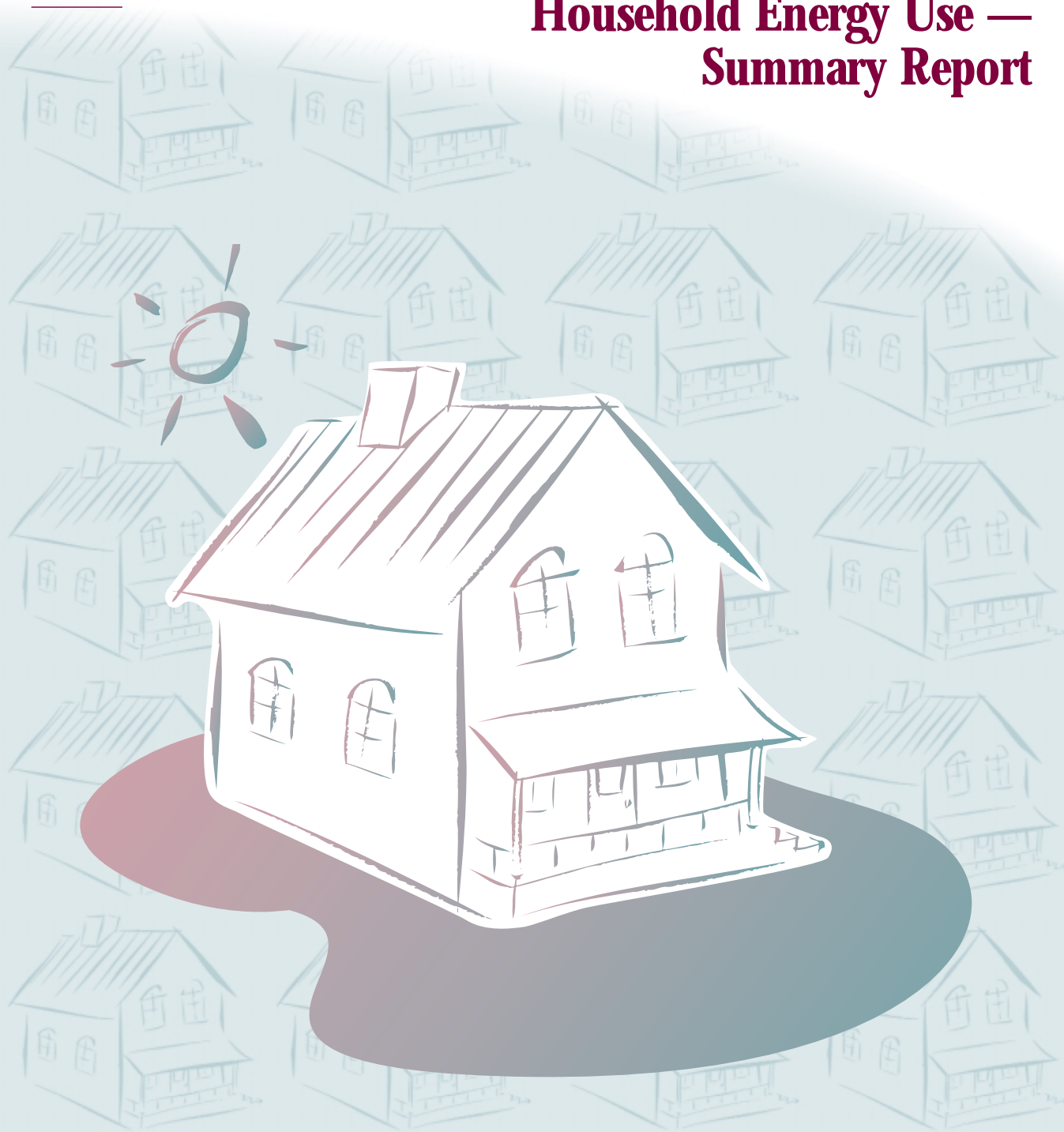




Office of Energy Efficiency
National Energy Use Database

1997 Survey of Household Energy Use — Summary Report



Natural Resources
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1997 Survey of Household Energy Use

Summary Report

Foreword

The main objective of Natural Resources Canada's Office of Energy Efficiency (OEE) is to reduce energy consumption while protecting the environment, thereby enabling Canadians to save energy at home, at work and on the road.

To achieve this, several programs have been designed and implemented by the OEE, including the following in the residential sector in particular:

- The EnerGuide program, which supplies information on the energy efficiency of major household appliances as well as heating, ventilation and air-conditioning equipment available on the market.
- The EnerGuide for Houses program, which helps homeowners obtain an independent evaluation and list of recommendations regarding energy efficiency to help improve home comfort and reduce heating and cooling costs.
- The R-2000 HOME Program, offered on a voluntary basis by new home builders, which establishes energy efficiency standards that exceed residential building codes while using environmentally responsible building materials and practices.

The National Energy Use Database (NEUD) is an information resource on energy end-use in all sectors of the Canadian economy, specifically the residential sector. The residential component of that database is updated by various surveys, including the 1993 and 1997 *Surveys of Household Energy Use*, the *Survey of Canadian New Household Equipment Purchases – 1994 and 1995*, the 1994 and 1995 *Home Energy Retrofit Survey* and the *Survey of Houses Built in Canada in 1994*. In addition to conducting surveys, the NEUD also works with the Canadian Appliance Manufacturers Association (CAMA) to estimate the average annual energy consumption of these appliances (more specifically, refrigerators, stoves, dishwashers, washing machines and dryers). Appendix B presents a list of statistical and analytical reports on the subject that have been published by the National Energy Use Database.

The Special Surveys Division of Statistics Canada conducted the *1997 Survey of Household Energy Use* (SHEU-1997) for the Office of Energy Efficiency (OEE) of Natural Resources Canada. This report is a summary of the main results obtained from the *1997 Survey of Household Energy Use* (SHEU-1997). To obtain more detailed information, we invite you to consult the *1997 Survey of Household Energy Use – Detailed Statistical Report*. This report also compares the results of the surveys conducted in 1993 and 1997, as well as other interim reports. These documents will help follow the existing energy efficiency programs, analyse and understand the possible effects of measures being considered for the future and, finally, estimate the energy efficiency potential in the residential sector.

This statistical report was prepared with the collaboration of Victor Tremblay of the firm STATPLUS.

Jean-François Bilodeau of Natural Resources Canada supervised the project as a whole. The following persons contributed, at one time or another, to the completion of this project: Anne Amos-Stewart, Glenda Taylor, Linda Yuen and Jacqueline Courtemanche.

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Highlights

The *1997 Survey of Household Energy Use* has found that the average heated area of houses (excluding the basement and garage) built since 1961 has progressively increased, stabilizing at around 1600 sq. ft. after 1983. Furthermore, when there is a basement or crawl space, two out of three are fully heated, and three out of four of these have at least partial insulation in the walls.

In 1997, about one out of ten households either replaced or added windows to its dwelling. These new windows were either standard double-paned (six percent) or energy-efficient double-paned (three percent). The use of double-paned windows has become the standard; in houses built since 1989, 10.8 windows out of 12.4 are double-paned.

In spite of these efforts, the occupants of one out of three houses experience undesirable drafts around their windows and, in half the houses, condensation on the windowpanes. While newer buildings are less likely to suffer from drafts, the condensation problem is particularly noticeable in houses built between 1983 and 1989. Houses built since 1990 are more likely to have air exchangers, which seem to decrease the frequency of this problem. In fact, more than one quarter of houses built since 1990, and 32 percent since 1993, are equipped with an air exchanger. Approximately 40 percent of recently installed air exchangers feature heat recovery units.

Also in 1997, about one out of 25 households upgraded the insulation of the roof-space or attic, and the same proportion added or improved insulation in either the walls of the house or the walls or floor of the basement.

Two thirds of Canadian houses use forced-air furnaces as their main heating system, whereas 18 percent use electric baseboards. Electricity plays an important role as the main source of heat in newer houses, with a 37 percent market share for the construction period from 1983 to 1989 and 29 percent after that period. More than half of houses built since 1990 use natural gas as the main source of heat.

One out of three houses surveyed uses wood for heat at least some of the time. The average house that uses wood burns 2.2 cords of wood per year. Nearly one out of three houses has a wood-burning fireplace. However, this type of fireplace is not used regularly; only one third of them are used once or more per week during the heating season. In comparison, only one out of eight houses has a gas fireplace, but nearly half of their owners use them more than three times per week, and only seven percent do not use them at all.

Air-conditioning systems are installed in about one third of houses. Of those, 63 percent have a central air-conditioning system, 10 percent have a heat pump and 27 percent have either a wall- or a window-mounted unit. The average system, whether central or not, is about ten years old. The average power rating of the window- or wall-mounted units is slightly above 8000 Btu.

During the summer of 1997, nearly half of households with central air-conditioning – including those with heat pumps – used their systems during half the season. This compares to one third of households equipped with wall- or window-mounted units.

An analysis of heating bills from households that use only electricity in their homes reveals that they consume on average 23 367 kWh (84.1 GJ) each year. Households that use both electricity and natural gas consume on average 8 587 kWh (30.9 GJ) of electricity and 122.1 GJ of natural gas. Therefore, energy consumption in dwellings using both of these energy sources amounts to 153.0 GJ, which is 82 percent more than the all-electric dwellings. This deviation can be explained by the difference in efficiency between the two sources of energy.

A comparison of current inventories and recent purchases shows that consumers appear to be selecting higher capacity major household appliances. This is especially true of refrigerators, washing machines and dryers.

Here are some of the specifications related to the main household appliances used by Canadians:

- One third of households has a second refrigerator.
- The ordinary kitchen stove remains the standard for cooking equipment, as 91 percent of all households use one, compared to nine percent that use a built-in oven and a separate cooktop.
- There is a dishwasher in three out of five houses.
- In almost three quarters of households, there is a freezer, the average age of which is 15 years.
- Ninety-four percent of users of washing machines do not use hot water for most of their loads and 79 percent use cold water for the rinse cycle. The average household washes 6.3 loads of laundry per week.

Between 1990 and 1997, the energy efficiency of all major household appliances on the market, except kitchen stoves, has increased substantially: energy savings for equivalent appliances vary between 20 percent and 40 percent. This performance can be attributed to significant research and development carried out by the appliance manufacturers plus the new rules and regulations on energy-consuming appliances that went into effect in 1995.

Almost all houses have hot water tanks. Natural gas and electricity share most of the market. The division appears to be primarily geographic, with the Ontario/Quebec border demarcating the dominant energy source. However, the penetration of natural gas in the Canadian market is evident; two thirds of newly purchased water heaters are gas fired. There appears to be a genuine concern for hot water conservation. The most common method of reducing hot water consumption has been installing flow reducers (nearly half of households). Another one quarter of households saved on their hot water consumption by insulating the pipes and the water heater itself.

Finally, the Canadian house uses an average of 40.9 light bulbs, with 36.5 indoors and 4.4 outdoors.

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Introduction

In 1993, Natural Resources Canada (NRCan) conducted its first survey of household energy use. This activity established a residential component of the National Energy Use Database (NEUD). NRCan's Office of Energy Efficiency (OEE), which had planned to repeat the survey periodically, repeated the exercise in 1998 in order to evaluate the evolution of the residential inventory and its characteristics. Since the reference period of this survey is the calendar year 1997, the present project shall henceforth refer to the *1997 Survey of Household Energy Use* (SHEU-1997).

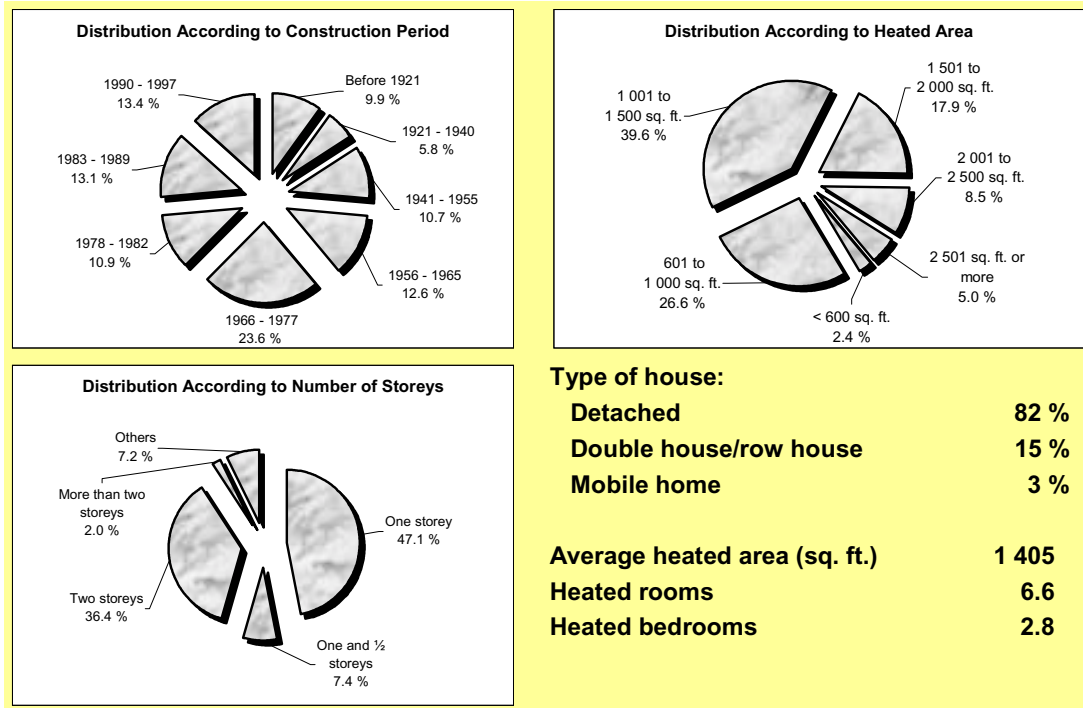
For this survey, the OEE decided to limit the scope of its research – the stock of houses – and excluded all communal dwellings of two or more units. On the question of methodology, the telephone interview in *SHEU-93* was replaced by a computer-assisted personal interview of the selected households. Some sections of the questionnaire and the formulation of some of the questions were also recast to improve the quality of the data gathered.

