1985 Primary Heating Fuel Use and Switching; Assessment of the Market for Conservation in the Northwest: Phase II

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May 1987

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Richland, Washington 99352

PREFACE

In October and November of 1985, a telephone survey of 1,058 households in the Pacific Northwest was conducted as part of a project to analyze the marketing environment for conservation activities of the Bonneville Power Administration (BPA). Analyses of the survey results are being published in a series of five reports:

- a tracking report analyzing the changes between 1983 and 1985
- a financing report focusing on the funding aspects of household energy conservation investments
- a consumer characterization and segmentation report with detailed analyses of market segments
- a fuel switching report presenting a summary of the above four reports with an emphasis on electrical utilities
- utility summary report.

The work on this series of reports is conducted by Pacific Northwest Laboratory (PNL) in support of BPA's efforts to develop the capability to deliver conservation programs for future use when it becomes necessary to acquire conservation resources. BPA's technical monitor for the project has been Terry Oliver, Office of Conservation.

This report, entitled 1985 Primary Heating Fuel Use and Switching; Assessment of the market for Conservation in the Northwest: Phase II, is the fourth report in the series. It presents information on the types of primary heating fuels used in the Pacific Northwest region, how these fuels affect the levels of past and intended conservation investments, and the types of primary heating fuel switching that occurred during the past two years (1983-1985). The report is based entirely on the 1985 survey data.

Comments and suggestions on this report are welcome. Please direct your correspondence to Pacific Northwest Laboratory, P.O. Box 999, Richland, Washington 99352.

D. L. Ivey
Project Manager

EXECUTIVE SUMMARY

This report presents information on the types of primary heating fuels used in residences in the Pacific Northwest region and how the heating fuels affect the level of investment in energy conservation measures (ECMs) by occupants of the residences. The types of heating fuel switching that occurred during the past two years (1983-1985) is also presented. The information was collected from random telephone surveys of households in Idaho, Oregon, Washington, and Western Montana. The Pacific Northwest Laboratory (PNL) conducted analyses of the survey results for the Bonneville Power Administration (BPA) to obtain a better understanding of consumer attitudes and behaviors and to facilitate conservation program planning, design, and marketing.

COVERAGE AND HYPOTHESES

This report covers the following hypotheses:

- There is no relationship between investing in ECMs and the type of primary heating fuel used in a residence.
- There is no relationship between the decision to switch to a new primary heating fuel during 1983-85 and the original type of primary heating fuel used in the residence.

In the following section, major findings for each chapter are presented.

PRIMARY HEATING FUEL USED BY ALL RESIDENCES

The top four heating fuels used by all residences regardless of ownership status are electricity (37%), wood (30%), natural gas (20%), and oil (11%). Electricity is the most frequently used primary heating fuel in all Pacific Northwest geographic quadrants with the exception of the Southeast. Wood is the most frequently used heating fuel in single family detached homes, whereas electricity is the most frequently used in all other types of residences. The majority of residences that are rented or leased use electricity as the primary heating fuel. However, for residences that are owned, wood is the most frequently used heating fuel (34%) followed by electricity (31%).

PRIMARY HEATING FUELS USED BY HOMEOWNERS

As previously mentioned, wood and electricity are the primary heating fuels used most frequently by homeowners. When considering only homeowners, the distribution of heating fuels changes across geographic quadrants. Wood is the most frequently used heating fuel in the Southeast and Southwest quadrants, whereas electricity is most frequently used in the Northwest quadrant. Heating fuels used most frequently in the Northeast quadrant include electricity (32%) and wood (31%). Wood is the most frequently used heating fuel in single family detached homes, while electricity is used most frequently in all other types of residences.

The type of primary heating fuel used by homes that are owned does appear to be related to whether different types of major ECMs have been installed. ECMs that appear to have been most affected include storm windows, heat pump furnaces, automatic or setback thermostats, insulated outside walls, storm doors, wood stoves or furnaces and fireplace inserts. Thus, the first hypothesis can be rejected.

