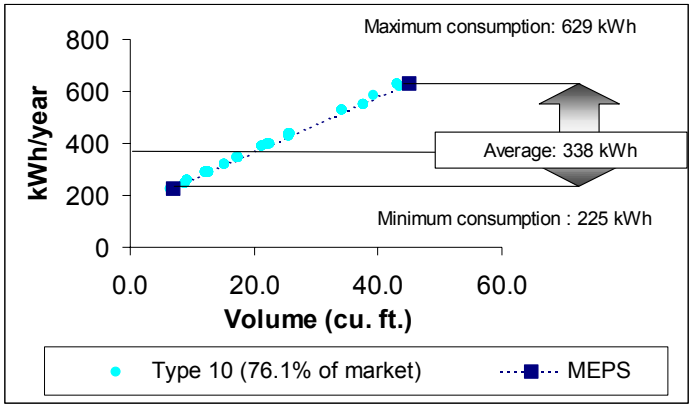


Figure 2.2. Type 9 Freezer Models Available in 1999

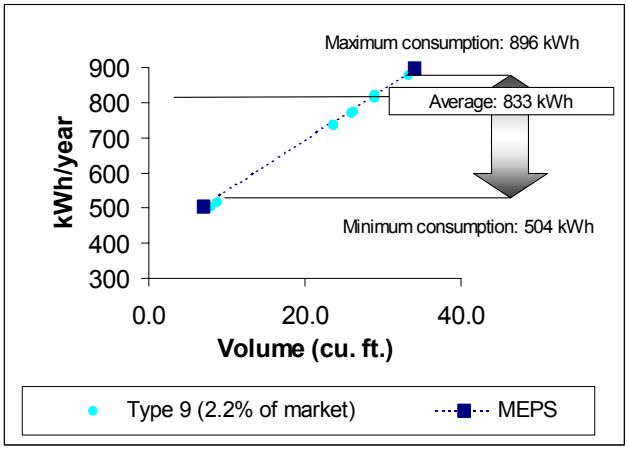
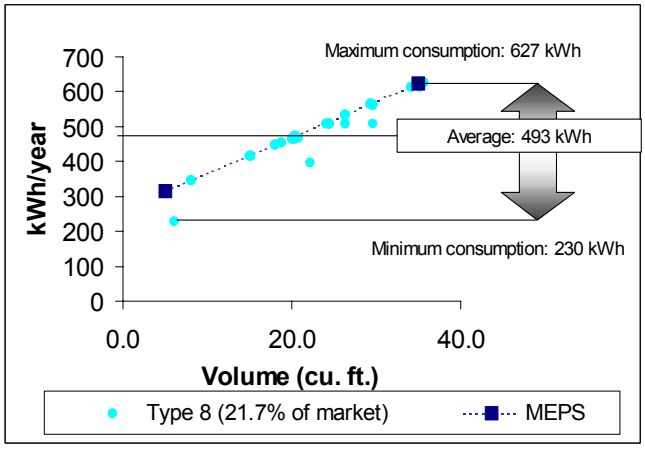


Figure 2.3. Type 8 Freezer Models Available in 1999



2.2 Distribution of Shipments

2.2.1 Distribution by Type

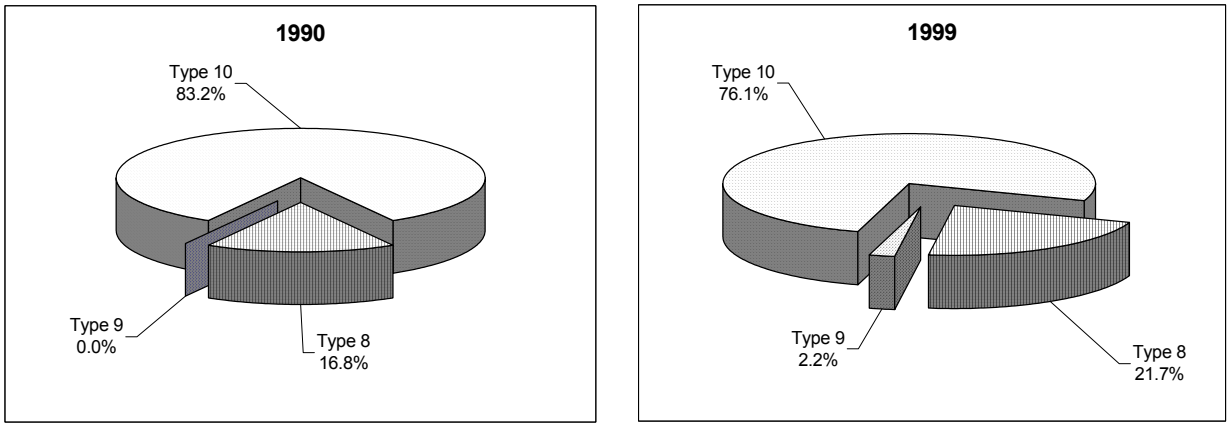
The market share of Type 10 freezers declined from 83.2 to 76.1 percent between 1990 and 1999. Yet, they consistently dominated the overall freezer market.

Conversely, upright freezers gained market share during the same period. Upright freezers with manual defrost (Type 8) exhibited a 4.9-percent increase in market share between 1990 and 1999. They accounted for 21.7 percent of the market in 1999.

Table 2.1. Distribution of Freezers by Type

Model Year	Type 8	Type 9	Type 10
	(%)	(%)	(%)
1990	16.8	0.0	83.2
1991	11.8	0.4	87.8
1992	12.9	0.3	86.7
1993	14.4	0.6	85.0
1994	12.9	0.6	86.4
1995	16.1	0.7	83.2
1996	17.2	1.1	81.7
1997	19.5	1.0	79.5
1998	21.1	1.8	77.1
1999	21.7	2.2	76.1
Average Annual Change	**0.5%**	**0.2%**	**0.8%**

Figure 2.4. Distribution of Freezers by Type for 1990 and 1999

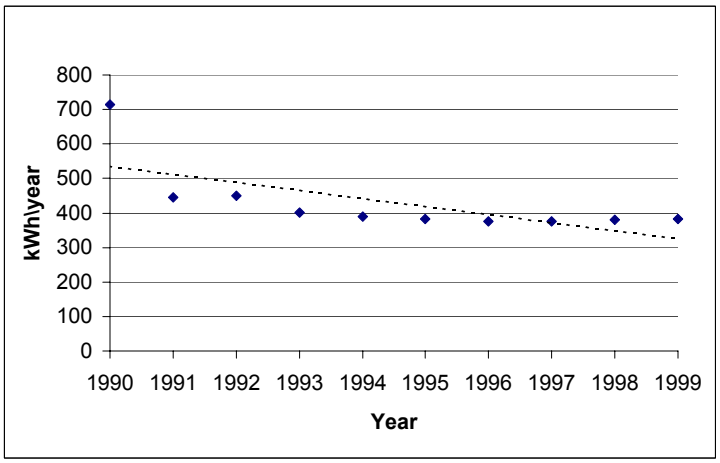


2.3 Energy Consumption

2.3.1 Average Annual Unit Energy Consumption by Model Year

Figure 2.5. Average Annual Unit Energy Consumption of Freezers by Model Year*

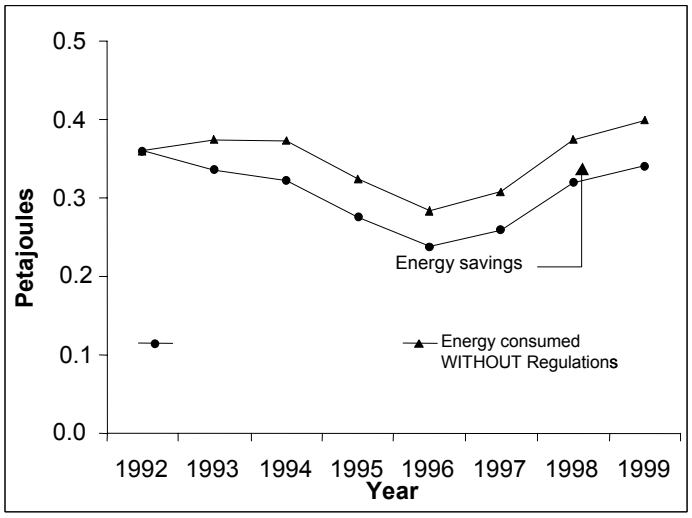
Between 1990 and 1999, freezers became significantly more energy efficient. As illustrated in Figure 2.5, the average annual unit energy consumption decreased significantly in 1991 and then gradually decreased to the year 1999. Overall, the average annual unit energy consumption decreased 46 percent, or 331 kWh, from 1990 to 1999.



*For greater detail, see Table C.6.