This report presents the results of the recent survey while referring to data obtained from other sources, including the 1993 survey. Chapter 1 describes the inventory of houses as determined by this new survey; Chapter 2 describes the characteristics of the thermal envelope; Chapter 3 describes the equipment used for heating houses and the heating habits of their residents; Chapter 4 deals with air conditioning and ventilation of houses; Chapter 5 reveals the penetration rates and characteristics of major household appliances; Chapter 6 describes water heating equipment; and Chapter 7 presents lighting. Finally, Appendix A sets forth the methodological elements of the study and Appendix B presents a list of reports produced by NEUD.

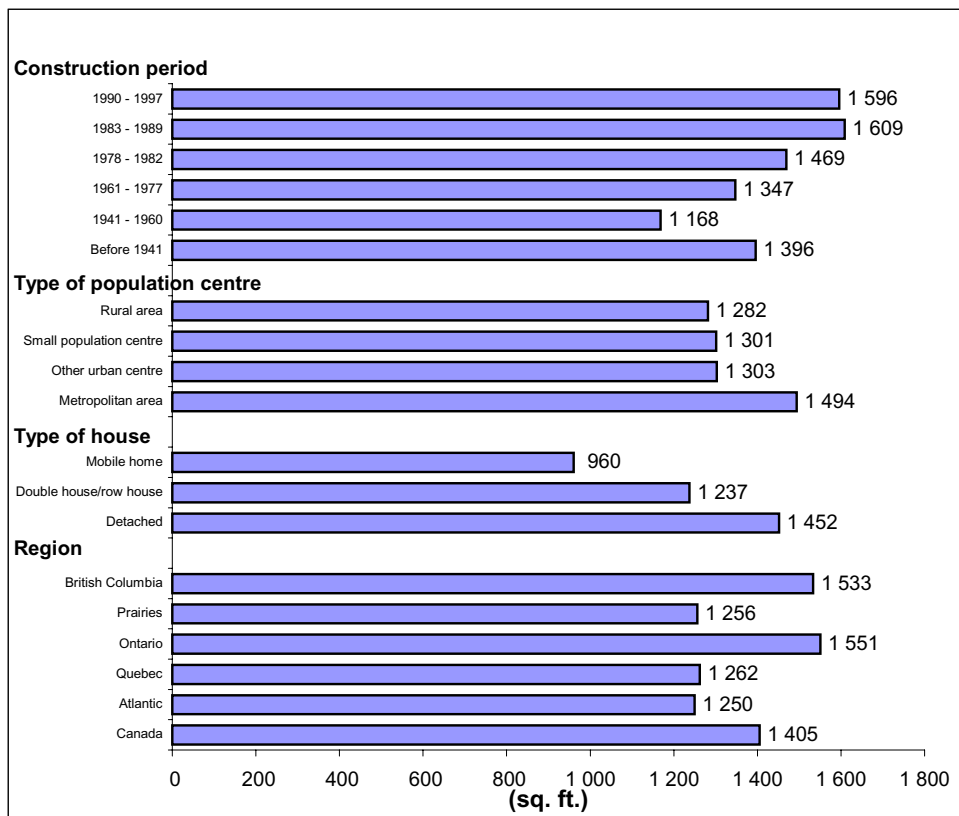
1 The Stock of Houses in Canada

In 1997, the average Canadian house had 6.6 heated rooms, including 2.8 bedrooms, over an average heated area of 1405 sq. ft. (compared with 1378 sq. ft. in 1993), excluding basement and garage. Although nearly half of all houses have only one storey, four out of five of them are detached units.

Figure 1.1: General Characteristics of Houses



Houses in Ontario and British Columbia have a larger average heated area than houses in other regions in the country. Houses in Quebec have an average of only 6.1 heated rooms compared with 7.0 heated rooms in Ontario. The Prairies have the largest proportion of single-storey houses, and British Columbia has the largest proportion of houses built after 1982.

Figure 1.2: Average Area of Houses (sq. ft.)

Houses built between 1941 and 1960 are characterized by their small area. Since that period, the heated area has increased progressively, stabilizing at around 1600 sq. ft. since 1983. Between 1941 and 1977, the proportion of one-storey dwellings was three out of five; since 1990, about one out of three houses (34 percent) has one storey.

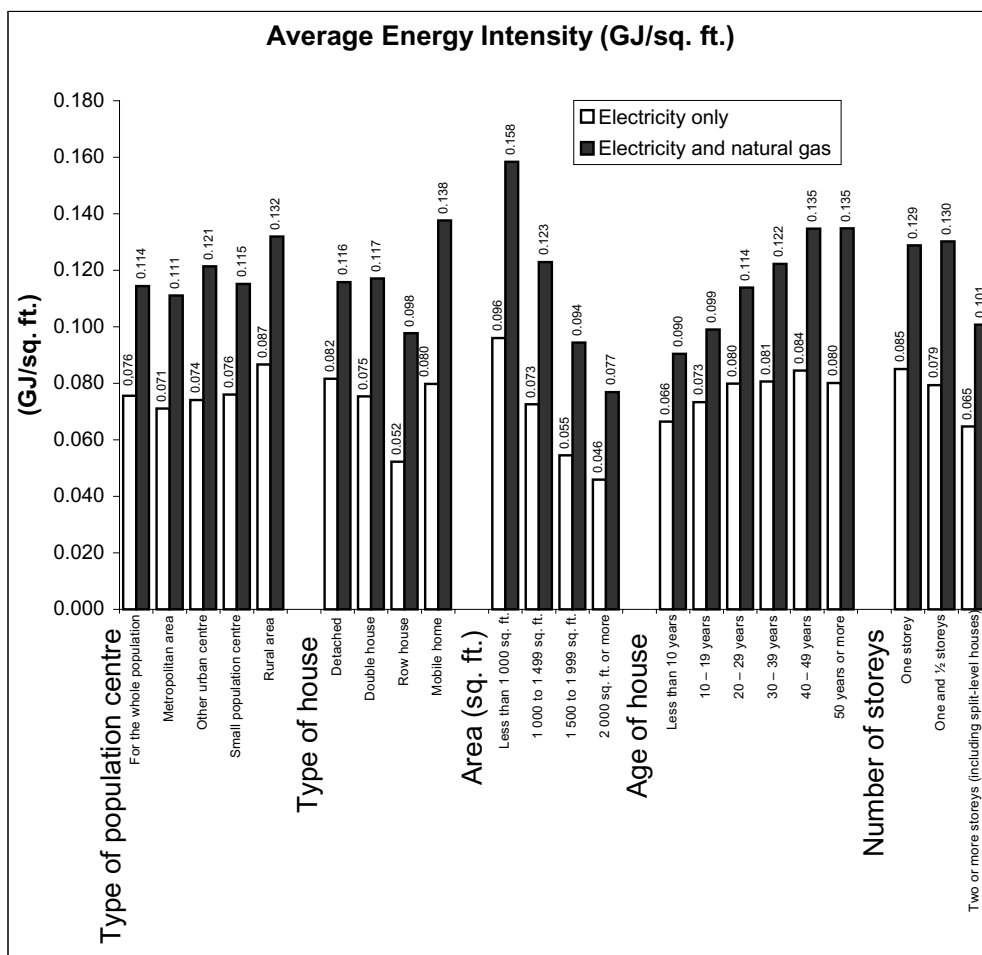
Table 1.3:
Distribution of Houses by Number of Storeys,
Average Number of Heated Rooms and Bedrooms,
by Region and Construction Period

	CA	Atlantic	QC	ON	Prairies	BC
Number of storeys (%)						
One storey	47.1	56.0	51.2	32.8	61.8	54.0
One and ½ storeys	7.4	10.1	6.5	8.4	6.3	5.1
Two storeys	36.4	26.2	38.4	46.4	20.9	33.5
More than two storeys	2.0	1.6	1.7	2.5	0.9	2.8
Split-level or other	7.2	6.1	2.2	9.8	10.1	4.6
Average number of ...						
Heated rooms	6.6	6.4	6.1	7.0	6.2	6.5
Heated bedrooms	2.8	2.9	2.6	3.0	2.8	2.8
<u>Construction period</u>						
	Before 1941	1941 to 1960	1961 to 1977	1978 to 1982	1983 to 1989	1990 to 1997
Number of storeys (%)						
One storey	22.9	58.7	62.3	48.9	37.0	34.4
One and ½ storeys	17.2	12.6	3.4	4.1	2.0	5.8
Two storeys	55.6	24.3	22.2	32.8	49.1	51.7
More than two storeys	4.3	1.4	1.5	1.4	1.8	1.8
Split-level or other	0.0	3.0	10.6	12.7	10.1	6.3
Average number of ...						
Heated rooms	6.8	6.1	6.5	6.5	6.8	6.8
Heated bedrooms	2.9	2.6	2.8	2.9	2.9	3.0

As a basis for our energy consumption estimates, electricity and natural gas bills from households that do not use any other energy source to a significant degree were analysed. In this respect, Canadian households that consume electricity exclusively for their dwellings consume on average 23 367 kWh (i.e. 84.1 GJ) each year. In households where electricity and natural gas are used, the average electricity consumption is 8 587 kWh (i.e. 30.9 GJ) and gas consumption is 122.1 GJ. The total energy consumption, therefore, for households using these two energy sources amounts to 153.0 GJ, i.e. 82 percent more than the consumption of all-electric dwellings. Even if part of the deviation between these two categories can be explained by an average heated area that is 20 percent greater where natural gas is an energy source, the difference is essentially due to the superior energy efficiency of electricity.

Energy consumption can also be analysed as a matter of energy intensity, i.e. the consumption of energy per square foot of habitable heated area. For all-electric houses, the estimated energy intensity is 0.076 GJ per sq. ft. and for houses using natural gas, the estimated energy intensity is 0.114 GJ per sq. ft. As shown by Figure 1.4, the energy intensity varies with the characteristics of the dwelling.

Figure 1.4: Average Energy Intensity (GJ per sq. ft.) – Houses Using Electricity as a Sole Source of Energy versus Houses Using Both Electricity and Natural Gas



Whether or not houses use natural gas, energy intensity appears to be higher in houses with fewer than two storeys than in dwellings of two storeys or more. This phenomenon could be explained by the fact that heat rises. The energy intensity is also higher in houses in rural areas than in more urban areas, and lower in row houses than in other types of dwellings. Moreover, energy intensity decreases as the heated area increases. This phenomenon can be explained by the fact that, even though the heated area of a dwelling is doubled, the surface of its thermal envelope is not.

The analysis shows that energy intensity increases with the age of the dwellings. Those under ten years of age consume only 0.066 GJ per sq. ft. when heated by electricity only, and 0.090 GJ per sq. ft. when natural gas is added. This tendency can be explained first by the improvement in the energy efficiency of houses and second by the fact that the areas of houses have tended to increase since 1960, stabilizing after 1982. For the average older house, which tends to have a large area, the high energy intensity can be explained by the lower efficiency level of its thermal envelope.

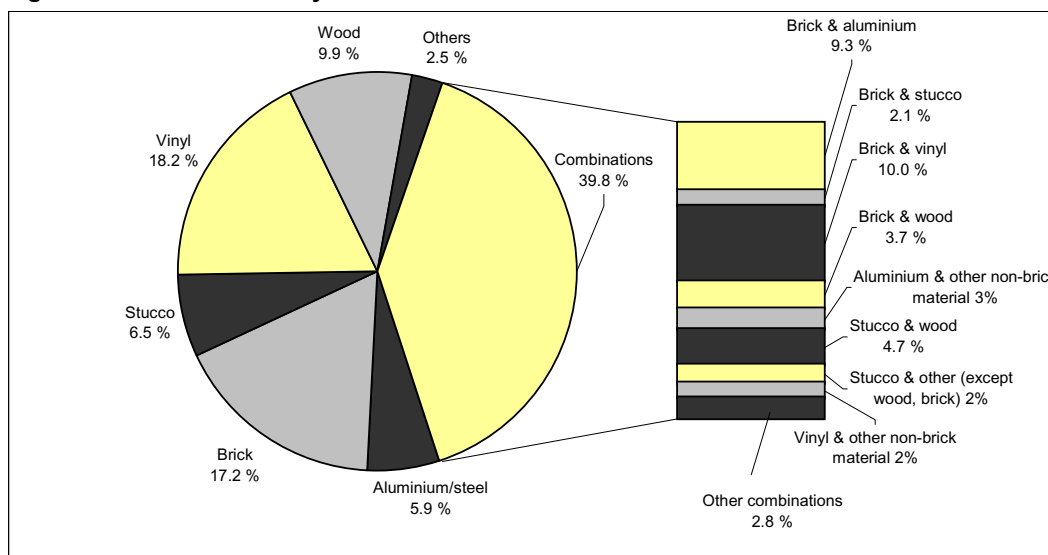
2 The Thermal Envelope

2.1 Characteristics of the Thermal Envelope

2.1.1 Exterior Materials

The most common exterior materials on houses include vinyl and brick and, to a lesser extent, wood, stucco and aluminium/steel together with the combinations of brick and vinyl, as well as brick and aluminium.

Figure 2.1.1: Distribution by Exterior Material



It should be noted that there are significant variations from one region to another in Canada. In the Atlantic provinces, two out of four houses are covered with vinyl only, and one out of four is covered exclusively with wood. In Quebec, brick is used extensively, either alone or with another material such as aluminum or vinyl. Brick is even more prevalent in Ontario: one third of the time it is the only facing, but is also used with vinyl or aluminum. In the Prairies, vinyl and stucco are often the only exterior materials, although stucco is also combined with other materials, especially wood. Finally, British Columbia distinguishes itself by the use of materials such as wood, vinyl or stucco. Stucco is often used with another product such as wood.