PRIMARY HEATING FUELS USED BY RENTERS

Over 50% of the renters in the Pacific Northwest region use electricity as their primary heating fuel. Almost 50% of the renters in each geographic quadrant use electricity except for those in the Southeast quadrant. In the Southeast quadrant, electricity is used by 33% of the renters and wood is used by 31%. Electricity is the most frequently used heating fuel for all types of residences with the exception of the single family detached home which most frequently uses wood and electricity.

Since over one third of the housing units in the Pacific Northwest are rentals, this segment presents a genuine conservation resource if developed and pursued. Tenants of rental units are not usually considered good candidates for investing in major ECMs because of the relatively long payback period and the lower average "length of occupancy" of the rental unit. Therefore, marketing strategies must continue to be geared towards the owners of the buildings.

RESIDENCES THAT SWITCHED PRIMARY HEATING FUELS

The largest proportion of residences to switch primary heating fuels during the past two years were those which had previously used electricity. Nearly all the residences previously using electricity as their primary heating fuel switched to wood. Overall, the most frequently given reason for switching heating fuels was that the new fuel was believed to be less expensive. The largest proportion of residences to change primary heating fuels were located in the southeast quadrant. This finding can partially explain how wood is the most frequent type of primary heating fuel in the Southwest quadrant overall.

The results suggest that the decision to change to a new primary heating fuel is related to the old type of primary heating fuel. The survey did not ask questions specifically related to the decision making process regarding switching fuels other than to ask the reason for switching. To fully answer the second hypothesis, it would be necessary to ask more detailed questions concerning the decision to switch. Therefore, this hypothesis can be tentatively rejected.

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1.0 INTRODUCTION

This report presents information on the types of primary heating fuels used by residences in the Pacific Northwest region. Included are how the fuels may have affected the level of past and intended conservation behaviors and whether primary heating fuels were switched. The information was collected by means of random telephone surveys from households in Idaho, Oregon, Washington, and Western Montana. Pacific Northwest Laboratory (PNL)^(a) conducted analyses of the survey results for the Bonneville Power Administration (BPA) to obtain a better understanding of consumer attitudes and behaviors and to facilitate conservation program planning, design, and marketing.

1.1 BACKGROUND

During 1983-84, PNL conducted the Phase I study of consumer energy conservation attitudes for the BPA. This study was part of an overall project designed to assess the marketing environment for BPA's energy conservation programs and activities. It was the first comprehensive regional study of its kind and established a baseline for future tracking.

In the baseline study, a telephone survey of 2,000 residents of the Northwest was conducted.^(b) The sample was drawn to represent a cross-section of consumers in the Northwest and was composed of 500 respondents from each of four geographic divisions or quadrants: Western Washington; Western Oregon; Eastern Oregon and Southern Idaho; Eastern Washington, Northern Idaho, and Western Montana. The respondents were adult heads of households. Only one respondent per household was interviewed. Eighty percent of the interviews were conducted during evening and weekend hours between October 30 and November 13, 1983. Seventy-five percent of the interviews lasted approximately 20 minutes. Interviews with the remaining respondents lasted approximately 50 minutes because of additional questions relating specifically to heat pumps and solar water heaters.

(a) Operated for the Department of Energy by Battelle Memorial Institute under contract DE-AC06-76RLO 1830.

(b) The survey was conducted by RMH Research Inc. of River Edge, New Jersey.

The respondents were asked questions regarding their attitudes, perceptions, and awareness of energy conservation; their conservation actions and measures to date; their methods of financing past conservation investments; their perceptions of energy institutions; their behaviors with respect to public communication media such as newspapers, radio and television; and their willingness to invest in energy conservation and its relationship to perceived rates of returns.

The results of the baseline study (RMH Research, Inc. 1984a) were published and compared with results from other studies (Fang 1985). A companion survey on the marketing environment for solar and heat pump water heaters was also conducted (RMH Research, Inc. 1984b).

In July 1985, PNL undertook Phase II of the project to analyze the marketing environment for BPA conservation activities with the following three objectives:

1. to track changes in consumer attitudes, interests, and opinions between 1983 and 1985
2. to identify more refined segments of the residential conservation market in terms of attitudes, interests, and opinions
3. to test hypotheses concerning consumer conservation actions and investment behaviors.