2.4 Energy Savings

Figure 2.6. Annual Energy Savings by Freezers, 1992–1999*



*For greater detail, see Table C.7.

It is estimated that, from 1993 to 1999, annual freezer energy consumption was slightly lower than it *would have been*, had the 1995 *Energy Efficiency Regulations* never been introduced and had manufacturers not improved the general energy efficiency of freezers.

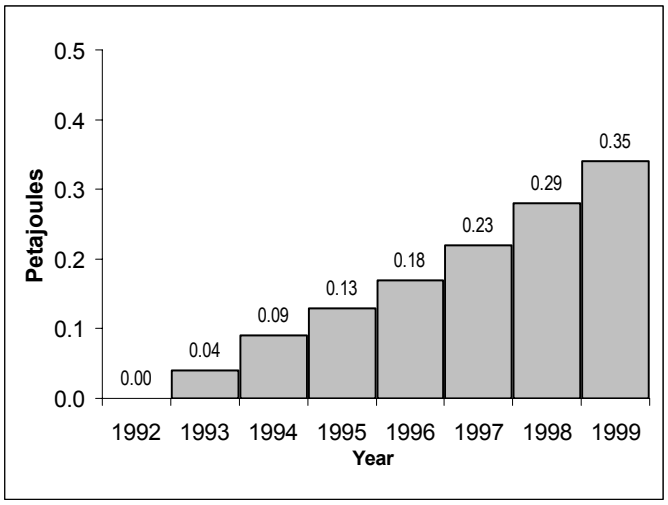
Figure 2.6 illustrates the difference between how much energy freezers were likely to have consumed annually in the absence of the MEPS and manufacturers introducing new technologies ("Energy consumed WITHOUT Regulations"), and how much energy freezers actually consumed as a result of manufacturers meeting the MEPS and developing energy efficiency ("Energy consumed WITH Regulations"). Graphically, the difference

between the two lines in Figure 2.6 represents the incremental annual energy savings that resulted from manufacturers meeting the MEPS and making related technological improvements.

The average annual energy savings for new freezers were estimated to be 0.05 PJ from 1993 to 1999. (No savings were expected for 1992.) The largest annual energy savings occurred in 1998 and 1999, when freezers consumed about 0.06 PJ less than they otherwise might have.

The cumulative energy savings for freezers are shown in Figure 2.7. Since annual energy savings accrue over time, cumulative energy savings grew steadily between 1992 and 1999 to reach 0.35 PJ in 1999.

Figure 2.7. Cumulative Energy Savings by Freezers, 1992–1999*



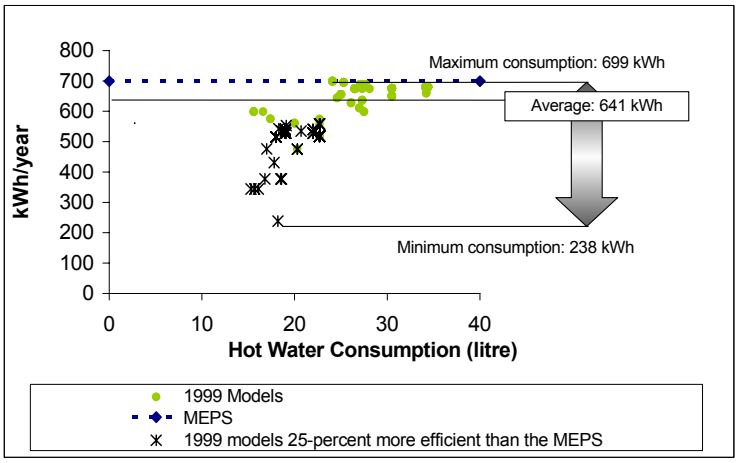
*For greater detail, see Table C.7.

3 Dishwashers

3.1 1999 Market Snapshot

The shipment-weighted average annual unit energy consumption of dishwashers in 1999 was 641 kWh. That year, nearly 29 percent of the standard models (exterior width ≥ 56 cm) that manufacturers made available on the market achieved energy consumption levels that were at least 25 percent better than the MEPS regulated in Canada.

Figure 3.1. Dishwasher Models Available in 1999



3.2 Distribution of Shipments

3.2.1 Distribution by Annual Unit Energy Consumption

Table 3.1. Distribution of Standard Dishwashers by Annual Unit Energy Consumption

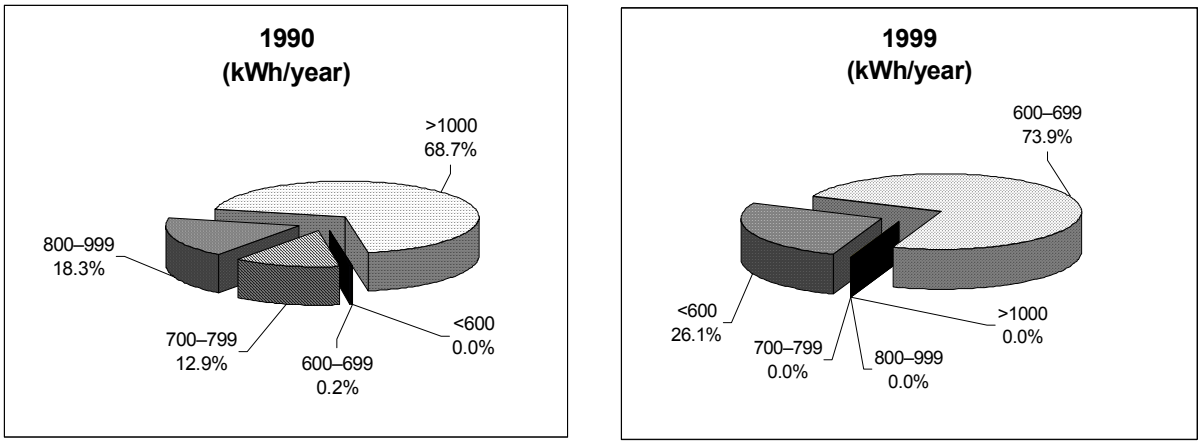
Model Year	kWh				
	< 600	600–699	700–799	800–999	>1000
	(%)	(%)	(%)	(%)	(%)
1990	0.0	0.2	12.9	18.3	68.7
1991	0.0	5.8	15.3	27.5	51.4
1992	0.0	8.5	7.4	63.1	20.9
1993	0.4	7.6	6.8	62.2	23.1
1994	1.0	32.7	31.0	23.5	11.7
1995	2.1	63.6	34.1	0.1	0.1
1996	4.6	63.2	32.0	0.0	0.1
1997	21.3	57.3	21.4	0.0	0.0
1998	24.0	72.3	3.7	0.0	0.0
1999	26.1	73.9	0.0	0.0	0.0
Average Annual Change	2.9%	8.2%	1.4%	2.0%	7.6%

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 1999, dishwashers consuming more than 700 kWh annually had practically disappeared from the market. At this time, virtually all dishwashers consumed less than 699 kWh annually.

The most dominant range of energy consumption was between 600 and 699 kWh. These units account for about three quarters (73.9 percent) of the market share.

Figure 3.2. Distribution of Dishwashers by Annual Unit Energy Consumption for 1990 and 1999