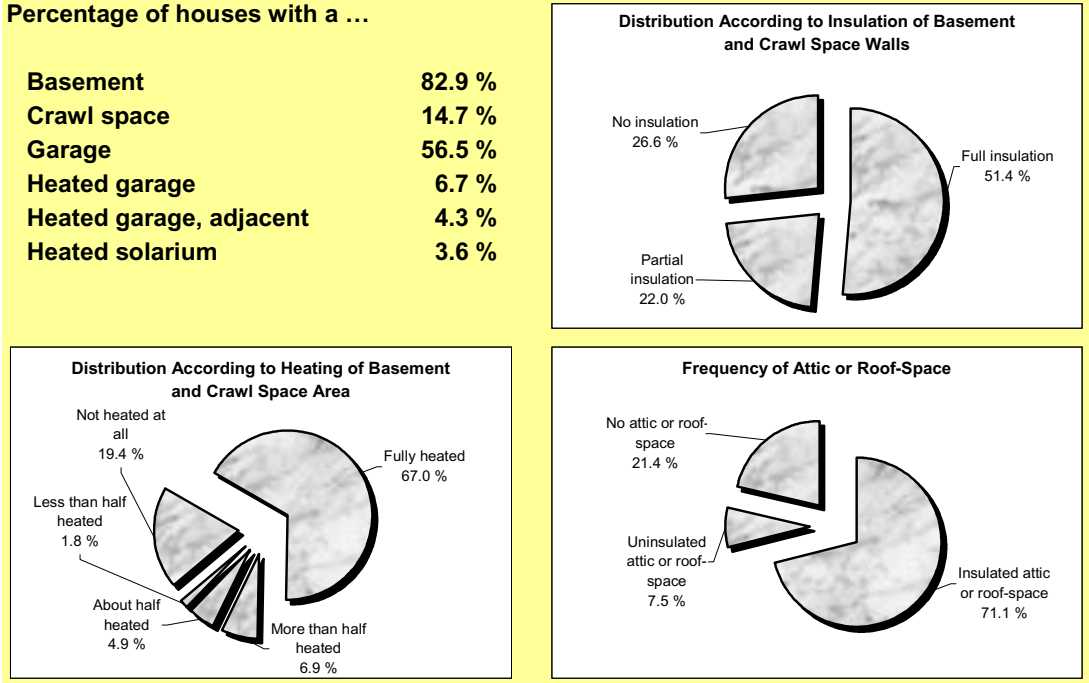
**Table 2.1.2:
Exterior Materials of Houses, by Region**

	CA	Atlantic	QC	ON	Prairies	BC
Main material on exterior walls (%)						
One material only:	60.1	82.6	54.4	53.5	64.5	66.5
Aluminium/steel	5.9	7.6	7.5	4.0	6.8	6.4
Brick	17.2	1.1	21.2	33.2	0.7	0.0
Stucco	6.5	0.0	2.2	1.5	16.7	17.1
Vinyl	18.2	45.9	13.9	9.9	25.8	18.7
Wood	9.9	24.6	4.7	3.1	13.1	22.6
Other	2.5	3.6	4.9	1.8	1.4	1.8
Two materials:	39.9	17.4	45.6	46.5	35.5	33.5
Brick and aluminium	9.3	0.4	17.2	14.6	0.4	0.9
Brick and stucco	2.1	0.0	1.5	1.5	4.5	2.5
Brick and vinyl	10.0	7.1	8.2	17.8	3.1	2.4
Brick and stone	0.7	0.0	2.0	0.7	0.0	0.0
Brick and wood	3.7	2.9	4.7	4.4	1.8	3.5
Aluminium and other non-brick material	2.8	1.5	4.1	2.7	2.0	3.2
Stucco and wood	4.7	0.2	0.3	0.1	14.5	13.6
Stucco and other (except wood, brick)	2.4	0.0	1.5	1.1	6.0	3.9
Vinyl and other non-brick material	2.0	4.2	2.3	1.3	2.1	1.6
Other combinations	2.2	1.0	3.7	2.4	1.2	2.1

2.1.2 Basements, Garages and Attics

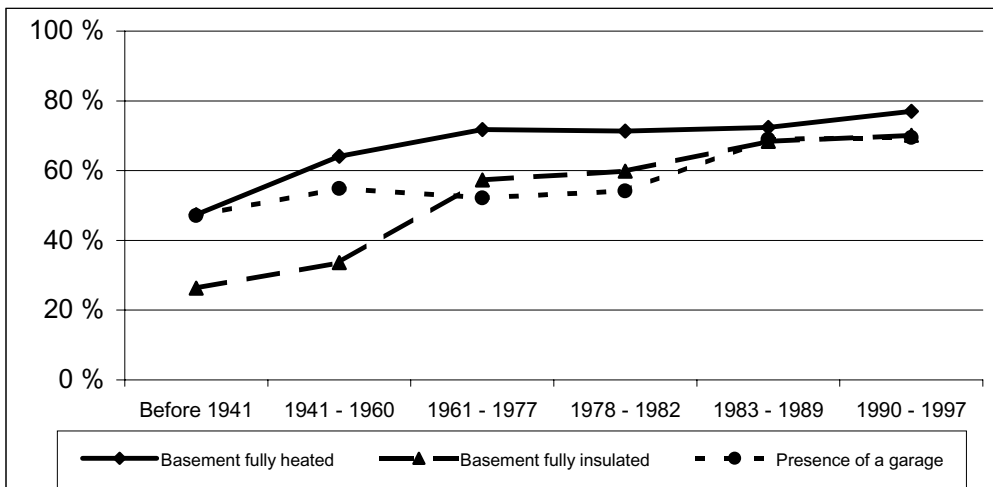
Despite the fact that Canadian houses are generally built – at least partially – over a basement, 15 percent of houses have a crawl space instead. Two thirds of these spaces are fully heated, and the walls of three out of four of them are either fully (51 percent) or partially (22 percent) insulated.

Figure 2.1.3: Presence of Basement, Garage and Attic



Four out of five houses have an attic or a roof-space, which is usually insulated. Heated solariums remain a rather rare feature, as are heated garages. Quebec stands somewhat apart from the national picture in this regard, as three quarters of basements and crawl spaces in that province are fully heated and two thirds of them have full interior insulation.

Figure 2.1.4: Percentage of Houses with Selected Equipment, by Construction Period



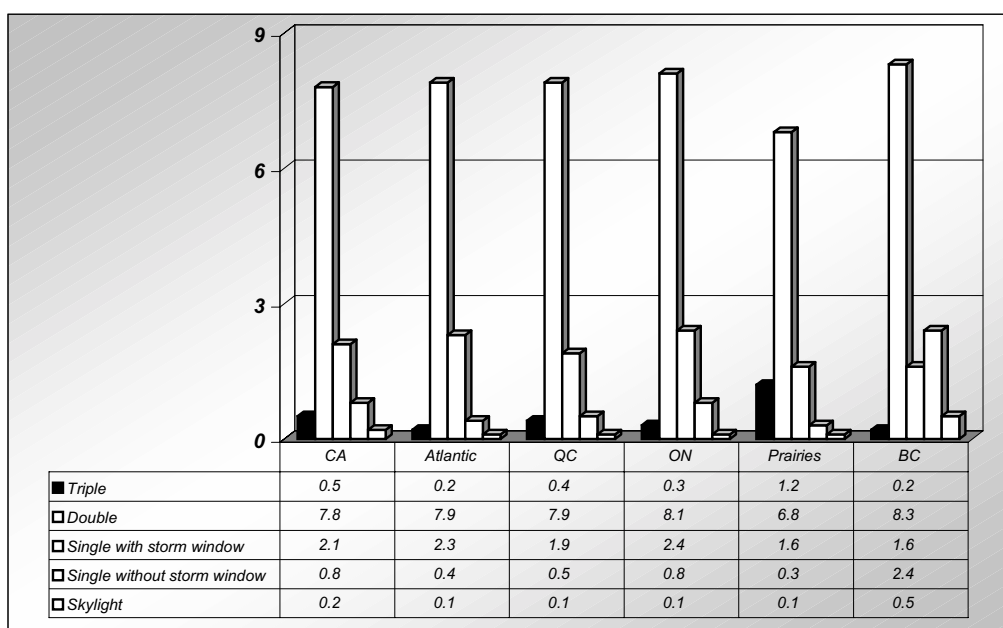
An analysis of these data by construction period shows an interesting evolution: the newer the house, the more likely it is that its basement or crawl space has complete interior insulation; the percentage rises from 26 percent for houses built prior to 1941 to 70 percent for houses built after 1990.

Since 1993, a "fully heated" basement is almost synonymous with a "fully insulated" basement. It must be noted that, in houses built since the 1993 survey, nine out of ten basements are insulated and seven out of ten basements are fully insulated.

2.1.3 Windows

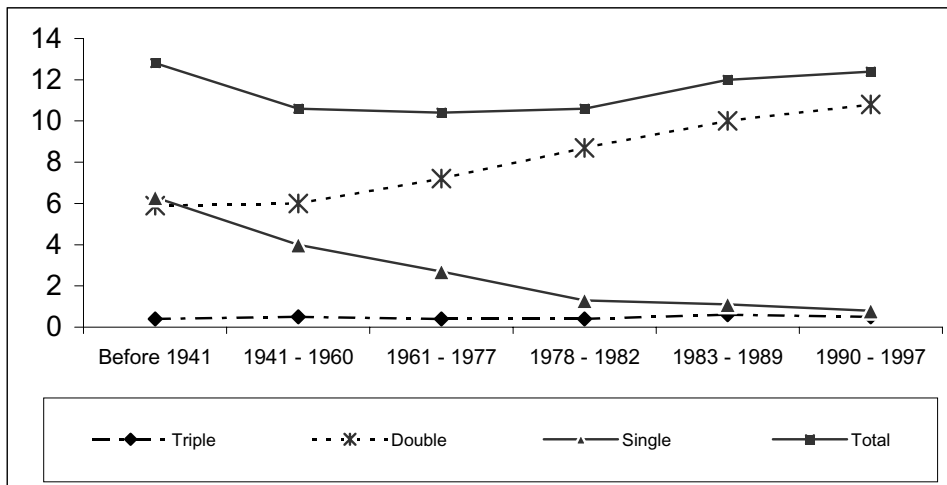
The average Canadian house has 11.3 windows in its heated area: these consist of 0.5 triple-paned windows, 7.8 double-paned windows and 2.9 single-paned windows (including 2.1 storm windows) and 0.2 skylights.

Figure 2.1.5: Number of Windows by Type of Window, by Region



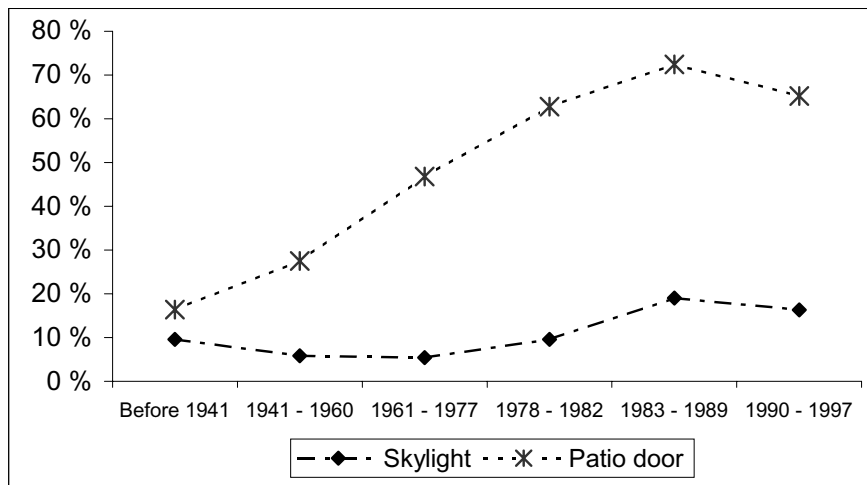
Regional variances in the number of windows reflect the average area of dwellings fairly well. British Columbia and Ontario have the highest numbers of windows, with 13.0 and 11.7 respectively. A typical house in British Columbia is characterized by a high average number of single-paned windows without storm windows (2.4) and skylights (0.5). Triple-paned windows are particularly prevalent in the Prairies: 19 percent of houses in that region have this type of window, compared to seven percent on the national scale.

Figure 2.1.6: Average Number of Windows by Type of Window, by Construction Period



A high number of windows, once the mark of pre-1941 houses, regained acceptance during the construction periods of 1983-1989 (12.0 windows) and after (12.4 windows). Over the years, double-paned windows have become the norm. In the average house built in 1990 and later, 10.8 out of 12.4 windows are double-paned. In comparison, the typical house built prior to 1941 has 6.3 single-paned windows (1.1 of which do not have a storm window); even now, almost one out of five houses dating from that period (18 percent) has single-paned windows without storm windows.

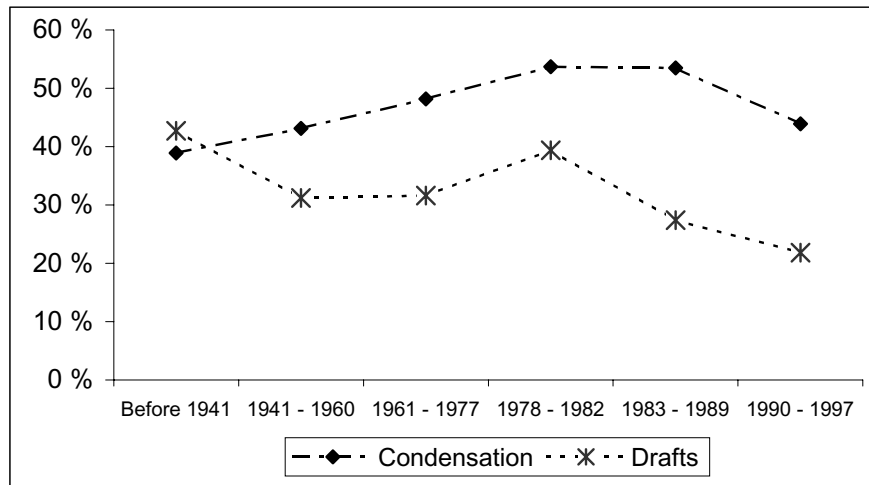
Figure 2.1.7: Houses with Skylights and Patio Doors, by Construction Period



The penetration rate of patio doors has shown a remarkable progression. Although 46 percent of all houses have at least one patio door, only 16 percent of houses that predate 1941 have at least one, compared to approximately seven out of ten houses built after 1982 with such doors. Skylights have become popular since 1983; nearly one out of five houses has at least one.

Residents of one out of three houses experienced drafts around their windows, but even more of them (47 percent of respondents) were concerned about condensation on their windows. Although recent constructions appear to have fewer problems with drafts (22 percent vs. 43 percent for houses built before 1941), condensation was a particular concern for residents of dwellings built between 1983 and 1989 (54 percent). The marked presence of air exchangers in more recent buildings (built since 1990) appears to have reduced the frequency of this problem (44 percent).