To achieve these objectives, a second survey of Northwest consumers was conducted in late 1985. This report provides the data, information, and analyses to achieve Objective 2 and part of Objective 3. Specifically, the two hypotheses being tested in this report include:

1. There is no relationship between investment in ECMs and the type of primary heating fuel used in a residence.
2. There is no relationship between the decision to switch to a new primary heating fuel from 1983 to 1985 and the original type of primary heating fuel used in the residence.

1.2 SURVEY AND SAMPLE DESCRIPTIONS

In the 1985 survey, 1,058 telephone interviews were completed. The sample was drawn from Idaho, Oregon, Washington and Western Montana, with nearly equal numbers of respondents from each of the same four geographical quadrants as in the 1983 sample. Interviews were conducted from October 15 through November 8, 1985. Calls were made from 4 p.m. to 9 p.m. on weekdays and from 10:30 a.m. to 7 p.m. on Saturdays and Sundays. Each interview took between 35 and 45 minutes to complete. The refusal rate was 13% and the termination rate was 10%.^(a)

The data presented in this report have been weighted to approximate population values in the BPA service area. First, the populations of counties within each of the four geographic quadrants in the BPA service area were determined and summed. This yielded a total population count for each geographic quadrant. The total counts for the four geographic quadrants were summed to arrive at a total population for the BPA service area. The populations of each division were then expressed as a percentage of the total population of the region. The weights were derived by comparing the sample observations from the geographic quadrants with their respective divisional populations. All population values were approximated by using the 1980 Census data.^(b) Table 1.1 presents the details of the weights by geographic division.

1.3 REPORT STRUCTURE

Chapter 2.0 provides an overview of the findings derived from the analyses conducted in this study and also discusses some of the implications. Chapter 3.0 reviews the primary heating fuels used by all of the residences in the sample. Chapter 4.0 looks at the primary heating fuels used in residences that are owned and the level of past conservation investment as well as the likelihood of future investments. Chapter 5.0 analyzes the primary heating fuels used in residences that are currently being rented or leased and also the

(a) For detailed description of sampling design, survey procedure, and survey instrument, see Columbia Research Center, 1985 Marketing Environment for BPA Conservation Activities: Phase II, Draft report submitted to Pacific Northwest Laboratory, December 6, 1985, Portland, Oregon.

(b) Total number of households in the Pacific Northwest for 1980 is 3,022,490.

TABLE 1.1. Weighted Population Values, by Geographic Quadrant

<u>Geographic Quadrant</u>	<u>Relative Weight</u>	<u>% of Total Households</u>	<u>Households in Division</u>	<u>Households in Sample</u>	<u>Weight for Division</u>
W. Washington	1.58	39.50	1,193,884	258	4,627.5
W. Oregon	1.22	20.80	846,297	270	3,134.4
E. Washington, N. Idaho & Montana	0.73	18.25	551,604	274	2,013.2
E. Oregon and S. Idaho	<u>0.57</u>	<u>14.25</u>	<u>430,705</u>	<u>256</u>	<u>1,682.4</u>
Total	4.00	100.0	3,022,490	1,058	---

types of low/no-cost conservation actions in which the occupants participated. Chapter 6.0 presents results on the type of fuel switching that occurred during the past two years (1983-1985).

2.0 FINDINGS

Chapters 3.0 through 6.0 present detailed analyses, discussion of data and information with respect to the types of primary heating fuels used in residences, the level of past and intended conservation investment behavior, and the types of primary heating fuel switching that occurred during the past two years (1983-1985). This chapter provides a summary of the findings and conclusions.

2.1 PRIMARY HEATING FUEL USED BY ALL RESIDENCES

The top four heating fuels used by all residences regardless of ownership status are electricity (37%), wood (30%), natural gas (20%), and oil (11%). Electricity is the most frequently used primary heating fuel in all geographic quadrants with the exception of the Southeast. Wood is the most frequently used heating fuel in single family detached homes, whereas electricity is the most frequently used in all other types of residences. The majority of residences that are rented or leased use electricity as the primary heating fuel. However, for residences that are owned, wood is the most frequently used heating fuel (34%) followed by electricity (31%).