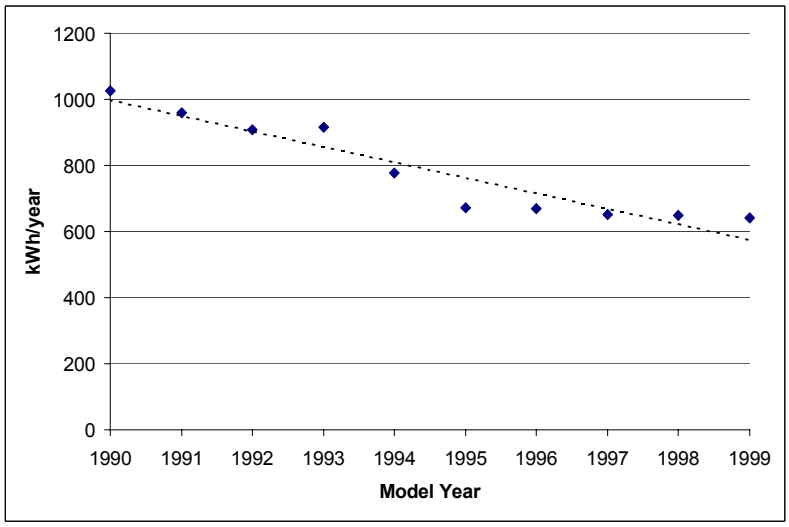


3.3 Energy Consumption

3.3.1 Average Annual Unit Energy Consumption by Model Year

Figure 3.3. Average Annual Unit Energy Consumption of Dishwashers by Model Year*

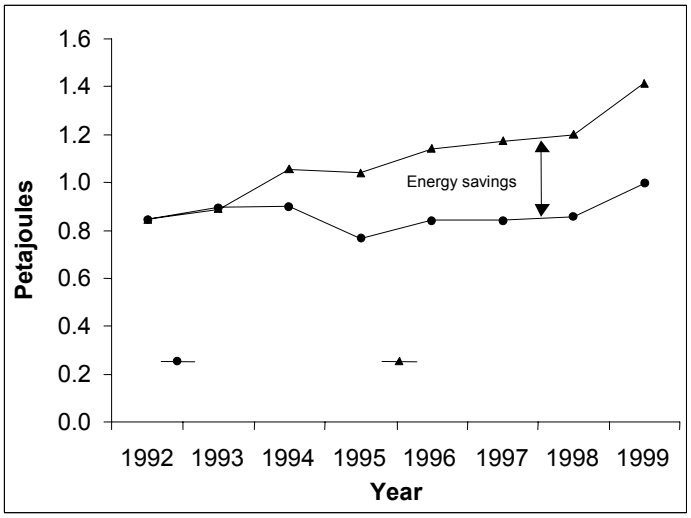
Between 1990 and 1999, the energy performance of dishwashers improved remarkably. As illustrated in Figure 3.3, the average annual unit energy consumption decreased by about 40 percent, or 385 kWh.



*For greater detail, see Table C.8.

3.4 Energy Savings

Figure 3.4. Annual Energy Savings by Dishwashers, 1992–1999*

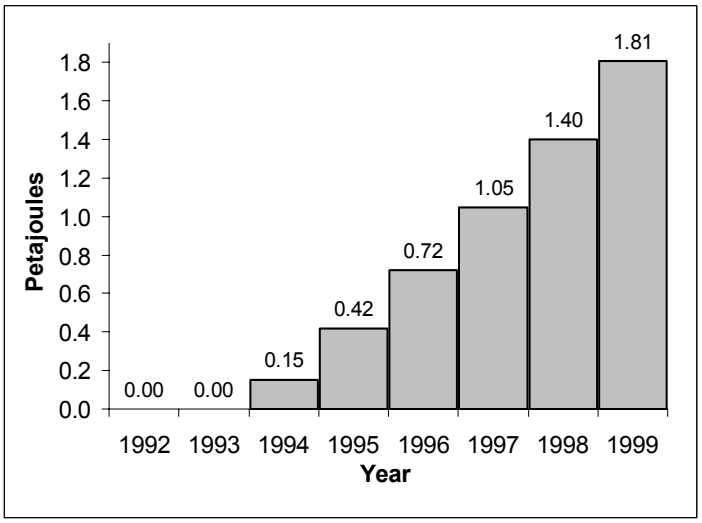


*For greater detail, see Table C.9.

It is estimated that from 1993 to 1999, annual dishwasher energy consumption was significantly less than it *would have been*, had the 1995 *Energy Efficiency Regulations* never been introduced and had manufacturers not improved the general energy efficiency of dishwashers.

Figure 3.4 depicts the difference between how much energy dishwashers were likely to have consumed annually if manufacturers and the Government of Canada had not implemented the Regulations ("Energy consumed WITHOUT Regulations"), and how much energy dishwashers actually consumed once the manufacturers met the MEPS and improved efficiency ("Energy consumed WITH Regulations"). Graphically, the difference between the two lines in Figure 3.4 represents the incremental annual energy savings that resulted from manufacturers meeting and, in many cases, surpassing the requirements of the Regulations.

Figure 3.5. Cumulative Energy Savings by Dishwashers, 1992–1999*



*For greater detail, see Table C.9.

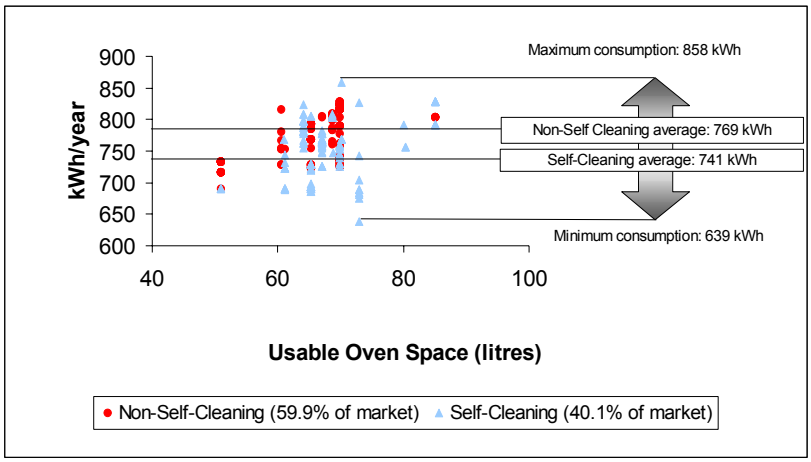
The average annual energy savings for dishwashers were estimated to be 0.26 PJ during 1993 to 1999. (No savings were expected for 1992.) This indicates that, on average, dishwashers consumed about 0.26 PJ less annually than they would have, in the absence of the MEPS, and had the manufacturers not improved the energy efficiency of dishwashers. The largest annual energy savings occurred in 1999, when dishwashers consumed 0.42 PJ less than they otherwise might have.

The cumulative energy savings for dishwashers are shown in Figure 3.5. Since annual energy savings accrue over time, cumulative energy savings grew steadily between 1992 and 1999. Cumulative energy savings reached a maximum of 1.81 PJ in 1999.

4 Electric Ranges

4.1 1999 Market Snapshot

Figure 4.1. Electric Range Models Available in 1999



In 1999, 40 percent of the electric ranges shipped in Canada were self-cleaning units. The shipment-weighted average annual unit energy consumption of these self-cleaning electric ranges in 1999 was 741 kWh, compared with 769 kWh for regular electric ranges. Even though the energy consumption rating takes into account the energy used during the self-cleaning cycles (based on 11 cleans per year), 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.

Electric ranges typically make up 90 percent of the market, whereas gas ranges currently make up 10 percent of the market.

4.2 Distribution of Shipments

4.2.1 Distribution by Type

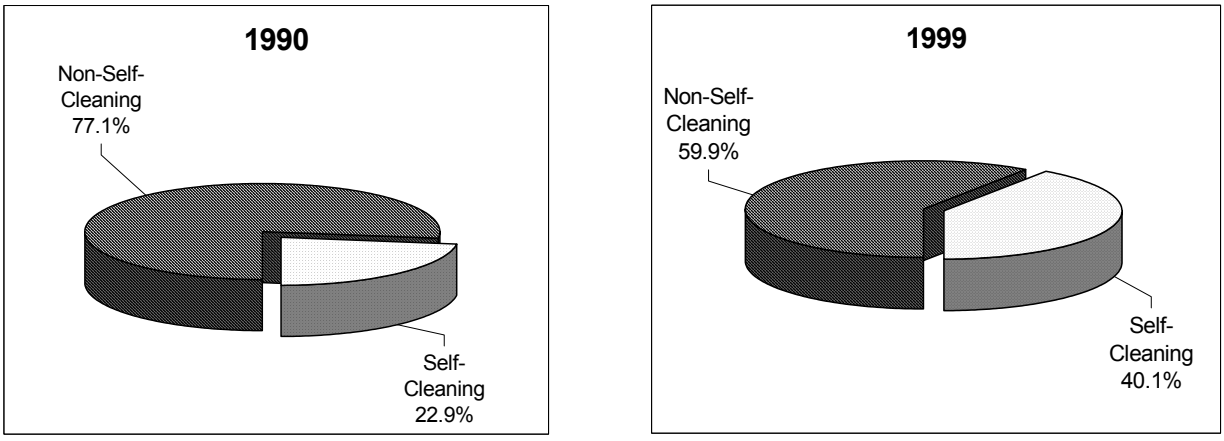
Table 4.1. Distribution of Electric Ranges by Type

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	64.5	35.5
1998	60.1	39.9
1999	59.9	40.1
Average Annual Change	**1.9%**	**1.9%**

Between 1990 and 1999, self-cleaning electric ranges increased in popularity. In 1990, they accounted for less than one quarter (22.9 percent) of all electric ranges available on the market. By 1999, the market share of self-cleaning electric ranges had increased to 40.1 percent.

In contrast, non-self-cleaning electric ranges decreased in market share, dropping from 77.1 percent in 1990 to about 60 percent in 1999.