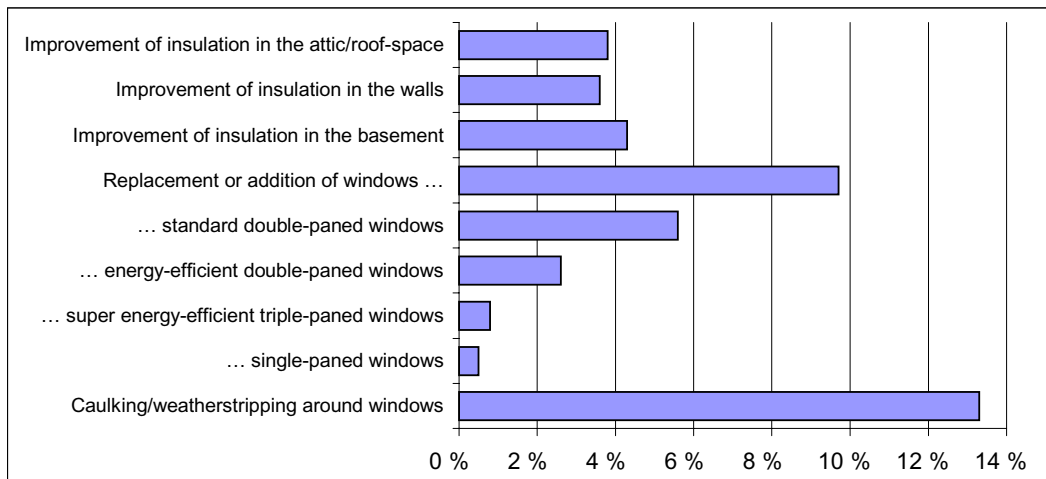
Figure 2.1.8: Houses with Problems Affecting Windows, by Construction Period



2.2 Improving Efficiency of the Thermal Envelope

During 1997, approximately one out of 25 households upgraded the insulation in the roof space or attic; the same proportion insulated the walls of their house or the walls or floor of their basement. Even more of them replaced or added windows (ten percent); the most frequent installations were standard double-paned windows (six percent) or energy-efficient double-paned windows (three percent). These renovations affected an average of 3.6 windows. Also in 1997, one out of seven households upgraded the caulking or the weatherstripping of existing windows, improving the energy efficiency of an average of 5.5 windows.

Figure 2.2.1: Percentage of Houses Having Undergone Energy-Efficiency Improvements



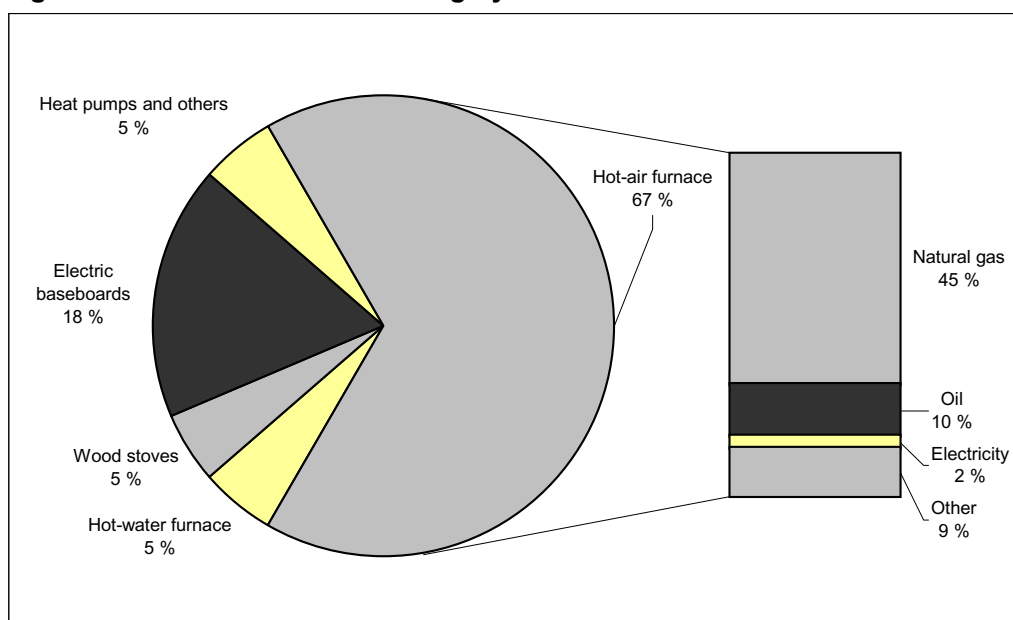
Cross-tabulation analyses show that these observations are almost universally valid for all regions, types of dwelling, construction periods, types of population centre or types of household. The only noteworthy variations concern recently built houses, for which this type of renovation is less necessary.

3 Residential Heating

3.1 Description of the Main Heating System

Two thirds of Canadian houses are heated by hot-air furnaces while 18 percent use electric baseboards. The rest of the market is divided among hot-water furnaces (5 percent), heat pumps (4 percent), wood stoves (5 percent), and other equipment (2 percent). The natural-gas-fired hot-air furnace is present in almost half of Canadian households.

Figure 3.1.1: Distribution of Heating Systems



In general, the average age of hot-air furnaces and other systems is 14 years. Electric baseboard heaters are, on average, 15 years old, whereas hot-water furnaces, with an average age of 19 years, are the oldest units in the inventory. Wood stoves (12 years) and heat pumps (nine years) are relatively young.

3.2 Description of the Main Source of Heating Energy

Of all heating systems together, natural gas is the main source of heating energy for 47 percent of houses, with electricity capturing 23 percent of the market and oil 12 percent. Wood is the main home heating source in five percent of households, while two percent depend on some other source of energy, and ten percent turn to a dual source of energy which, in two out of three cases, is a combination of electricity and natural gas.

**Table 3.2.1:
Distribution of Houses,
by Energy Source of Main Heating System**

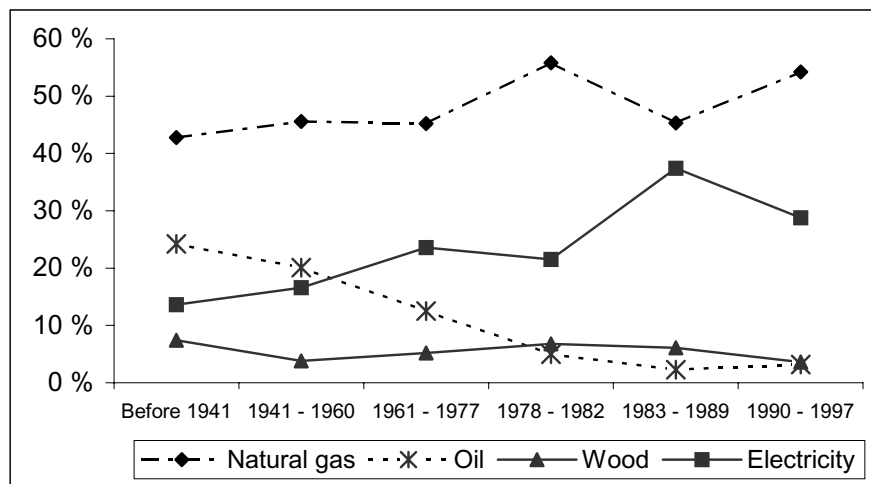
Energy source	CA	Atlantic	QC	ON	Prairies	BC
Natural gas (%)	47.3	0.0	3.7	66.5	76.7	51.9
Oil (%)	12.2	40.5	15.9	10.5	1.3	7.0
Wood (%)	5.4	15.0	11.0	2.2	0.8	5.7
Electricity (%)	23.1	37.5	59.5	9.3	5.3	20.2
Others (including dual source) (%)	12.0	6.9	9.8	11.4	15.9	15.2

Energy source	Before 1941	Construction period				
		1941 to 1960	1961 to 1977	1978 to 1982	1983 to 1989	1990 to 1997
Natural gas (%)	42.8	45.6	45.2	55.8	45.3	54.2
Oil (%)	24.2	20.1	12.5	5.0	2.3	3.2
Wood (%)	7.4	3.8	5.2	6.8	6.1	3.6
Electricity (%)	13.6	16.6	23.6	21.5	37.4	28.8
Others (including dual source) (%)	12.0	13.9	13.5	10.9	8.8	10.2

The distribution of main heating systems and energy sources varies to some extent between regions of the country. In the Atlantic provinces, oil and electricity share the major part of the market, and it is the only region where oil holds such an important position. Wood plays a significant role there and in Quebec. However, in Quebec, electricity clearly dominates the market as the main energy source in three out of five houses. In all of the western provinces, natural gas lays an indisputable claim as main heating fuel; in the Prairies, it is the main energy source in three out of four houses.

An analysis of the results by construction period confirms the evolution of the market. One out of four houses built prior to 1941 uses oil as its main energy source. However, this proportion decreases progressively to the point where it holds only three percent of the market in houses built after 1982. Electricity plays an important role in recent houses, having captured 37 percent of the market for the construction period 1983-1989 and 22 percent thereafter. Moreover, natural gas is the main energy source for heating in more than half of all houses built since 1990 (54 percent).

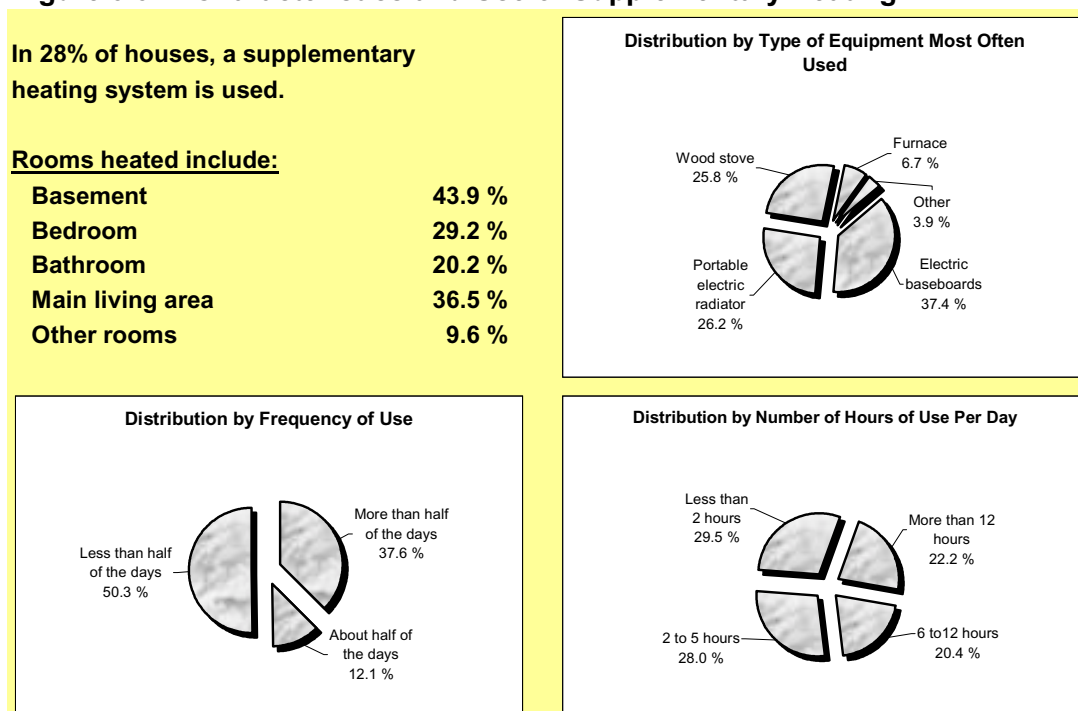
Figure 3.2.2: Market Shares of Main Energy Sources, by Construction Period



3.3 Supplementary Heating Systems

In slightly more than one quarter of the housing inventory, the main heating system is complemented by a secondary system. Out of eight homes using supplementary heating, three use electric baseboards, two use portable electric radiators, two others use wood stoves, and the eighth uses another system.

Figure 3.3.1: Characteristics and Use of Supplementary Heating



Most of the time, this complementary system heats the basement or the main living area (main living area include kitchen, living room, dining room and family room). It is also often used for bedrooms and bathrooms. The secondary status of these units is confirmed by the fact that half of their users operate them less than half of the number of days in the heating season. In 58 percent of all cases, they are used less than six hours per day.

Only one out of five households with natural gas uses a supplementary heating system. Conversely, more than one out of three homes with an oil system are complemented by a supplementary heating system, often electric baseboards or wood stoves. Where electricity is the main energy source, nearly one out of three households depends on some other system. Most often, the wood stove is the first choice for heating the basement or main living area of the house.

**Table 3.3.2:
Distribution of a Supplementary Heating System
and Equipment Most Often Used,
by Fuel, Main System, and Region**

	<u>Fuel used for main system</u>				
	All	Natural gas	Oil	Electricity	Others
Use of a supplementary heating system (%)	28.4	21.1	35.2	30.8	40.7
Among users of a supplementary heating system:					
Most often-used system (%)					
Electric baseboards	37.4	39.8	41.3	12.1	57.1
Portable electric radiators	26.2	49.9	17.7	10.4	13.8
Wood stoves	25.8	5.8	35.8	63.9	9.7
Furnace	6.7	1.3	1.7	7.8	16.2
Other	3.9	3.2	3.6	5.7	3.2
	<u>Main system</u>				
	All	Hot air	Hot water	Wood stove	Electric baseboards
Use of a supplementary heating system (%)	28.4	23.9	30.7	76.1	28.5
Among users of a supplementary heating system:					
Most often-used system (%)					
Electric baseboards	37.4	37.9	47.2	69.6	1.3
Portable electric radiators	26.2	39.7	15.4	4.3	10.0
Wood stoves	25.8	16.2	22.9	1.2	77.7
Furnace	6.7	2.2	10.2	22.9	7.6
Other	3.9	4.1	4.3	2.1	3.4
	Atlantic	QC	ON	Prairies	BC
Use of a supplementary heating system (%)	33.8	39.8	22.6	20.9	33.6
Among users of a supplementary heating system:					
Most often-used system (%)					
Electric baseboards	31.5	45.0	38.2	27.4	34.7
Portable electric radiators	9.6	2.1	39.6	52.2	34.5
Wood stoves	41.7	43.1	16.5	8.3	15.4
Furnace	11.7	8.3	3.5	4.1	8.5
Other	5.5	1.5	2.2	8.1	6.9

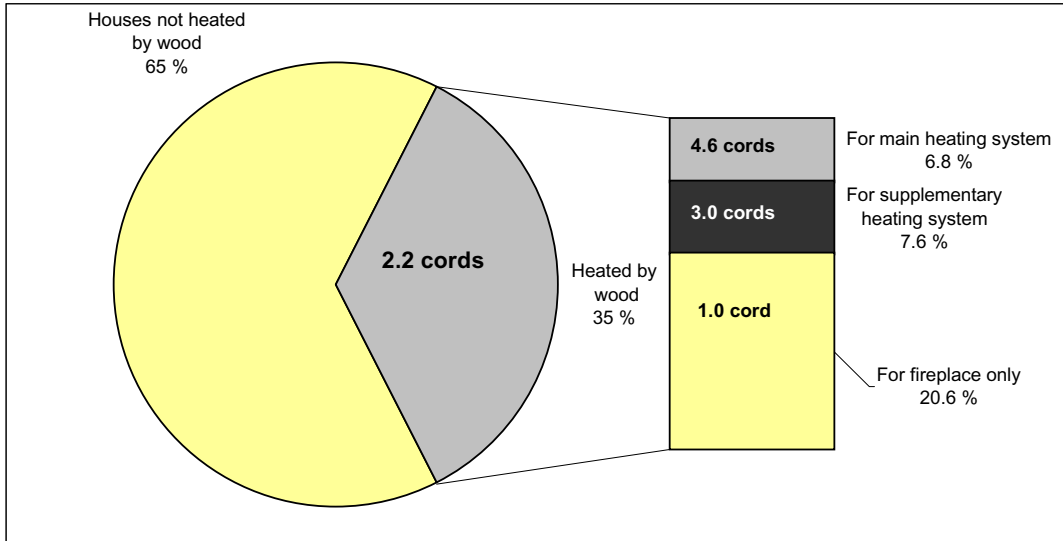
The extent to which the use of wood and electricity complement each other can be observed from another angle. On one hand, three quarters of all houses heated primarily by wood stoves are also equipped with a supplementary heating system. In 70 percent of cases, the system is electric baseboards, which can take over when needed. On the other hand, in three out of four cases where houses are heated primarily by electric baseboards, the secondary system is a wood stove.