These initial findings are interesting. However, variables such as type of residence and ownership status of the residence may distort the results to a certain degree when considering energy conservation investment. In order to better understand what types of primary heating fuels are used in the Pacific Northwest and how they effect the level of conservation investments, the results need to be segmented first by ownership status of the residence.

2.2 PRIMARY HEATING FUELS USED BY HOMEOWNERS

As mentioned in the previous chapter, wood and electricity are the primary heating fuels used most frequently by homeowners. When considering only homeowners, the distribution of heating fuels changes across geographic quadrants. Wood is the most frequently used heating fuel in the Southeast and Southwest quadrants, whereas electricity is most frequently used in the Northwest quadrant. Heating fuels used most frequently in the Northwest quadrant

include electricity (32%) and wood (31%). Wood is the most frequently used heating fuel in single family detached homes, and electricity is used most frequently in all other types of residences.

The installation of different types of ECMs appears to be related to the type of primary heating fuel used in residences that are owned. The ECMs that appear most effected include storm windows, heat pump furnaces, automatic or setback thermostats, insulated outside walls, storm doors, wood stoves or furnaces, and fireplace inserts.

In addition to knowing which ECMs have been installed in a residence, it is also important to know the likelihood of future installations and the ECMs most likely to be installed. The results showed that weatherproofing, storm windows, insulation in the roof or attic, and storm doors are the ECMs most likely to be installed by homeowners in the next two to three years. Residences using electricity were most likely to indicate an intent to install storm windows, heat pump furnaces, and wood stoves or wood furnaces.

The results indicate that in some instances having a specific ECM in a residence is related to the type of primary heating fuel used. Therefore, the hypothesis that there is no relationship between investing in ECMs and the type of primary heating fuel used by a residence can be rejected for certain types of ECMs.

2.3 PRIMARY HEATING FUELS USED BY RENTERS

Over 50% of the renters in the Pacific Northwest use electricity as their primary heating fuel. Almost 50% of the renters in each geographic quadrant use electricity with the exception of the Southeast quadrant. In the Southeast quadrant electricity is used by 33% of the renters and wood is used by 31%. Electricity is the most frequently used heating fuel for all types of residences except for the single family detached home which most frequently used wood and electricity.

Almost 50% of the renters lower their thermostat, select energy-efficient appliances when purchasing, and use shades or drapes to aid heating or cooling in their residences. The majority of residences that are rented reported that

they do not have a secondary heating fuel with the exception of residences that use wood. Over 50% of the residences that use wood as a primary heating fuel report electricity as their secondary heating fuel.

Since over one third of the housing units in the Pacific Northwest are rentals, this segment presents a genuine conservation resource if developed and pursued. Tenants of rental units are not usually considered good candidates for investing in major ECMs. Therefore, marketing strategies must continue to be geared towards the owners of the buildings.

2.4 RESIDENCES THAT SWITCHED PRIMARY HEATING FUELS

The largest proportion of residences to have switched primary heating fuel during the past two years were those that previously used electricity. Of those that switched and previously used electricity as their primary heating fuel, almost all of them switched to wood. Overall, the reason most frequently given for switching heating fuels was that the new fuel was believed to be less expensive. The largest proportion of residences to change primary heating fuels was located in the Southeast quadrant. These findings can partially explain how wood is the most frequently used type of primary heating fuel in the Southeast quadrant.

Approximately 14% of the residences that switched primary heating fuels during the past two years switched to electricity. The most frequent types of primary heating fuels before switching were natural gas and oil. The largest proportion of homes that switched to electricity is located in the Northeast quadrant. The majority of the residences that switched to electricity felt that electricity rates will increase in the next five years, and the increase will be more than 20%. However, the most frequent reason given by these residences for switching to electricity was that it would still be less expensive than the former heating fuel.

Approximately 45% of the residences that switched their primary heating fuel during the past two years switched from electricity to another fuel. The majority of residences that discontinued electricity switched to wood. This is particularly important because it would be relatively easy for these residences

as well as other residences that use wood as the primary heating fuel to switch back to electricity. This could in turn, effect electricity demand in the region.