Figure 4.2. Distribution of Electric Ranges by Type for 1990 and 1999

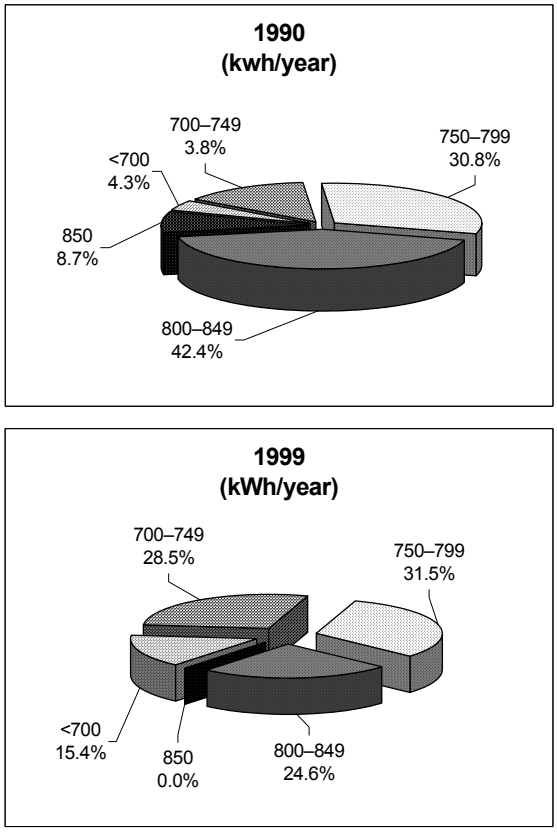


4.2.2 Distribution by Annual Unit Energy Consumption

Table 4.2. Distribution of Electric Ranges by Average Annual Unit Energy Consumption

Model Year	kWh/year				
	<700	700–749	750–799	800–849	>850
	(%)	(%)	(%)	(%)	(%)
1990	4.3	13.8	30.8	42.4	8.7
1991	0.8	15.9	27.6	54.0	1.8
1992	0.0	15.0	58.1	26.5	0.3
1993	0.1	18.4	42.8	38.5	0.2
1994	1.7	32.2	28.5	37.4	0.1
1995	3.3	35.0	22.5	39.2	0.0
1996	3.2	27.6	26.4	42.7	0.0
1997	3.4	27.4	29.2	40.0	0.0
1998	8.4	23.2	31.4	37.1	0.0
1999	15.4	28.5	31.5	24.6	0.0
Average Annual Change	**1.2%**	**1.6%**	**0.1%**	**2.0%**	**1.0%**

Figure 4.3. Distribution of Electric Ranges by Annual Unit Energy Consumption for 1990 and 1999



Between 1990 and 1999, improvements in the energy efficiency of electric ranges were limited. Prior to 1992, ranges that consumed between 800 and 849 kWh per year dominated the market (42–54 percent). In 1999, the market share of electric ranges in this category fell to 24.6 percent. The electric ranges that dominated the market in 1999 consumed between 750 and 799 kWh per year.

Other improvements between 1990 and 1999 included an increased proportion of electric ranges that consumed less than 700 kWh, as well as the disappearance of the most energy-consuming category (850 kWh or more).

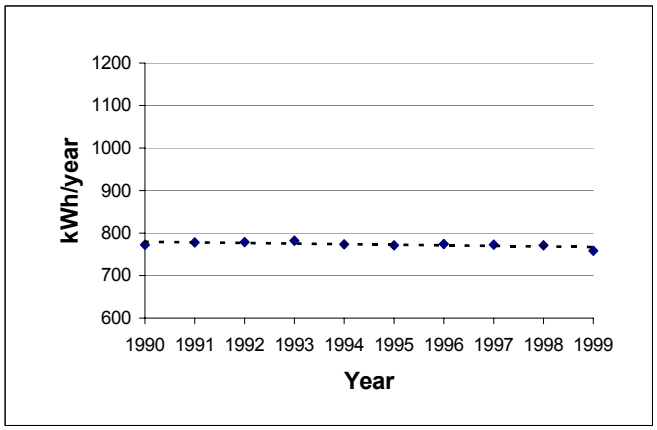
4.3 Energy Consumption

4.3.1 Average Annual Unit Energy Consumption by Model Year

Between 1990 and 1999, the energy consumption of electric ranges remained relatively unchanged.

As illustrated in Figure 4.4, the average annual unit energy consumption of non-self-cleaning electric ranges decreased by about 2 percent, or 14 kWh.

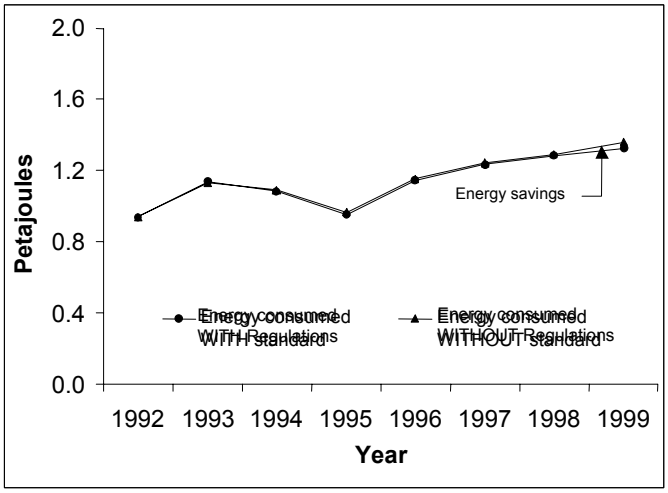
Figure 4.4. Average Annual Unit Energy Consumption of Non-Self-Cleaning Electric



*For greater detail, see Table C.10.

4.4 Energy Savings

Figure 4.5. Annual Energy Savings by Electric Ranges, 1992–1999*



*For greater detail, see Table C.11.

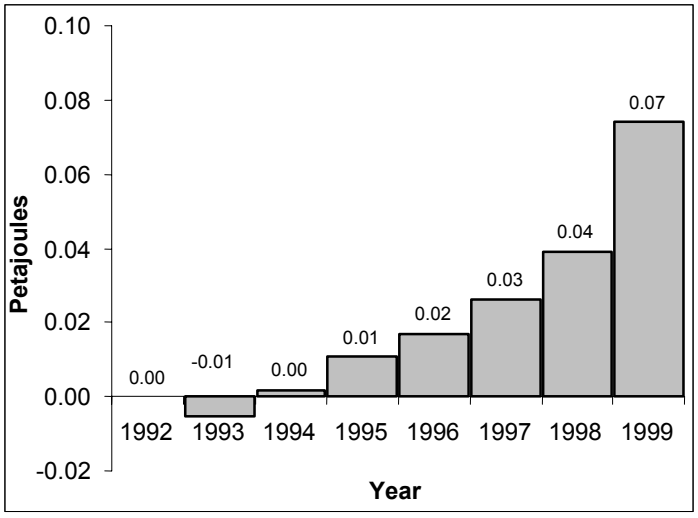
Electric ranges were the only appliances that did not experience a notable decline in their energy consumption following the introducing of the *Energy Efficiency Regulations* in 1995.

Figure 4.5 shows that electric ranges actually consumed about the same amount of energy that they would have used – even in the absence of either the *Energy Efficiency Regulations* or technological improvements by manufacturers.

The average annual energy savings for electric ranges during 1993 to 1999 were estimated to be 0.01 PJ. (No savings were expected for 1992.) The largest annual energy savings occurred in 1999, when electric ranges consumed 0.04 PJ less than they otherwise might have.

The cumulative energy savings for electric ranges are shown in Figure 4.6. Although cumulative energy savings declined negligibly from 1992 to 1993, they grew steadily between 1994 and 1999, as annual energy savings began to accrue. However, cumulative energy savings were still relatively small compared with other appliance types. Savings reached a maximum of 0.07 PJ in 1999.

Figure 4.6. Cumulative Energy Savings by Electric Ranges, 1992–1999*



*For greater detail, see Table C.11.

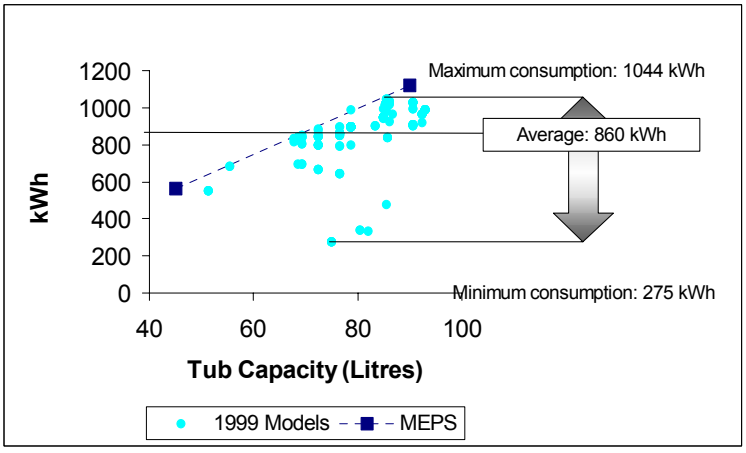
5 Clothes Washers

5.1 1999 Market Snapshot

Figure 5.1. Clothes Washer Models Available in 1999

In 1999, the shipment-weighted average annual unit energy consumption of clothes washers was 860 kWh.