This combination of heating systems obviously has regional overtones. For example, two out of five households in Quebec have supplementary heating systems, usually electric baseboards or wood stoves. Only one out of five households in Ontario and the Prairies uses supplementary heating.

3.4 Use of Wood as Fuel in Houses

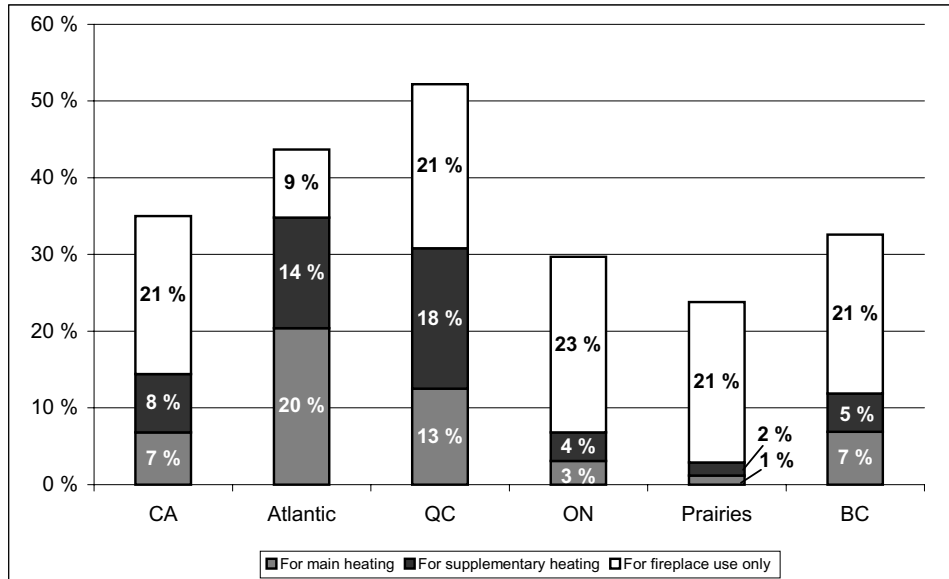
One out of three houses is heated, at least occasionally, by wood. This represents an average annual consumption of 2.2 cords. More specifically, seven percent of households use this fuel as their main heating fuel (perhaps in combination with another source), eight percent use wood for supplementary heat, and finally, 21 percent use wood only in the fireplace. When wood is burned as the main heating source, the average annual consumption is 4.6 cords.

Figure 3.4.1: Distribution of Houses, by Different Uses of Wood



In Quebec, one out of two houses uses wood for heating. Many houses use wood for supplementary heat, and a good number of them limit its use to the fireplace. The Atlantic provinces, where one house out of five uses wood as the main energy source, make the greatest use of wood for that purpose.

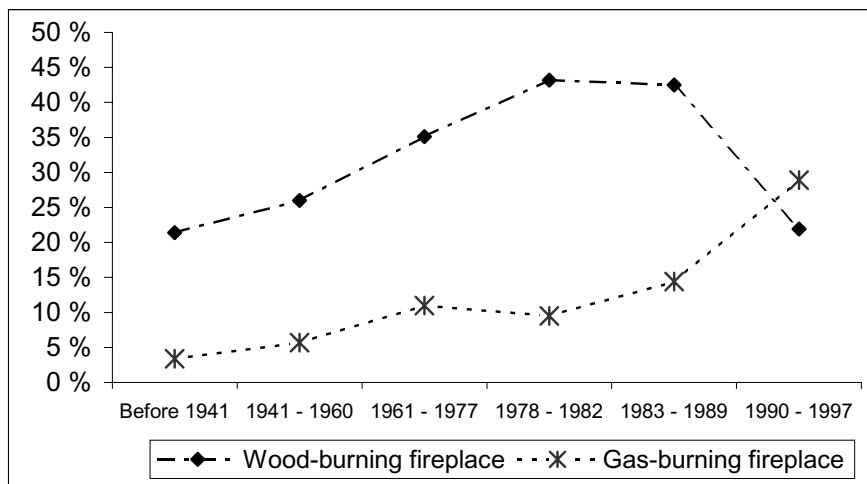
Figure 3.4.2: Percentage of Houses where Wood is Used for Different Purposes, by Region



3.5 Presence of Fireplaces

Almost one out of three houses has a wood-burning fireplace. The highest frequency is in British Columbia, with a penetration rate of two out of five houses. This is comparable to the pan-Canadian percentage of houses built with fireplaces between 1978 and 1989.

Figure 3.5.1: Penetration Rate of Wood- and Gas-Burning Fireplaces, by Construction Period



In comparison, only one out of eight houses has a gas fireplace. In British Columbia, the proportion is three out of ten houses. Gas fireplaces are especially prevalent in houses built after 1990; three out of ten houses are equipped with gas fireplaces, exceeding the penetration rate of wood fireplaces (22 percent).

Since the 1993 survey, there has been significant progression in the penetration rate of gas fireplaces, surpassing the five percent penetration rate estimated at that time. There are two explanations for this growth rate. First, 35 percent of houses built since 1993 are equipped with gas fireplaces. Second, 40 percent of the existing gas fireplaces were converted from older wood fireplaces.

Wood fireplaces tend to be old; in fact, three out of four are over ten years old. Nearly half of them are not equipped with glass doors. They are not used regularly, however; only one out of three is used once or more each week during the heating season.

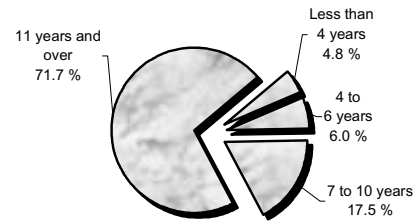
Figure 3.5.2: Characteristics and Use of Wood Fireplaces

Wood fireplaces are found in 31 % of houses.

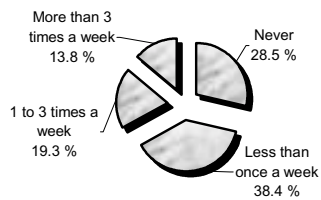
Penetration rate by region:

Atlantic	17.9 %
Quebec	29.5 %
Ontario	34.1 %
Prairies	27.2 %
British Columbia	41.8 %

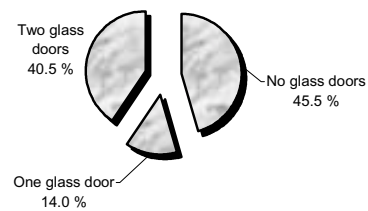
Distribution by Age of Wood Fireplace



Distribution by Frequency of Use

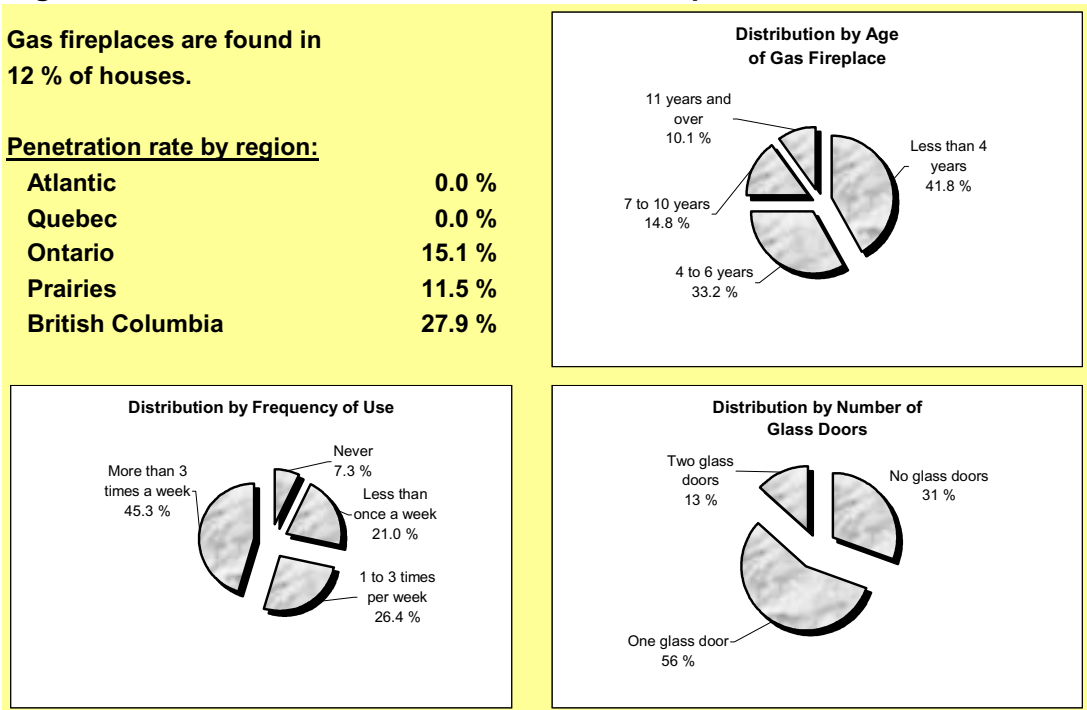


Distribution by Number of Glass Doors



Conversely, almost half of the gas fireplaces (45 percent) are used by their owners more than three times a week, and only seven percent are never used. Relative newcomers to the market, 42 percent of these units are less than four years old. They generally have at least one glass door (69 percent). It must be noted that 40 percent of these gas fireplaces replaced wood-burning fireplaces.

Figure 3.5.3: Characteristics and Use of Gas Fireplaces

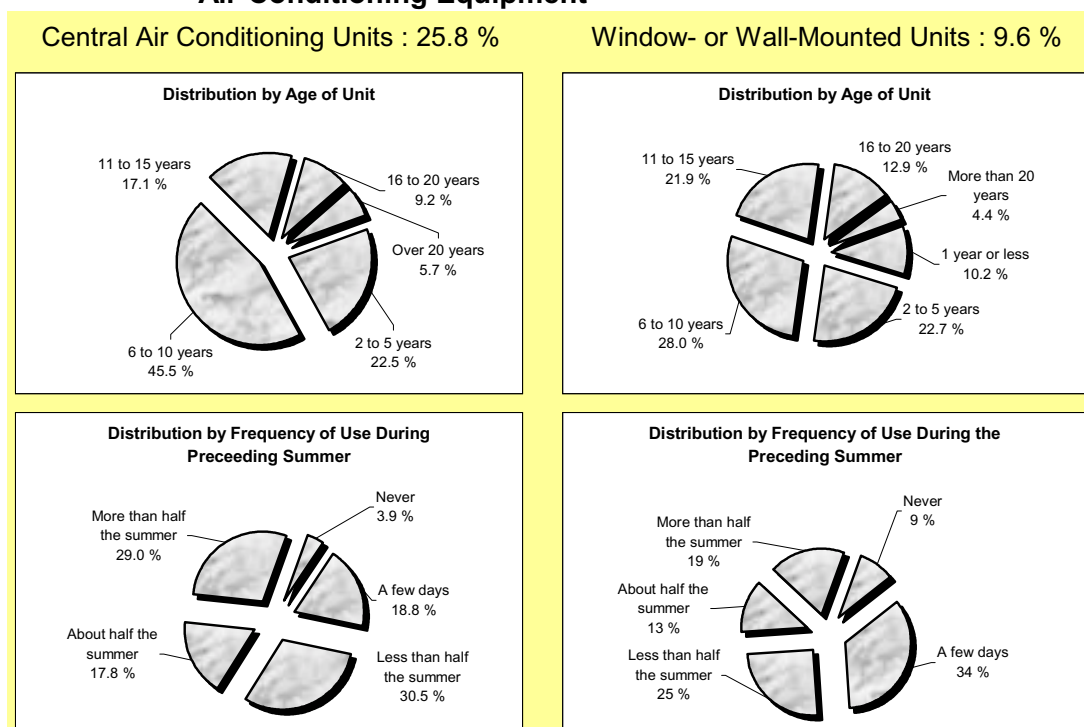


4 Air Conditioning and Ventilation of Houses

4.1 Air-Conditioning Equipment

About one third of all houses are equipped with air-conditioning systems. Among them, 63 percent have a central unit, ten percent have a heat pump, and 27 percent have window- or wall-mounted units. The average system is approximately ten years old, whether central or not. Window- and wall-mounted units have an average power rating of slightly over 8000 Btu.