Nearly all of the residences that discontinued using electricity felt that electricity rates will increase during the next five years. And they all felt that the increase would be approximately 5%. The most frequently given reason for switching primary heating fuels was that the new fuel would be less expensive.

The results suggest that the decision to change to a new primary heating fuel is related to the former type of primary heating fuel. Therefore, the hypothesis can be tentatively rejected that there is no relationship between the decision to switch to a new primary heating fuel from 1983 to 1985 and the original type of primary heating fuel used in the residence. The survey did not ask any questions specifically related to the decision process regarding switching fuels other than to inquire about the reason for switching. To fully answer the hypothesis, more detailed questions would be necessary concerning the decision to switch.

3.0 PRIMARY HEATING FUEL USED BY ALL RESIDENCES

Knowledge of the type of primary heating fuel used by a residence and the type of secondary heating fuel, if there is one, is important when planning marketing strategies for residential energy conservation. The use of certain primary heating fuels may influence 1) the decision to invest or not to invest in energy conservation, 2) what type(s) of ECMs are typically employed, and 3) how many ECMs are usually installed. This chapter reviews the types of primary heating fuels used in all of the residences interviewed.

3.1 PRIMARY HEATING FUELS AND RELATED DEMOGRAPHICS--ALL RESIDENCES

Results of the Phase II survey indicate that there are eight types of primary heating fuel used by the sample residences (see Figure 3.1). The top four

FIGURE 3.1. Primary Heating Fuels Used by Phase II Survey Residences, Full Sample (n=3002)

fuels, electricity (38%), wood (29%), natural gas (20%) and oil (11%), account for the primary heating fuel used by 97.0% of all the residences. (These include all residence types, single family, multiple family, etc.)

Since the geographic location of a residence may be an important factor when trying to explain why certain residences invest in ECMs, the BPA service area was divided into four geographic quadrants. The quadrants are as follows:

Northwest - Residences in Washington state west of the Cascade mountains.

Southwest - Residences in Oregon state west of the Cascade mountains.

Northeast - Residences in Washington state east of the Cascade mountains, the state of Idaho (Pacific Time Zone) and the state of Montana west of the Continental Divide (all counties served by BPA).

Southeast - Residences in the state of Oregon east of the Cascade mountains, the state of Idaho (Mountain Time Zone) and counties in northern California, Nevada and Wyoming served by BPA.

The distribution of primary heating fuels appears to be related to the geographic quadrant in which the residence was located. Electricity is the most frequently used heating fuel in all quadrants except the Southeast. In the Southeast quadrant, wood (37%) is the most frequently used heating fuel closely followed by electricity (20%) and natural gas (22%). Table 3.1 shows the distribution of primary fuels within each quadrant.

The distribution of primary heating fuels by the type of residence where respondents currently live is shown in Table 3.2. Wood (35%) is the most frequent type of primary heating fuel in single family detached homes. However, residences that are categorized as 2 to 4 family home-duplex-townhouses, most frequently use electricity (69%) as their primary heating fuel as do buildings with more than 4 units (85%) and mobile homes/trailers (60%).

TABLE 3.1. Primary Heating Fuel, by Geographic Quadrant of Residences

Geographic Quadrant	Full Sample (in 1000s) Primary Heating Fuel (n=3002)				
	Natural Gas	Oil	Wood	Electricity	Other
Northwest (n=1185)	18%	10%	27%	44%	1%
Southwest (n=840)	22	14	28	34	2
Northeast (n=550)	17	10	29	40	4
Southeast (n=427)	22	7	37	30	5

TABLE 3.2. Primary Heating Fuel, by Type of Residence Where Respondents Currently Live

Type of Residence	Full Sample (in 1000s) Primary Heating Fuel (n=3002)				
	Natural Gas	Oil	Wood	Electricity	Other
Single family detached home (n=2275)	23%	13%	34%	28%	2%
2 to 4 family home-duplex-townhouse (n=278)	12	8	9	69	2
Building with more than 4 units (n=211)	11	1	0	85	3
Mobile Home-Trailer (n=238)	5	2	27	60	6