Among standard models that manufacturers made available for the market in 1999, 3.4 percent achieved energy efficiency levels that were at least 50 percent better than the MEPS.



5.2 Distribution of Shipments

5.2.1 Distribution by Annual Unit Energy Consumption

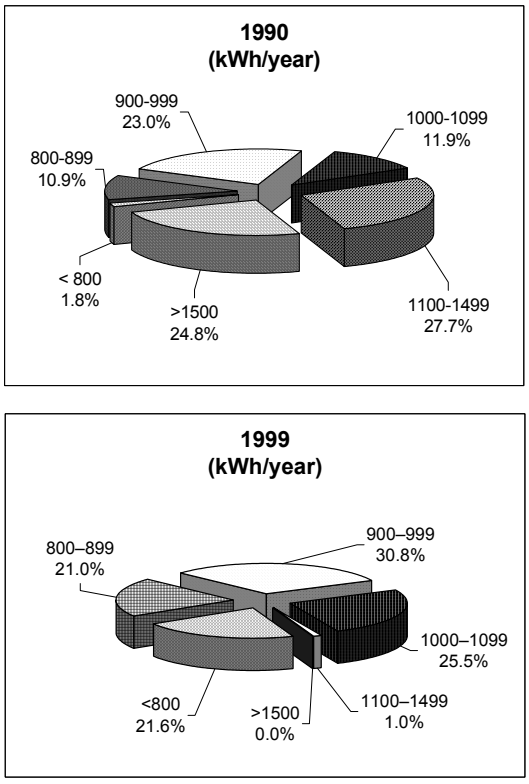
Table 5.1. Distribution of Clothes Washers by Annual Unit Energy Consumption

Model Year	kWh/year					
	<800	800–899	900–999	1000–1099	1100–1499	>1500
	(%)	(%)	(%)	(%)	(%)	(%)
1990	1.8	10.9	23.0	11.9	27.7	24.8
1991	0.4	21.8	12.2	12.8	22.3	30.6
1992	0.1	10.4	12.2	26.8	34.9	15.6
1993	0.4	15.6	13.4	38.0	27.2	5.4
1994	0.6	23.6	25.5	45.8	3.9	0.6
1995	0.8	26.7	28.0	42.7	1.4	0.4
1996	2.2	34.9	17.9	42.9	1.7	0.3
1997	4.5	37.4	10.0	46.3	1.8	0.0
1998	9.4	30.0	9.4	49.4	1.7	0.0
1999	21.6	21.0	30.8	25.5	1.0	0.0
Average Annual Change	**2.2%**	**1.1%**	**0.9%**	**1.5%**	**0.8%**	**2.8%**

Figure 5.2. Distribution of Clothes Washers by Annual Unit Energy Consumption for 1990 and 1999

The energy consumption of clothes washers improved between 1990 and 1999. In 1990, clothes washers that used between 1100 and 1499 kWh a year dominated the market. They made up a little more than a quarter of the market (27.7 percent). Over half of clothes washers (52.5 percent) consumed more than 1100 kWh per year.

By 1999, clothes washers that used between 900 and 998 kWh a year dominated the market. The proportion of higher energy-consuming clothes washers (over 1100 kWh per year) decreased to 1 percent.

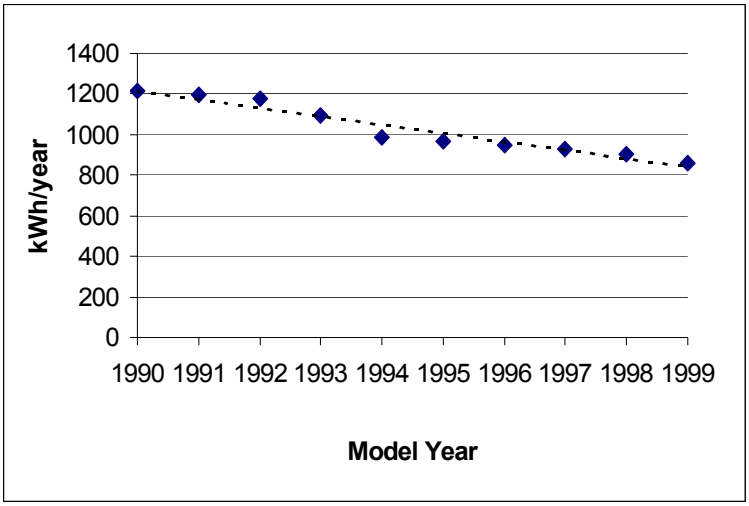


5.3 Energy Consumption

5.3.1 Average Annual Unit Energy Consumption by Model Year

Figure 5.3. Average Annual Unit Energy Consumption of Clothes Washers by Model Year*

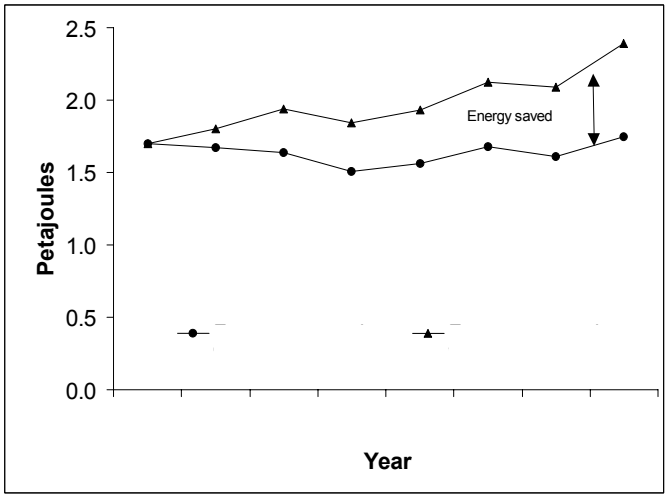
Between 1990 and 1999, the average annual unit energy consumption of clothes washers improved remarkably. As illustrated in Figure 5.3, the average annual unit energy consumption decreased by about 30 percent, or 360 kWh.



*For greater detail, see Table C.12.

5.4 Energy Savings

Figure 5.4. Annual Energy Savings by Clothes Washers, 1992–1999*



*For greater detail, see Table C.13.

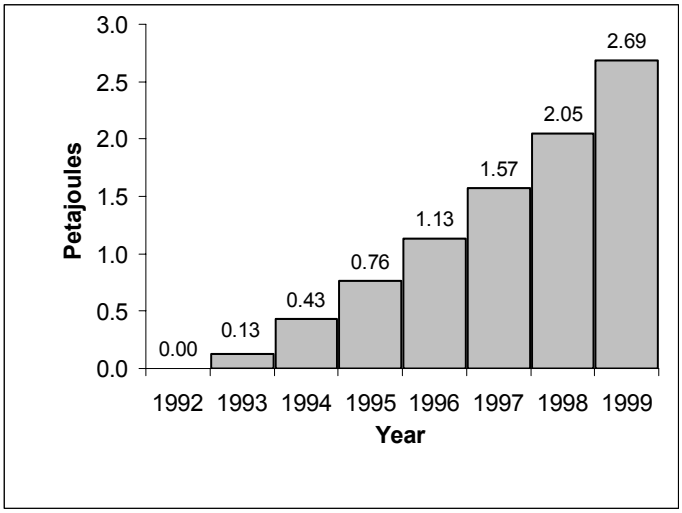
It is estimated that from 1993 to 1999, the annual energy consumption of clothes washers was slightly less than it *would have been*, had manufacturers neither complied with the *Energy Efficiency Regulations* introduced in 1995 nor improved the energy efficiency of clothes washers.

Figure 5.4 illustrates the difference between the energy that clothes washers were likely to have consumed annually if manufacturers had not met the MEPS and improved technology ("Energy consumed WITHOUT Regulations"), and how much energy they actually consumed as a result of the *Energy Efficiency Regulations* being introduced and the manufacturers improving the energy efficiency of clothes washers ("Energy consumed WITH Regulations").

Graphically, the difference between the two lines in the figure represents the incremental annual energy savings that resulted from the Regulations and from manufacturers improving technology. On average, clothes washers would have consumed 0.38 PJ more per year, had the *Energy Efficiency Regulations* and manufacturers' technological improvements *not* been implemented. The largest annual energy savings occurred in 1999, when clothes washers consumed about 0.64 PJ less than they otherwise might have.