Figure 4.1.1: Penetration Rate and Characteristics of Air-Conditioning Equipment



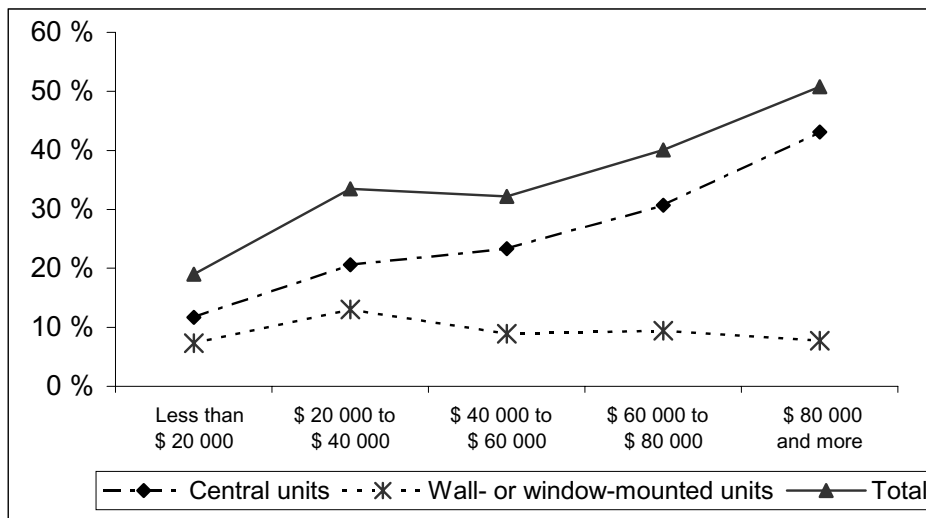
During the summer of 1997, almost half of the households with central air conditioning, including heat pumps, used them during at least half of the summer. This proportion is only about one in three for houses without central units.

As for ventilation units, ceiling fans were found in three out of five houses and portable units in one out of two.

4.2 Factors Influencing the Presence of Air-Conditioning Equipment

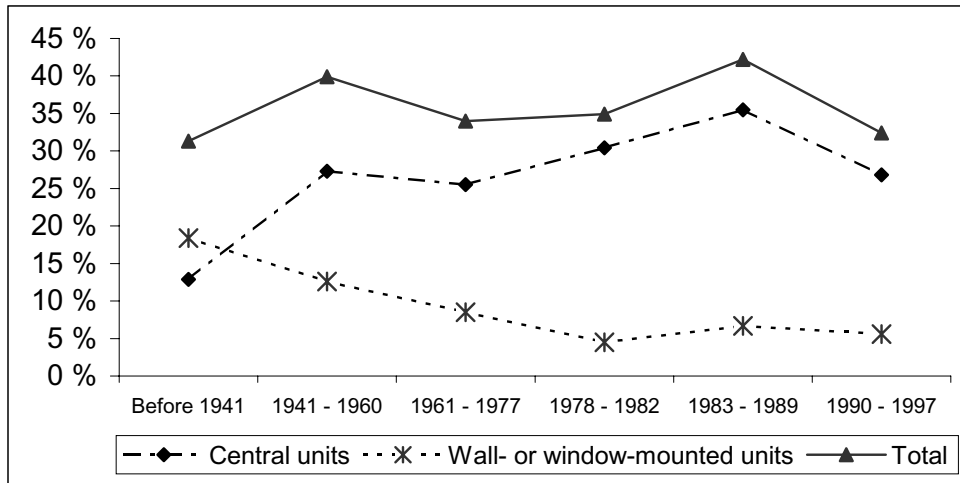
The largest concentration of air-conditioned houses can be found in Ontario (63 percent) and the greater metropolitan areas (46 percent). Household income appears to be a determining factor in ownership of air-conditioning equipment; the penetration rate rises from 19 percent in households with an annual income below \$20 000 to 51 percent where income is \$80 000 and over. The level of household income does not appear to affect the penetration rate of wall- or window-mounted units; central systems appear to be responsible for this difference.

Figure 4.2.1: Penetration Rate of Air-Conditioning Equipment, by Household Income



The percentage of air-conditioned houses does not fluctuate much in relation to the construction period; dwellings built prior to 1941, however, have a much lower rate of central air conditioning (13 percent) and a higher rate of wall- or window-mounted units (18 percent) compared to houses built after this period.

Figure 4.2.2: Penetration Rate of Air-Conditioning Equipment by Construction Period



4.3 Presence of Air Exchangers

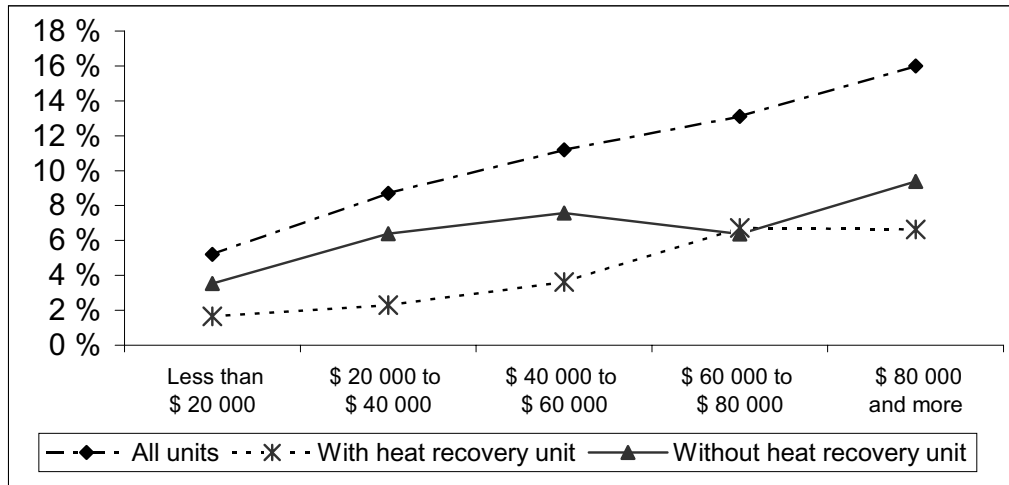
In general, air exchangers remain relatively marginal equipment (11 percent of houses), especially exchangers with heat recovery units (four percent). However, this technology (with heat recovery), promoted via the R-2000 HOME Program, is becoming more and more prevalent in recent construction; nearly one quarter of houses built since 1990 have an air exchanger and 11 percent also have a heat recovery unit. In fact, 32 percent of houses built since the 1993 survey are equipped with an air exchanger.

Table 4.3.1:
Proportion of Houses with Air Exchanger
(with or without Heat Recovery Unit),
by Region and Period of Use

	With air exchanger	With heat recovery unit	Without heat recovery unit
All houses	10.7	3.9	6.8
Region (%)			
Atlantic	18.8	5.9	12.9
Quebec	19.5	6.7	12.8
Ontario	8.4	3.7	4.7
Prairies	5.5	1.7	3.8
British Columbia	5.3	2.5	2.8
Among houses with exchangers:			
Period of use (%)			
Throughout the year	56.7	61.7	55.7
In the winter	13.0	19.1	11.0
In the summer	8.7	4.6	8.3
From time to time	17.1	10.9	20.7
Other	0.8	2.3	0.0
Never	3.8	1.5	4.3

The Atlantic provinces (19 percent) and Quebec (20 percent) have the highest penetration rates of air exchangers. The level of household income also has an important impact on the ownership of these appliances; for example, in households where income reaches or exceeds \$80 000, 16 percent of houses have an air exchanger and seven percent also have a heat recovery unit.

Figure 4.3.2: Penetration Rate of Air Exchangers, by Household Income



More than one-half of households with air exchangers (57 percent) use them throughout the year. In 81 percent of cases where a house is also equipped with a heat recovery unit, it too is used throughout the year.

5 Major Household Appliances

The *Survey of Household Energy Use* did not allow measurement of energy consumption of major household appliances. However, the distribution of these appliances by age, indirectly gives us information on the unit energy consumption of these appliances using the *Energy Efficiency Regulations*, established by the *Energy Efficiency Act*, which sets the minimum requirements concerning the energy efficiency of a large number of energy-consuming appliances. Moreover, with the co-operation of the Canadian Appliance Manufacturers Association (CAMA), NRCan, in its report entitled *Energy Consumption of Major Household Appliances Marketed in Canada – Trends for 1990-1997*, has prepared estimates of the energy consumption of appliances that have recently appeared on the market. The consumption data quoted in this chapter have been taken from that report. Comparison of the average consumption of the major appliances placed on the market in 1990 and 1997 shows that most of them have substantially improved their energy efficiency. The improvements can be attributed to the significant research and development carried out by the appliance manufacturers and to the regulations that were implemented in 1995.

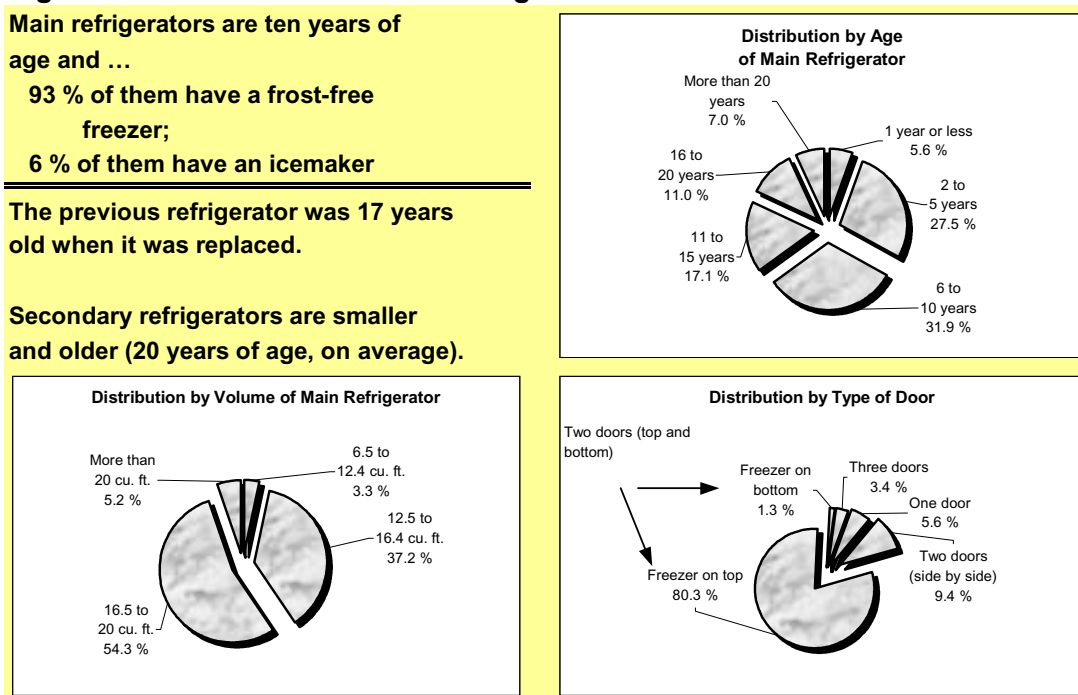
5.1 Penetration Rate, Characteristics and Habits of Use of Household Appliances

5.1.1 Refrigerators

The main refrigerator is ten years old on average and generally has two doors, one above the other, with the freezer – which is almost always frost-free – on top. The average unit is between 16.5 and 20 cu. ft. (54 percent of the time; an increase since the 1993 survey, when it was 46 percent), although many are between 12.5 and 16.4 cu. ft.

The most-popular-sized refrigerators on the market in 1990 (16.5–18.4 cu. ft.) consumed an average of 1067 kWh per year. The 1997 equivalent model consumes only 666 kWh.

Figure 5.1.1: Characteristics of Refrigerators



One third of all households (33 percent) also own a second refrigerator. It is clearly older (20 years old on average) than the main appliance, and often has only one door (43 percent) and a capacity of less than 16.5 cu. ft. (74 percent).

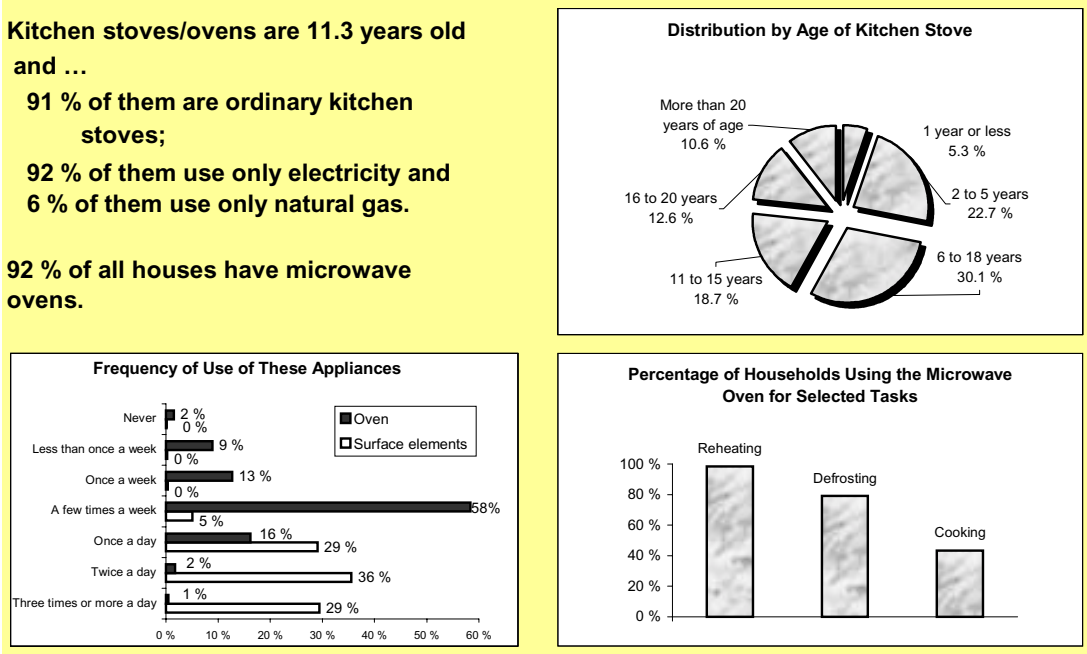
When the current main refrigerator replaced an older appliance, the older one was, on average, 17 years old. Only ten percent of households continue to use their old unit regularly.

5.1.2 Cooking Appliances

The ordinary kitchen stove remains the standard for cooking appliances, as 91 percent of all households have one whereas nine percent use a built-in oven with a separate cooktop. These units operate almost exclusively by electricity, and their average age is 11.3 years.

The average annual consumption of an electric stove is an estimated 775 kWh. This consumption level remained virtually unchanged between 1990 and 1997.

Figure 5.1.2: Characteristics and Use of Cooking Appliances



Two thirds of all households use the surface elements of their stoves at least twice a day; conversely, four out of five use their oven less than once a day.

The microwave oven is very popular among people living in houses; it is used not only to reheat and defrost foods but also, more and more often, for cooking.