The type of primary heating fuel used by a residence is also related to the amount of money spent by the residents during the past two years to reduce the energy used in their residences. Residences whose primary fuel is categorized as "other" have the highest proportion of respondents spending more than \$2,000 during the past two years (23%). However, it should be noted that this segment has a very small sample size, or less than 3% of the total sample. Conversely, respondents who live in residences with electricity as their primary heating fuel have the largest proportion of respondents not to have spent any money during the past two years to reduce the amount of energy used in their homes (see Table 3.3).

Whether a residence is owned or being rented/leased has an influence on the type of primary heating fuel used by the residence. Over 50% of the

TABLE 3.3. Amount of Money Spent During the Past Two Years to Reduce Energy Use in the Residence, by Primary Heating Fuel

Primary Heating Fuel	Full Sample (in 1000s) Amount Spent (n=2215)				
	\$0.00	\$1-\$500	\$501-\$1000	\$1001-2000	\$+2000
Natural Gas (n=413)	55%	25%	7%	2%	12
Oil (n=228)	46	32	4	10	8
Wood (n=604)	36	31	9	10	13
Electricity (n=911)	64	24	5	4	3
Other (n=59)	43	25	9	0	23

residences being rented/leased use electricity as their primary heating fuel, whereas residences that are owned most frequently use wood (34.2%) and electricity (31%) (see Table 3.4).

3.2 SUMMARY

The top four heating fuels used most frequently by all residences are electricity (37%), wood (30%), natural gas (20%), and oil (11%). Electricity is the most frequently used primary heating fuel in all four geographic quadrants with the exception of the Southeast. Wood is the most frequently used heating fuel in single family detached homes, whereas electricity is the most frequently used in 2 to 4 family home-duplex-townhouses, buildings with more than 4 units, and mobile home-trailers. The majority of residences that are rented or leased use electricity as the primary heating fuel. However, for residences that are owned, wood is the most frequently used heating fuel (34%) followed by electricity (31%).

TABLE 3.4. Primary Heating Fuel, by Ownership Status of Residences

Ownership Status	Full Sample (in 1000s) Primary Heating Fuel (n=3002)				
	Natural Gas	Oil	Wood	Electricity	Other
Own (n=2140)	21%	12%	34%	31%	3%
Rent/Lease (n=862)	17	7	17	57	2

These initial findings are interesting. However, variables such as type of residence and ownership status of the residence may distort the results to a certain degree. In order to better understand what types of primary heating fuels are used in the Pacific Northwest and how they effect the level of conservation investment, the results need to first be segmented by ownership status of the residence. This is done in the following chapters.

4.0 PRIMARY HEATING FUELS USED BY HOMEOWNERS

As a way to form a clearer picture of the use of primary heating fuels in the Pacific Northwest and to focus on respondents who would be most inclined to invest in ECMs, this chapter will investigate only residences that are owned by respondents. The decision to invest in one or more ECMs depends on many factors one of which may be the type of primary heating fuel used in a residence. The following results will be used to test the hypothesis that there is no relationship between investing in ECMs and the type of primary heating fuel used by a residence.

4.1 PRIMARY HEATING FUELS AND RELATED DEMOGRAPHICS--HOMEOWNERS

As previously mentioned, wood and electricity are the primary heating fuels used most frequently by homeowners (see Figure 4.1). The distribution of primary heating fuels within each geographic quadrant did change somewhat from

FIGURE 4.1. Distribution of Primary Heating Fuels, Homeowners (n=2138)

the distribution containing all of the residences (homeowners and renters, see Table 4.1). The percentage of residences using electricity dropped in each quadrant, whereas the percentage of residences using wood increased. This effect of ownership status does, in fact, appear to influence the distribution of primary heating fuels by the full sample because of its large percentage of residences that are rented or leased and that use electricity as the primary heating fuel.