Figure 5.5. Cumulative Energy Savings by

The cumulative energy savings for clothes washers are shown in Figure 5.5. The savings grew steadily between 1992 and 1999, as annual energy savings began to accrue. They reached a maximum of 2.69 PJ in 1999.



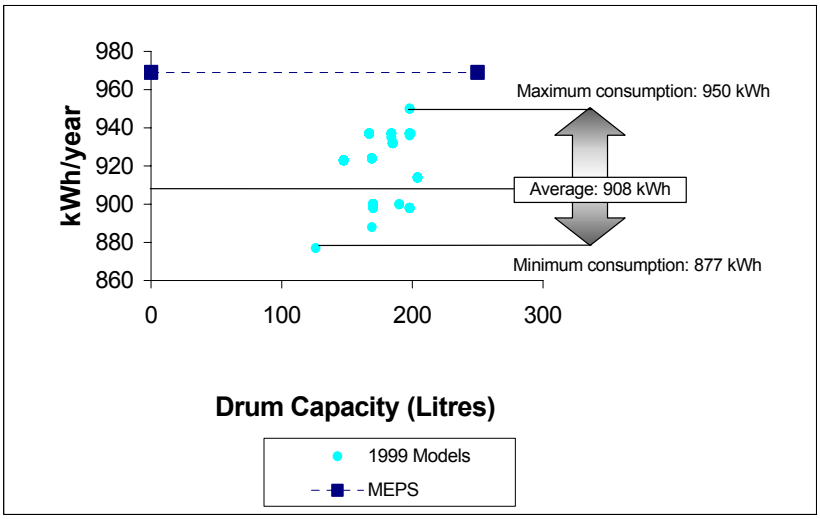
*For greater detail, see Table C.13.

6 Electric Clothes Dryers

6.1 1999 Market Snapshot

In 1999, the shipment-weighted average annual unit energy consumption of all electric clothes dryers was 908 kWh per year.

Figure 6.1. Electric Clothes Dryer Models Available in 1999



6.2 Distribution of Shipments

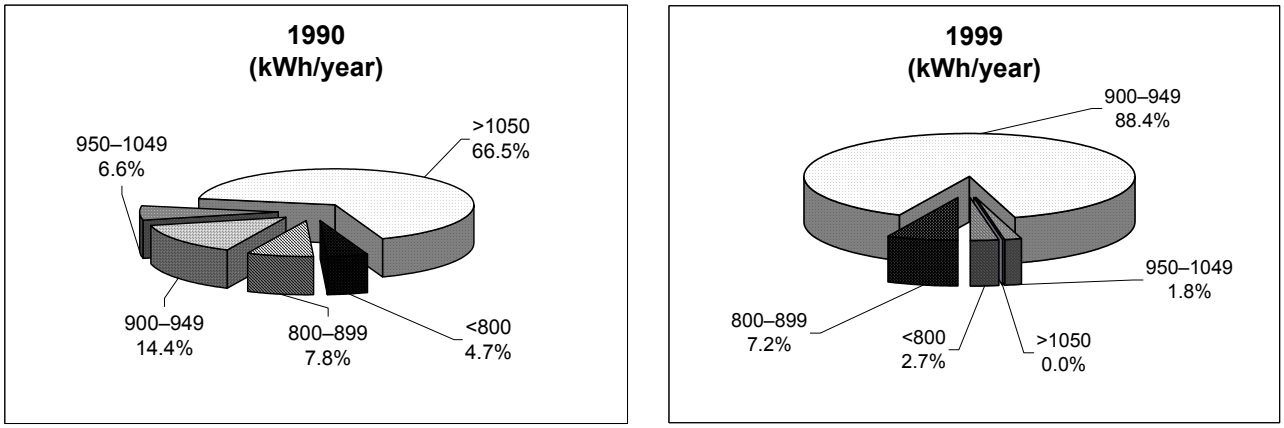
6.2.1 Distribution by Annual Unit Energy Consumption

Table 6.1. Distribution of Electric Clothes Dryers by Annual

Year	kWh/year				
	<800	800–899	900–949	950–1049	>1050
	(%)	(%)	(%)	(%)	(%)
1990	4.7	7.8	14.4	6.6	66.5
1991	5.3	0.2	30.0	38.0	26.5
1992	4.4	28.9	37.5	18.2	11.0
1993	4.1	29.0	53.6	7.2	6.1
1994	4.3	24.1	54.6	14.9	2.2
1995	3.1	16.2	68.5	10.8	1.4
1996	4.1	11.8	82.9	1.3	0.0
1997	4.8	13.0	81.0	1.1	0.0
1998	3.0	8.9	87.1	1.0	0.0
1999	2.7	7.2	88.4	1.8	0.0
Average Annual Change	**0.2%**	**0.1%**	**8.2%**	**0.5%**	**7.4%**

Between 1990 and 1999, electric clothes dryers exhibited significant improvements in energy consumption. The most dominant consumption level in 1990 (over 1050 kWh/year) had disappeared by 1999. That year, 88.4 percent of electric clothes dryers consumed between 900 and 949 kWh per year. As well, the number of electric clothes dryers using 950 kWh or more per year accounted for only 1.8 percent of the market. This corresponds to a 71.3-percent decrease in market share since 1990.

Figure 6.2. Distribution of Electric Clothes Dryers by Annual Unit Energy Consumption for 1990 and 1999

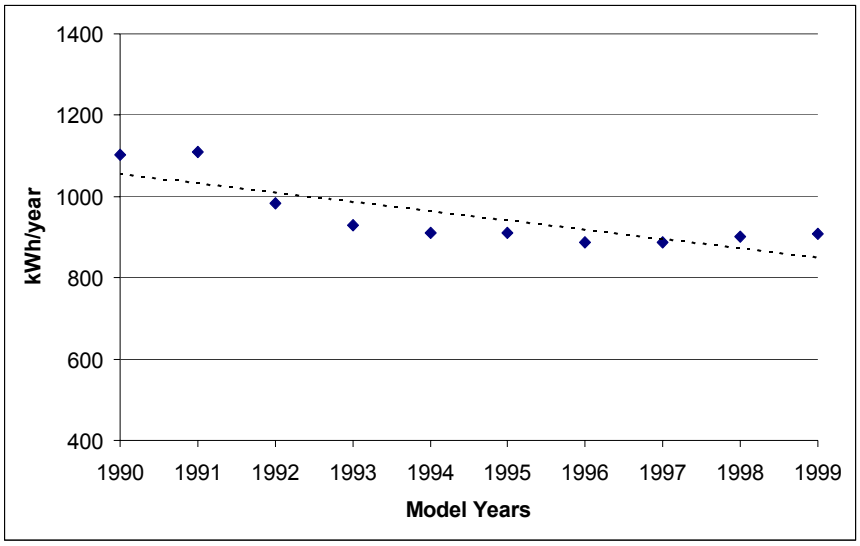


6.3 Energy Consumption

6.3.1 Average Annual Unit Energy Consumption by Model Year

Figure 6.3. Average Annual Unit Energy Consumption of Electric Clothes Dryers by Model Year*

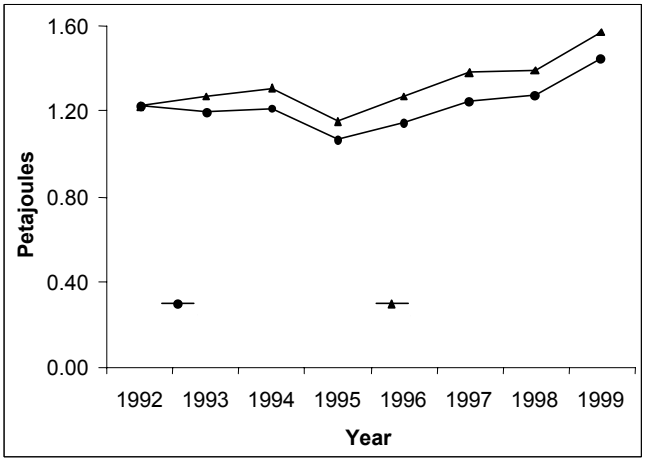
Between 1990 and 1999, the energy efficiency of electric clothes dryers improved. As illustrated in Figure 6.3, the average annual unit energy consumption decreased by about 18 percent, or 200 kWh.



*For greater detail, see Table C.14.

6.4 Energy Savings

Figure 6.4. Annual Energy Savings by Electric Clothes Dryers, 1992–1999*



*For greater detail, see Table C.15.