5.1.3 Dishwashers

Three out of five houses have a dishwasher. These appliances are on average 8.5 years old, and 72 percent of them are 10 years old or less. In a normal week, the dishwasher is used 4.2 times; half of the households use it three times or less. Slightly more than half of users (57 percent) allow dishes to dry without heat, either with the door closed or open to ambient air. This percentage confirms the results obtained during the 1993 survey (58 percent).

Looking at all dishwashers on the market, the average annual consumption has dropped from 1026 kWh in 1990 to 650 kWh in 1997, a decrease of 37 percent. In 1997, almost all of the models had an annual average energy consumption below 800 kWh. The consumption rating provides for the energy required to heat the water and is based on 322 normal cycles per year, which is slightly more than the average use observed during the 1997 survey.

Figure 5.1.3: Characteristics and Use of Dishwashers

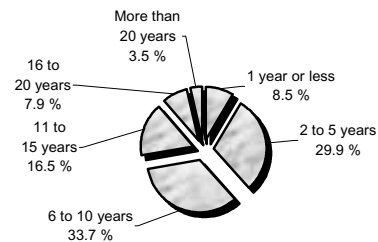
Dishwashers are, on average, 8.5 years old and ...

98 % of them have a standard capacity

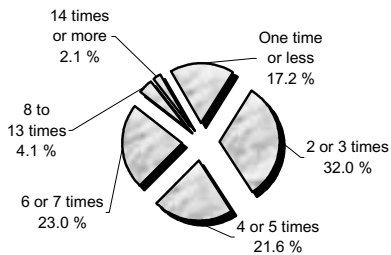
2 % of them are compact dishwashers

There is a dishwasher in 59 % of all houses.

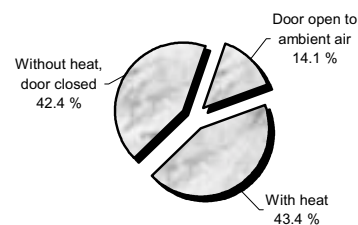
Distribution by Age Dishwasher



Distribution by Frequency of Use of Dishwashers per Week



Distribution by Drying Habits



5.1.4 Freezers

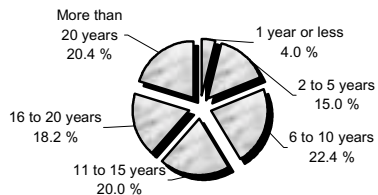
Almost three quarters of all houses have a freezer. Some houses (seven percent) have two freezers. On the average, the main freezer is 15 years old. Most are chest-style freezers.

Figure 5.1.4: Characteristics of Freezers

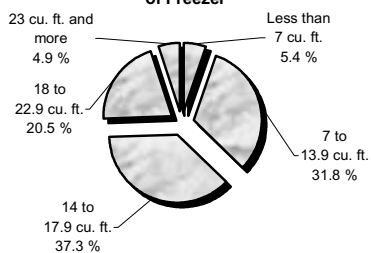
Freezers are 14.7 years old, on average and ...

72 % of all houses have a freezer
6.5 % of all houses have two freezers.

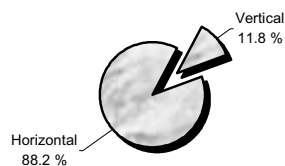
Distribution by Age of Freezer



Distribution by Capacity of Freezer



Distribution by Type of Freezer

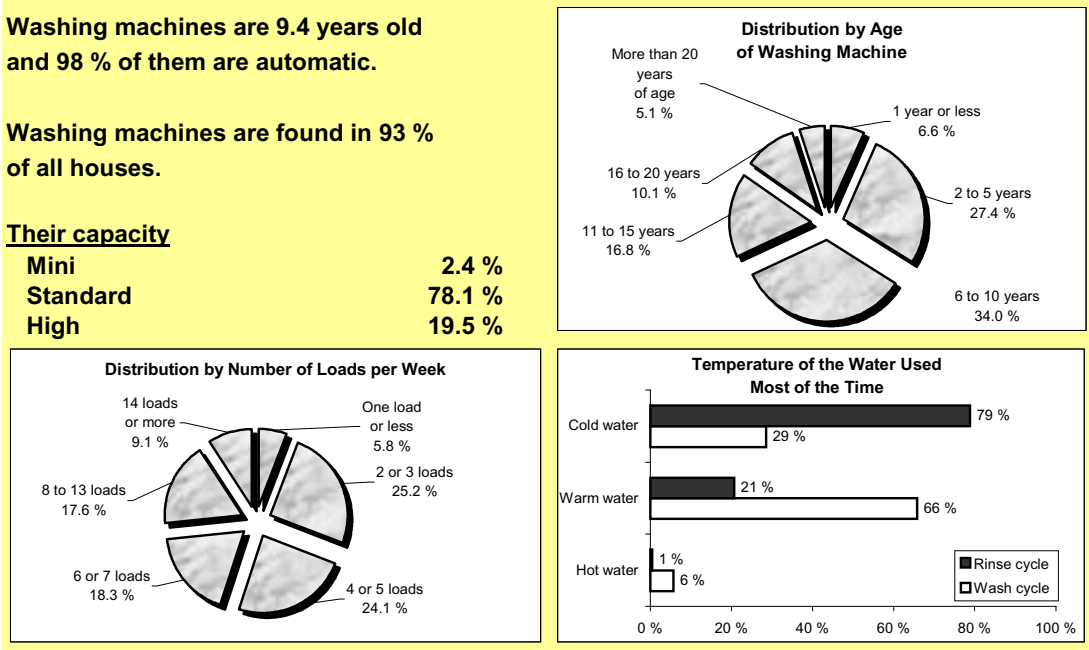


5.1.5 Washing Machines

Almost all houses are equipped with an automatic washing machine, and one that is not combined with a clothes dryer. With an average age of 9.4 years, these machines usually are of standard capacity; one in five is considered high capacity. Two different sources confirm the trend towards high-capacity appliances. First, the *1993 Survey of Household Energy Use* determined that the penetration rate of these high-capacity machines was 14 percent. Second, the *Survey of Canadian New Household Equipment Purchases 1994 and 1995* found that 62 percent of all washing machines purchased during the two years studied were high-capacity machines.

In 1990, only half of the washing machines on the market were rated at an average annual consumption of less than 1100 kWh, while in 1997, almost all of the appliances (98 percent) were below this level. This estimate is based on 416 normal loads of laundry per year, and includes the energy required to heat the water.

Figure 5.1.5: Characteristics and Use of Washing Machines



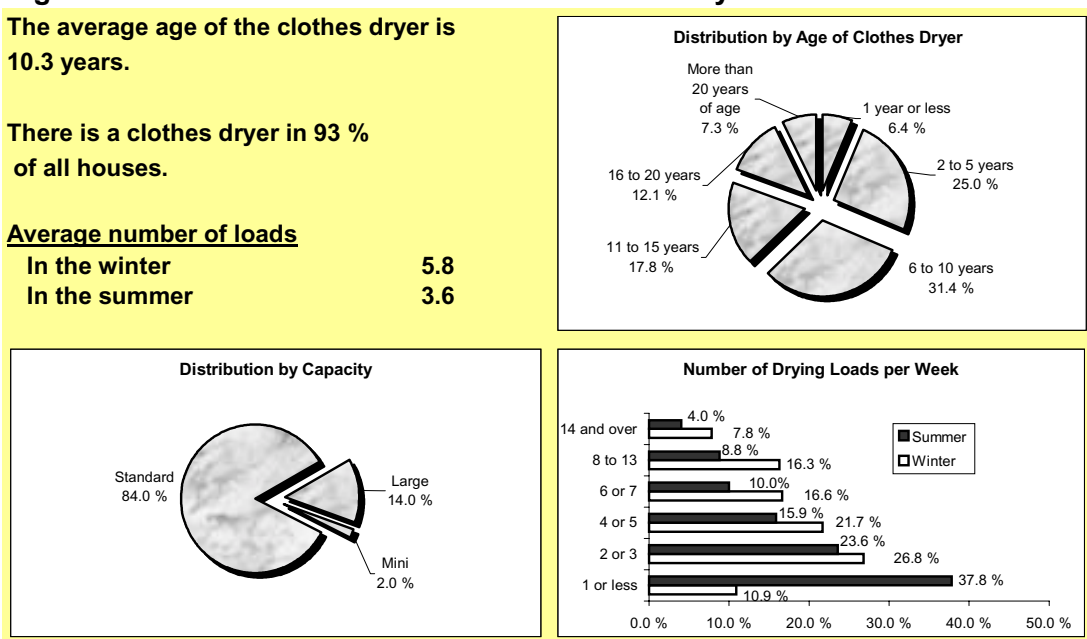
Economical laundry practices appear to be part of our cultural reality; 94 percent of users state that they do not wash with hot water most of the time. Likewise, 79 percent of them state that they use cold water for the rinse cycle, which confirms the estimates of the 1993 survey. The average household did 6.3 washloads per week, according to the results of the 1997 survey.

5.1.6 Clothes Dryers

The clothes dryer is another appliance almost universally present in Canadian households. Most of them are rated standard (84 percent) or high capacity (14 percent). The 1993 survey showed a penetration rate of nine percent for large dryers, whereas the *Survey of Canadian New Household Equipment Purchases 1994 and 1995* indicated that 56 percent of dryers purchased fell within that size category. This confirms the trend towards high-capacity appliances.

In 1997, the average annual consumption of most dryers available on the market (99 percent) was below 950 kWh, compared with 27 percent in 1990. Between 1990 and 1997, the average annual consumption dropped from 1103 kWh to 888 kWh. This consumption estimate is based on 416 loads per year.

Figure 5.1.6: Characteristics and Use of Clothes Dryers



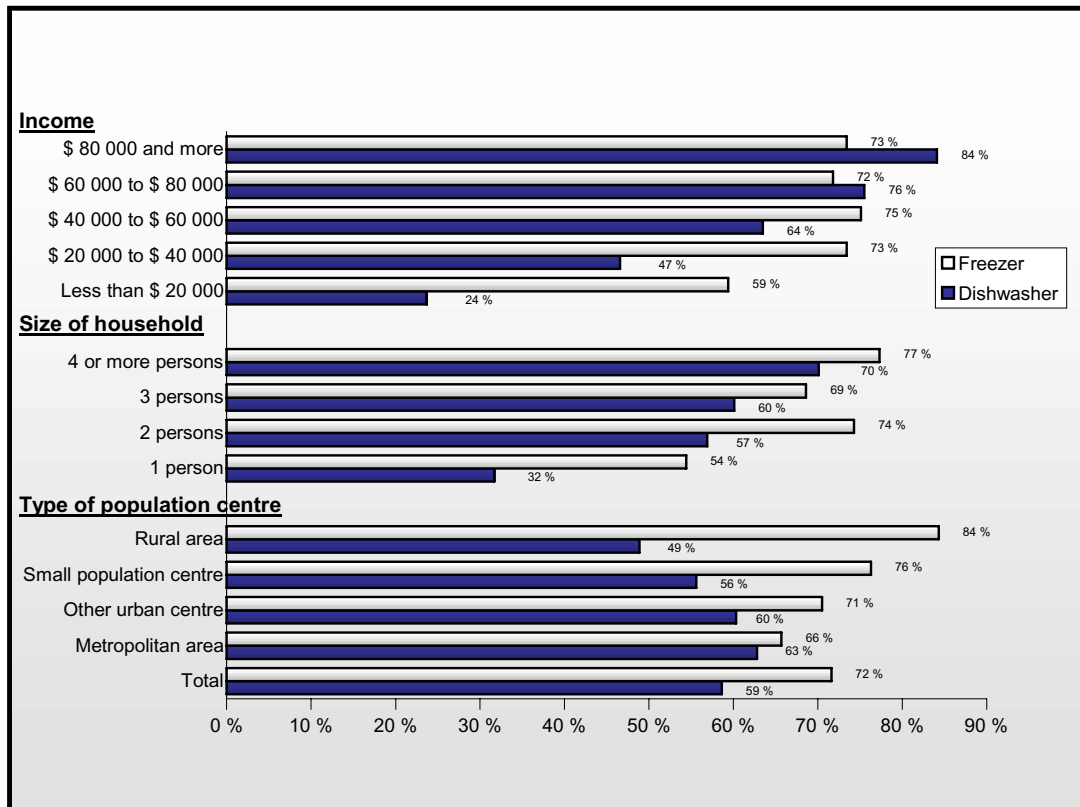
According to the results of the 1997 survey, the average clothes dryer was used for 5.8 loads per week in the winter, but only 3.6 loads per week in the summer.

5.2 Penetration Rate of Large Household Appliances

The penetration rates of microwave ovens, washing machines and clothes dryers are so high that little can be learned about household profiles from their presence.

However, it is observed that the penetration rate for dishwashers and freezers tends to increase with household income. For example, dishwashers are more rare in households with an annual income of less than \$20 000 (24 percent) than in households with an annual income of \$80 000 or more (84 percent). The rate of ownership of this appliance also increases with the number of persons within the household. Dishwashers are found in only one third of single-person households, but are in seven out of ten households with four members or more.

Figure 5.2.1: Penetration Rate of Dishwashers and Freezers' by Income and Size of the Household and by Type of Population Centre

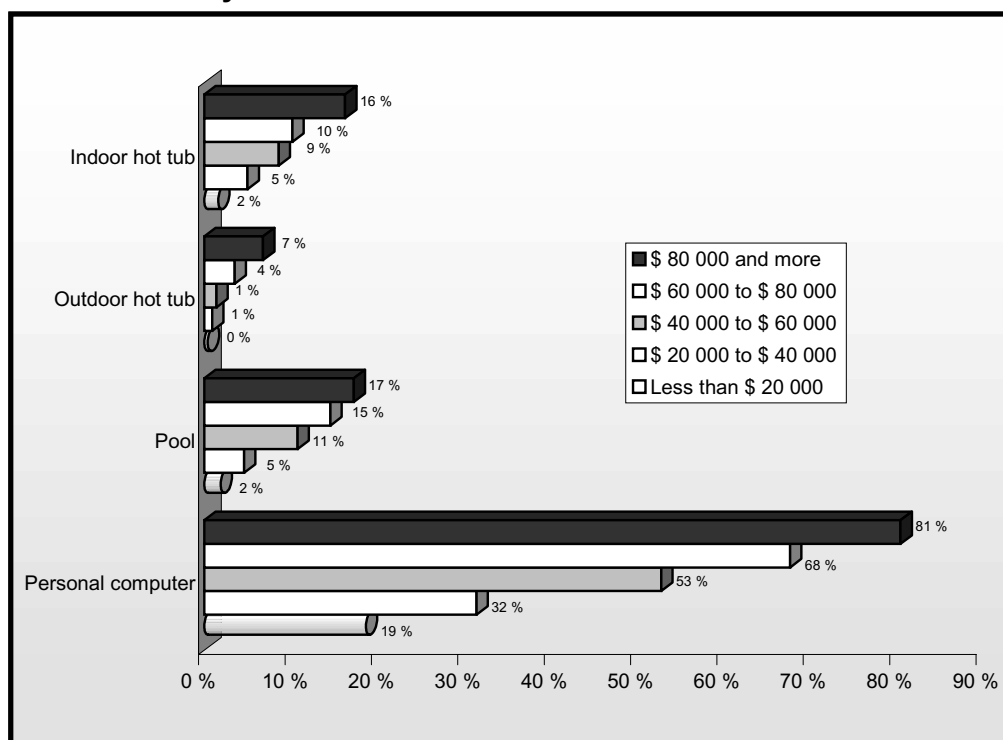


Freezers are much more prevalent in rural areas than in metropolitan areas. The reverse is true for dishwashers.

5.3 Penetration Rate of Selected Energy-Consuming Appliances

A vast number and variety of energy-consuming appliances are found in households. The heaviest energy consumers, aside from the major household appliances, are personal computers (with a penetration rate of 49 percent), heated waterbeds (seven percent), pools (ten percent; three percent for heated pools), hot tubs (eight percent indoor; two percent outdoor), and saunas (one percent). As can be expected, the household income has a great influence on the rate of penetration of these items.

Figure 5.3.1: Penetration Rate of Selected Energy-Consuming Appliances by Household Income



Regional variances can be observed in other analyses. Among the most significant are the high presence of swimming pools in Quebec (24 percent, of which 19 percent are above-ground pools) and the presence of outdoor hot tubs in British Columbia, the highest in the survey with 8 percent.

Personal computers have shown an impressive increase in penetration rate. The 1993 survey found that only 29 percent of households were equipped with computers at that time. Now, they are present in three out of five households (58 percent) in metropolitan areas although this ratio barely exceeds one in three in small population centres (35 percent) and rural areas (36 percent).

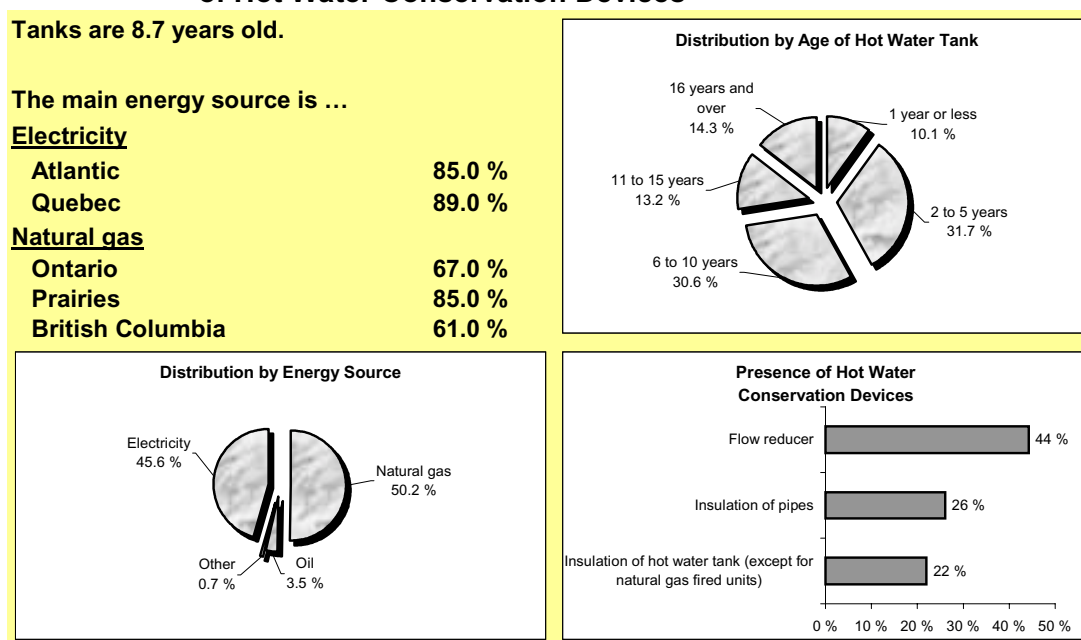
6 Hot Water

6.1 Description of Water-Heating Equipment

Almost all houses (98 percent) have a hot water tank. Most of the market is divided between natural gas (50 percent) and electricity (46 percent). This division appears to be geographic, with the Quebec/Ontario border demarcating the two dominant energy sources.

The growth of natural gas in this market is confirmed by both the comparative results obtained from the 1993 survey (44 percent) and the data from the report *Survey of Canadian New Household Equipment Purchases 1994 and 1995*, which states that two thirds (64 percent) of recent acquisitions are powered by that energy source.

Figure 6.1.1: Characteristics of Hot Water Tanks and the Presence of Hot Water Conservation Devices



Hot water tanks are, on average, 8.7 years old; one quarter of them (28 percent) are more than ten years old.

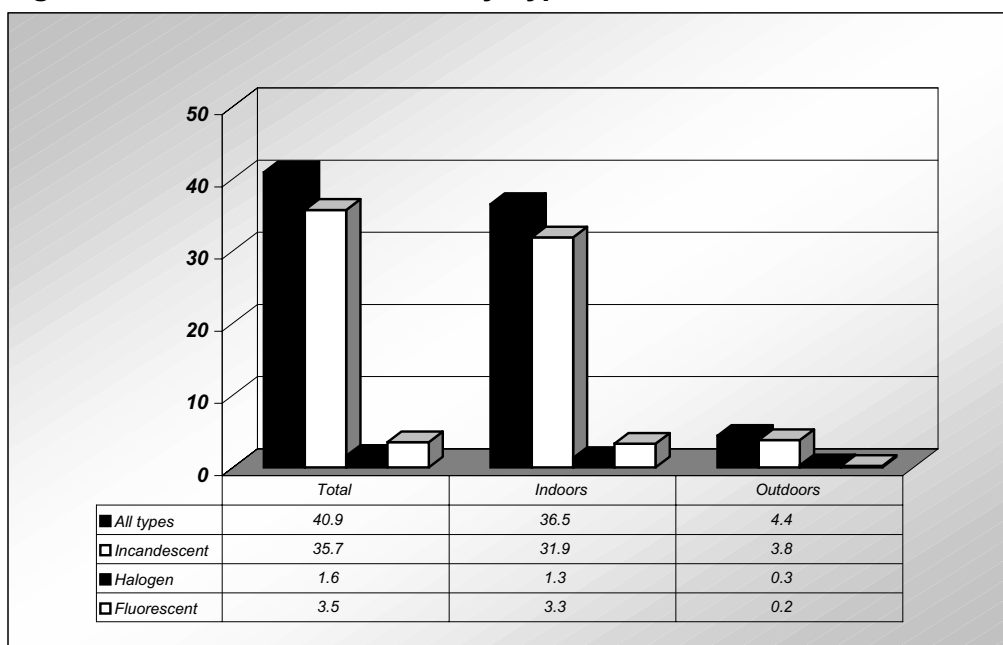
The most frequent method of reducing hot water consumption is the installation of flow reducers (44 percent); in 1997 alone, 9 percent of all households with hot water tanks made this modification. Other conservation efforts include insulating the pipes (26 percent) and insulating the water heater itself (22 percent). This last item does not apply to natural-gas-fired units.

7 Lighting

7.1 Number and Types of Light Bulbs

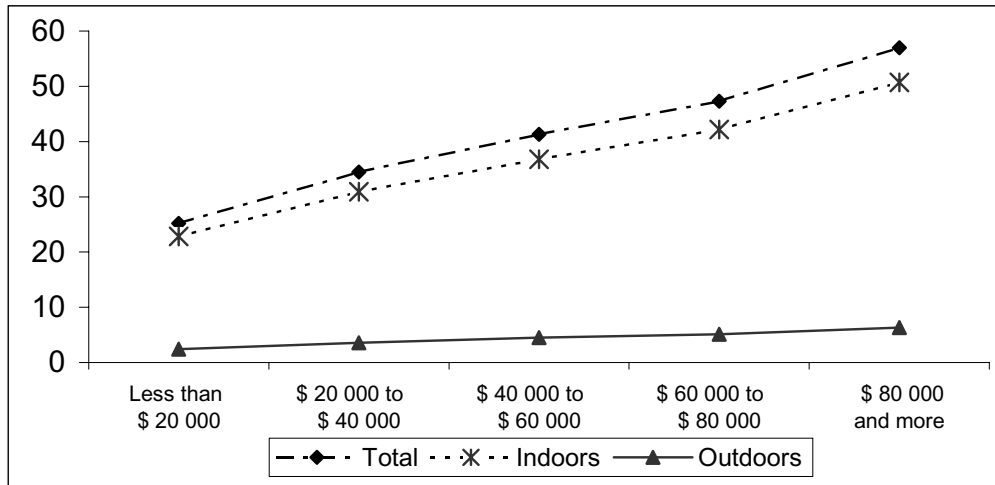
The average Canadian house is fitted with 40.9 light bulbs; 36.5 of them indoors and 4.4 outdoors. Most of these, whether used indoors or outdoors, are incandescent bulbs. The rest are fluorescent (3.5 per house) and halogen (1.6). These two types of bulbs remain a minor part of the market, regardless of house characteristics or household profile. The only exception to this observation seems to be in Quebec, where the average household had 2.7 halogen bulbs, or 8 percent of indoor bulbs.

Figure 7.1.1: Number of Bulbs by Type and Place of Use



Recently built houses use about 50 percent more light bulbs than older ones. For example, houses built prior to 1961 are fitted with 33 light bulbs, and houses built after 1982 are fitted with 48 bulbs. Even in newer houses, the proportion of fluorescent bulbs or halogen bulbs is no higher than in older buildings.

Figure 7.1.2: Total Number of Light Bulbs Used, by Household Income



The number of light fixtures in a house is directly related to household income, because of the obvious link between income and the area of the house. The average number of light bulbs used more than doubles between households with an annual income below \$20 000 (25.7) and households with an income of \$80 000 or more (57.0).

Appendix A Methodological Summary of the 1997 Survey

The Special Surveys Division of Statistics Canada conducted the *1997 Survey of Household Energy Use* (SHEU-1997) for the Office of Energy Efficiency (OEE) of Natural Resources Canada.

The methodological documentation of the SHEU-1997 appears in detail in the *Microdata User's Guide* prepared by Statistics Canada. In short, the sample of the SHEU-1997 is comprised of a sub-sample of households rotated out of the *Labour Force Survey* in October 1997. These data were collected during the period of March 5–19, 1998. After making an appointment by telephone with the member of the household who was most familiar with the characteristics of the house and its equipment, the interviewer, with the help of a computer, administered the questionnaire at the home of the respondent.

The 1997 survey was limited to residents of houses; some 4563 households participated altogether. The design effect was estimated at 2.5. Consequently, all percentages calculated on the basis of the complete sample hold a maximum margin of error of 2.3 percent, at a confidence level of 95 percent; thus the margin of error is 1.4 percent for estimates on the order of ten percent.

As a general rule, the data file was processed as Statistics Canada had transmitted it, without applying any special imputation procedure in case of unanswered questions. As a result, the calculation base of any percentage or any average is equal to the number of households that supplied an answer to any given question. More complete information regarding data processing and the determination of the sampling error will be found in Appendix A of the *1997 Survey of Household Energy Use – Detailed Statistical Report*.

Appendix B List of Statistical and Analytical Reports Published by the National Energy Use Database

These reports are or will soon be viewable and downloadable from the Office of Energy Efficiency Web site: <http://oee.nrcan.gc.ca/dpa/>

- ◆ *1993 Survey of Household Energy Use – National Results*; Catalogue No. M92-85/1994E; ISBN 0-662-22793-X.
- ◆ *1993 Survey of Household Energy Use – Provincial Results*; Catalogue No. M92-96/1995; ISBN 0-662-61978-1.
- ◆ *Survey of Canadian New Household Equipment Purchases, 1994 & 1995 – Statistical Report*; Catalogue No. M92-133/1997; ISBN 0-662-62902-7.
- ◆ *The Household Equipment of Canadians – Features of the 1993 Stock & the 1994 & 1995 Purchases – Analysis Report*; Catalogue No. M92-131/1997; ISBN 0-662-62806-3.
- ◆ *Survey of Houses Built in Canada in 1994 – Statistical Report*; Catalogue No. M92-136/1994; ISBN 0-662-62970-1.
- ◆ *Trends in Energy Characteristics of Homes in Canada – Analysis Report*; Catalogue No. M92-85/1-1997; ISBN 0-662-63165-X .
- ◆ *The 1994 Home Energy Retrofit Survey – Statistical Report*; Catalogue No. M92-135/1994; ISBN 0-662-62969-8.
- ◆ *The 1995 Home Energy Retrofit Survey – Statistical Report*; Catalogue No. M92-135/1995F; ISBN 0-662-64000-4.
- ◆ *Energy Consumption of Major Household Appliances Marketed in Canada – Trends from 1990 to 1997*; Catalogue No. M92-176/1999; ISBN 0-662-64615-0.
- ◆ *National Private Vehicle Use Survey – October–December 1994 – Statistical Report; Working Paper prepared for the NEUD, OEE.*
- ◆ *National Private Vehicle Use Survey – October 1994 to September 1996 – Detailed Statistical Report*; Catalogue No. M92-191/2000E; ISBN 0-662-29031-3. (available in winter 2000/2001)
- ◆ *National Private Vehicle Use Survey – October 1994 to September 1996 – Summary Report*; Catalogue No. M92-190/2000; ISBN 0-662-65006-9.

- ◆ *1997 Survey of Household Energy Use – Detailed Statistical Report*; Catalogue No. M92-85/1997E; ISBN 0-662-29209-X.
(available in winter 2000/2001)
- ◆ *1997 Survey of Household Energy Use – Summary Report*;
Catalogue No. M92-85/1997-1; ISBN 0-662-65123-5.

To obtain a copy of any of these reports, contact:

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c/o DLS
Ottawa ON K1A 0S9
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