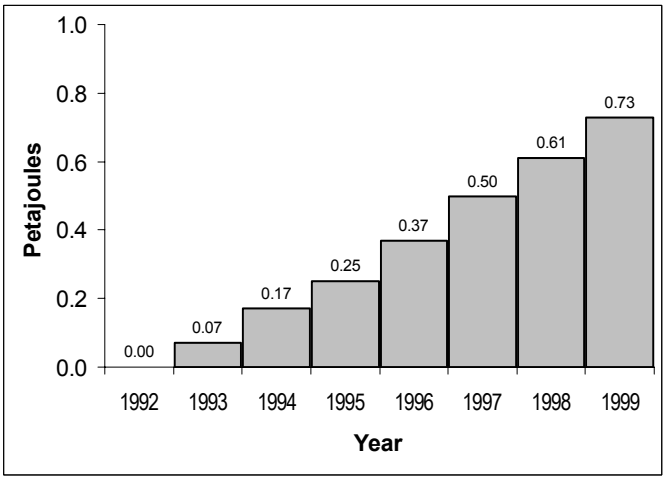
It is estimated that from 1993 to 1999, the annual energy consumption of electric clothes dryers was less than it *would have been*, had the 1995 *Energy Efficiency Regulations* never been introduced and had manufacturers not improved the general energy efficiency of electric clothes dryers.

Figure 6.4 illustrates the difference between the energy that electric clothes dryers were likely to have consumed annually if manufacturers had not met the MEPS or improved technology ("Energy consumed WITHOUT Regulations") and how much energy they actually consumed as a result of manufacturers meeting and surpassing the *MEPS* ("Energy consumed WITH Regulations").

Graphically, the difference between the two lines on the figure represents the incremental annual energy savings that resulted from the standards and from manufacturing improvements. On average, electric clothes dryers would have consumed 0.10 PJ more a year had manufacturers not met the *MEPS* and improved efficiency. The largest annual energy savings occurred in 1997, when electric clothes dryers consumed 0.13 PJ less than they otherwise might have.

Figure 6.5. Cumulative Savings by Electric Clothes Dryers, 1992–1999*

The cumulative energy savings for electric clothes dryers are shown in Figure 6.5. Savings grew steadily between 1992 and 1999, as annual energy savings began to accrue. They reached a maximum of 0.75 PJ in 1999.



*For greater detail, see Table C.15.

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 (OEE) 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 the 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 could determine the shipment data for an individual model or manufacturer. NRCan retained the services of Chrispen-Roberts Direct Data Ltd. each year for this task.

The following sections describe the database preparation process conducted by Chrispen-Roberts Direct Data Ltd.

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 Chrispen-Roberts Direct Data Ltd. matched the model number from the manufacturer with the corresponding model in the *EnerGuide Directory*. Thus they arrived at the total energy consumption represented by all shipments of that model within each year. Then they aggregated these figures to provide the data presented in this report.

The analysts used the standard database and spreadsheet software to assemble the data, manipulate them as required and pass 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 electric clothes dryer, clothes washer, dishwasher, freezer, electric range and refrigerator on the Canadian market from 1990 to 1999. When the project first began in 1996, only three manufacturers provided shipment data. The 1999 data collection increased to six data contributors, covering the vast majority of appliance models sold in Canada. NRCan is approaching additional manufacturers in order to expand the coverage for future data collection.

Manufacturers sent the data in various electronic and printed formats. Chrispen-Roberts Direct Data Ltd. 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 basically consisted of the appliance type, model number and number of shipments in each year. Each manufacturer 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 and model year.

Because of the nature of the freezer market, Chrispen-Roberts Direct Data Ltd. could not obtain 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 of each appliance to calculate the shipment-weighted energy use of each appliance type.

A.1.4 Data Matching

Analysts from Chrispen-Roberts Direct Data Ltd. matched the manufacturer's data for each model with the corresponding energy consumption data from the *EnerGuide Directory* for that model. After the model was matched, the manufacturer's shipments for each model was multiplied 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) was then sub-totalled 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. Also, some model numbers have additional prefixes or suffixes to indicate features that do not affect energy use (e.g., colour, door-swing). Therefore, 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 Directory*. When a match was found, the corresponding energy consumption figure, and the information on the type from the *EnerGuide 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. Thus, a match where only one character differed was flagged and removed from further matching attempts. 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 Directory* that had considerably fewer characters, the model was flagged for manual checking. Also, they 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 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 a "reasonability" criterion: a model would be manually checked if its shipments were reported more than three years after the last time the corresponding model appeared in the EnerGuide list.

Sometimes difficulties occurred where the model number in NRCan's EnerGuide 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). With the help of the manufacturers, most of these cases were resolved.

After automated processes were performed, a number of models remained unmatched. Whenever one of these models represented a substantial number of shipments for that appliance type, analysts handled it on an exceptional basis. Again with the help of the manufacturers, these models were positively identified and assigned a correct energy rating and type.

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 kWh; therefore, its shipment-weighted total energy use for the year is $5238 \times 683 = 3\ 577\ 554$ kWh. This aggregate figure and the shipment figures were summed as necessary to provide totals for appliance and type and size category as appropriate for each appliance type.

In the case of refrigerators, the actual cubic volume of each model was available from the *EnerGuide 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 that Chrispen-Roberts Direct Data Ltd. prepared for NRCan consisted of such information as the appliance type, model year, total energy consumption and average unit consumption. In the case of refrigerators, they further categorized the information by the refrigerator type and size. All the information was transferred to a spreadsheet 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:

$$\frac{\sum_{i=1}^{7} S\_type_i \times \overline{UEC\_type_i}}{\sum_{i=1}^{7} S\_type_i}$$

where S_type_i = Number of Sales of Type *i* refrigerators

$\overline{UEC\_type_i}$ = Average Unit Energy Consumption of Type *i* refrigerators

As mentioned in Data Preparation (Section A.1 above), 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 was a three-step process. First, baseline levels of energy consumption were estimated for each appliance type, for each year between 1990 and 1999. For all appliances, baseline levels of energy consumption reflected the OEE's assumptions about how much energy each appliance type *would have consumed* had the *Energy Efficiency Regulations* not been implemented in 1995, and had manufacturers not improved overall appliance efficiency levels. To estimate baseline levels of energy consumption, the OEE assumed the following:

- In the absence of the 1995 *Energy Efficiency Regulations* and general energy efficiency improvements made by manufacturers, the unit energy consumption for all appliance types would not have improved (unit energy consumptions would have held constant at 1992 levels);

- In the absence of the 1995 *Energy Efficiency Regulations* and general energy efficiency improvements made by manufacturers, appliance shipments would have been the same as they actually were during 1990 to 1999.

"Actual" or current levels of energy consumption for all appliances were calculated in an identical fashion. Even though the MEPS was not introduced until 1995, market forces such as the U.S. regulations and the impending Regulations expected from the 1992 *Energy Efficiency Act* have showed an impact on energy improvement in major household appliances since the Act came into force. Therefore, it was deemed appropriate to use 1992 as the baseline measure when calculating the energy savings. The average annual unit energy consumption for each appliance type for each model year was used, instead of holding it constant at 1992 levels.

Incremental energy savings were then calculated by taking the difference between baseline and actual levels of energy consumption, for all appliances.

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.

The 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, which, 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 an 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 cooktop, 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) 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 frozen food at an average temperature of –17.8°C (0°F) or lower; (ii) with the inherent capability for freezing of food; and (iii) with a minimum freezing capability of 2 kg/100 L/24 h. The process of freezing involves removing heat from products to lower their temperature to a point where most of the water contained therein is solidified.

Freezers are typically built as either a vertical model or a chest model, and grouped into the following three types:

Type 8
Upright freezers with manual defrost

Type 9
Upright freezers with automatic defrost

Type 10
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 ≤ 5°C (≥ 32 ≤ 41°F).

Refrigerators as per the *EnerGuide Appliance Directory* are grouped under seven 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 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

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.

Appendix C

Tables

Table C.1. Average Annual Unit Energy Consumption of Refrigerators by Volume

Model Year	Volume (cu. ft.)														
	0–2.4	2.5–4.4	4.5–6.4	6.5–8.4	8.5–10.4	10.5–12.4	12.5–14.4	14.5–16.4	16.5–18.4	18.5–20.4	20.5–22.4	22.5–24.4	24.5–26.4	26.5–28.4	28.5–30.4
	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(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	308	336	364	465	377	547	570	631	646	680	731	894	885	1051	1070
1997	–	–	338	465	377	548	568	632	666	698	736	925	898	923	1093
1998	–	335	354	465	412	564	562	624	676	710	741	844	889	860	983
1999	–	335	–	–	412	552	574	629	666	670	734	809	900	842	978

Table C.2. Average Annual Unit Energy Consumption Per Cubic Foot of Refrigerators (kWh/cu. ft./year) by Volume

Model Year	Volume (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
	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./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	40	48	42	41	37	35	34	38	35	38	36
1997	62	62	40	48	42	41	38	36	34	39	35	34	37
1998	65	62	44	49	42	40	39	37	35	36	35	31	33
1999	–	–	44	48	43	41	38	34	34	34	35	31	33

Table C.3. Average Annual Unit Energy Consumption of Type 3 Refrigerators by Volume

Model Year	Volume (cu. ft.)									
	4.5–6.4	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
	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)
1990	370	864	756	861	955	1044	936	932	–	1104
1991	370	864	733	916	915	999	845	857	–	1104
1992	370	864	699	745	924	929	822	915	–	1257
1993	370	864	593	599	700	730	714	813	–	982
1994	370	864	563	545	628	665	688	786	–	795
1995	370	864	554	540	626	662	677	708	777	866
1996	370	–	547	570	631	646	634	645	783	824
1997	370	–	548	567	632	666	635	690	671	798
1998	370	–	564	561	624	673	636	701	604	693
1999	–	–	552	574	629	664	611	693	583	717

Table C.4. Average Annual Unit Energy Consumption Per Cubic Foot of Type 3 Refrigerators by Volume

Model Year	Volume (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
	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)	(kWh/cu. ft./yr.)
1990	68	–	91	66	64	62	60	48	43	–	43
1991	68	–	91	64	68	59	57	43	40	–	43
1992	68	–	91	61	55	60	53	42	43	–	49
1993	68	–	91	52	45	45	42	37	38	–	39
1994	68	–	91	49	40	41	38	35	37	–	31
1995	68	–	91	48	40	41	38	35	33	33	34
1996	68	–	–	48	42	41	37	33	30	33	32
1997	68	–	–	48	42	41	38	33	32	29	31
1998	68	–	–	49	42	40	39	33	33	26	27
1999	–	–	–	48	43	41	38	31	32	25	28

Table C.5. Energy Savings by Refrigerators, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	1.22	1.22	0.00	0.00
1993	1.27	1.59	0.32	0.32
1994	1.30	1.80	0.50	0.82
1995	1.26	1.77	0.51	1.33
1996	1.28	1.80	0.52	1.85
1997	1.38	1.89	0.51	2.36
1998	1.52	2.07	0.55	2.91
1999	1.65	2.25	0.60	3.51

Table C.6. Average Annual Unit Energy Consumption of Freezers by Model Year

Model Year	Type 8	Type 9	Type 10	Total
	(kWh/yr.)	(kWh/yr.)	(kWh/yr.)	(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	496.2	829.6	339.5	381.3
1999	493.1	833.7	338.3	383.0

Table C.7. Energy Savings by Freezers, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	0.36	0.36	0.00	0.00
1993	0.34	0.38	0.04	0.04
1994	0.32	0.37	0.05	0.09
1995	0.28	0.32	0.05	0.14
1996	0.24	0.28	0.05	0.18
1997	0.26	0.31	0.05	0.23
1998	0.32	0.38	0.06	0.29
1999	0.34	0.40	0.06	0.35

Table C.8. Average Annual Unit Energy Consumption of Dishwashers by Model Year

Model Year	kWh/year
1990	1025.7
1991	959.0
1992	908.0
1993	914.2
1994	777.4
1995	671.2
1996	668.8
1997	650.2
1998	648.0
1999	640.8

Table C.9. Energy Savings by Dishwashers, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	0.85	0.85	0.00	0.00
1993	0.89	0.89	0.00	0.00
1994	0.90	1.05	0.15	0.15
1995	0.77	1.04	0.27	0.42
1996	0.84	1.14	0.30	0.72
1997	0.84	1.17	0.33	1.05
1998	0.85	1.20	0.34	1.40
1999	1.00	1.41	0.42	1.81

Table C.10. Average Annual Unit Energy Consumption of Electric Ranges by Model Year

Model Year	Non-Self-Cleaning	Self-Cleaning	Total
	(kWh/yr.)	(kWh/yr.)	(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	762.4	774.3
1997	780.2	759.1	772.7
1998	778.2	760.2	771.0
1999	769.8	741.7	758.5

Table C.11. Energy Savings by Electric Ranges, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	0.94	0.94	0.00	0.00
1993	1.14	1.13	-0.01	-0.01
1994	1.08	1.09	0.01	0.00
1995	0.95	0.96	0.01	0.01
1996	1.15	1.15	0.01	0.02
1997	1.23	1.24	0.01	0.03
1998	1.28	1.29	0.01	0.04
1999	1.32	1.36	0.04	0.07

Table C.12. Average Annual Unit Energy Consumption of Clothes Washers by Model Year

Model Year	kWh/year
1990	1218.0
1991	1197.4
1992	1175.5
1993	1094.2
1994	989.3
1995	966.4
1996	949.2
1997	930.7
1998	905.0
1999	860.6

Table C.13. Energy Savings by Clothes Washers, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	1.70	1.70	0.00	0.00
1993	1.67	1.80	0.12	0.12
1994	1.64	1.94	0.31	0.43
1995	1.51	1.84	0.33	0.76
1996	1.56	1.93	0.37	1.13
1997	1.68	2.12	0.44	1.57
1998	1.61	2.09	0.48	2.05
1999	1.75	2.39	0.64	2.69

Table C.14. Average Annual Unit Energy Consumption of Electric Clothes Dryers by Model Year

Model Year	kWh/year
1990	1102.6
1991	1108.7
1992	983.3
1993	928.6
1994	910.8
1995	909.7
1996	888.0
1997	887.7
1998	900.9
1999	908.0

Table C.15. Energy Savings by Electric Clothes Dryers, 1992–1999

Year	Energy Consumed WITH Regulations	Energy Consumed WITHOUT Regulations	Annual Energy Savings	Cumulative Energy Savings
	(PJ)	(PJ)	(PJ)	(PJ)
1992	1.23	1.23	0.00	0.00
1993	1.20	1.27	0.07	0.07
1994	1.21	1.31	0.10	0.17
1995	1.07	1.15	0.09	0.25
1996	1.15	1.27	0.12	0.38
1997	1.25	1.38	0.13	0.51
1998	1.28	1.39	0.12	0.63
1999	1.45	1.57	0.12	0.75

Appendix D

List of National Energy Use Database Publications

List of Publications
National Energy Use Database Initiative (NEUD)
Office of Energy Efficiency (OEE)

You can view and download the following reports from the OEE's Web site at http://oee.nrcan.gc.ca/infosource/businesses/index.cfm.

- *1993 Survey of Household Energy Use – National Results,*
  Cat. No. M92-85/1994E, ISBN 0-662-22793-X.
- *1993 Survey of Household Energy Use – Provincial Results,*
  Cat. No. M92-96/1995, ISBN 0-662-61978-1.
- *1995 Home Energy Retrofit Survey – Statistical Report, January 2000,*
  Cat. No. M92-135/1995E, ISBN 0-662-64000-4.
- *1997 Survey of Household Energy Use – Detailed Statistical Report,*
  Cat. No. M92-85/1997E, ISBN 0-662-29209-X.
- *1997 Survey of Household Energy Use – Summary Report,*
  Cat. No. M92-85/1997-1, ISBN 0-662-65123-5.
- *Energy Consumption of Major Household Appliances Marketed in Canada – Trends for 1990–1997, April 2000,*
  Cat. No. M92-176/1999, ISBN 0-662-64615-0.
- *National Private Vehicle Use Survey – October 1994 to September 1996 – Detailed Statistical Report, Working Paper prepared for the NEUD, OEE. December 2000.*
- *National Private Vehicle Use Survey – October-December 1994 – Statistical Report, Working Paper prepared for the NEUD, OEE. December 1999.*
- *National Private Vehicle Use Survey – October 1994 to September 1996 – Summary Report, October 2000,*
  Cat. No. M92-190/2000, ISBN 0-662-65006-9.
- *Survey of Canadian New Household Equipment Purchases, 1994 & 1995 – Statistical Report,*
  Cat. No. M92-133/1997, ISBN 0-662-62902-7.
- *Survey of Houses Built in Canada in 1994 – Statistical Report,*
  Cat. No. M92-136/1994, ISBN 0-662-62970-1.
- *The 1994 Home Energy Retrofit Survey – Statistical Report,*
  Cat. No. M92-135/1994, ISBN 0-662-62969-8.

- *The Household Equipment of Canadians – Features of the 1993 Stock & the 1994 & 1995 Purchases – Analysis Report,*
  Cat. No. M92-131/1997, ISBN 0-662-62806-3.

- *Trends in Energy Characteristics of Homes in Canada – Analysis Report,*
  Cat. No. M92-85/1-1997, ISBN 0-662-63165-X.

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