The distribution of primary heating fuels and the type of residence respondents were currently living in is shown in Table 4.2. The most frequently used primary heating fuels in single family detached homes are wood

TABLE 4.1. Primary Heating Fuel, by Geographic Quadrant of Residences

Quadrant	Homeowners (in 1000s) Primary Heating Fuel (n=2138)				
	Natural Gas	Oil	Wood	Electricity	Other
Northwest (n=824)	21%	13%	31%	32%	2%
Southwest (n=57)	24	14	35	26	2
Northeast (n=413)	15	11	32	38	4
Southeast (n=330)	20	8	38	29	5

TABLE 4.2. Primary Heating Fuel, by Type of Residence Where Respondents Currently Live

Type of Residence	Homeowners (in 1000s) Primary Heating Fuel (n=2138)				
	Natural Gas	Oil	Wood	Electricity	Other
Single family detached home (n=1873)	23%	13%	35%	27%	2%
2-4 Family Home-Duplex-Townhouse (n=41)	8	17	24	44	8
Building with more than 4 units (n=11)	27	0	0	73	0
Mobile Home-Trailer (n=215)	5	2	28	59	6

(35%), electricity (27%) and natural gas (23%). Electricity is the most frequently used primary heating fuel in residences categorized as 2 to 4 family home-duplex-townhouse (44%), buildings with more than 4 units (73%), and mobile homes/trailers (59%).

Among homeowners, there is a relationship between the money spent during the past two years to reduce energy use in the residence and the type of primary heating fuel used by the residence. Residences whose primary heating fuel is categorized as "other" had the greatest proportion of respondents spending more than \$2,000 during the past two years (32%) (see Table 4.3). On the other hand, residences using electricity as primary heating fuel had the smallest percentage to spend more than \$2,000 during the past two years (4%). The overall distribution of money spent and the type of heating fuel used by all of the respondents (homeowners and renters, Table 2.3) does appear to be influenced by renters, since the percentage of residences not spending any money change when looking only at residences that are owned. The most dramatic change is evident in the percentages of residences that are owned and use electricity as primary heating fuel. Less than 50% of homeowners using electricity spent no money during the past two years; whereas in the full sample (homeowners and renters), over 60% of all residences using electricity spent no money.

TABLE 4.3. Amount of Money Spent During the Past Two Years to Reduce Energy Use in the Residence, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Amount Spent (n=1487)				
	\$0.00	\$1-\$500	\$501-\$1000	\$1001-\$2000	\$2000+
Natural Gas (n=300)	52%	24%	7%	3%	14%
Oil (n=182)	47	28	5	10	10
Wood (n=489)	34	29	10	12	15
Electricity (n=473)	51	30	8	7	4
Other (n=43)	33	22	13	0	32

4.2 PRIMARY HEATING FUELS AND MAJOR ENERGY CONSERVATION MEASURES IN THE RESIDENCES

The type of primary heating fuel used by residences that are owned appears to be related to whether several of the ECMs were already in the residence. These ECMs include storm windows, heat pump furnaces, automatic or setback thermostats, insulated outside walls, storm doors, wood stoves or furnaces, and fireplace inserts.

Over 75% of the residences using each type of primary heating fuel currently report having weatherproofing in their residence (see Table 4.4). This high percentage should not be surprising since weatherproofing is one of the least expensive types of conservation measures to install. What is not known is how much weatherproofing is actually in the residence. Similar to weatherproofing, over 65% of all residences using each type of primary heating fuel report having storm windows in their residences (see Table 4.5). The largest proportion of residences having storm windows are those using electricity as primary heating fuel (87%). The relatively high percentages of residences that have weatherproofing and storm windows may be related to the occupants' participating in a utility program, such as Residential Weatherization; and respondents may have received specific information and/or financial support for these measures.

TABLE 4.4. Weatherproofing Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Homeowners (in 1000s)</u> <u>Weatherproofing in</u> <u>the Residence (n=2103)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=432)	78%	22%
Oil (n=254)	79	21
Wood (n=705)	80	20
Electricity (n=653)	87	13
Other (n=58)	94	6

TABLE 4.5. Storm Windows Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Storm Windows in the Residence (n=2136)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=440)	67%	34%
Oil (n=261)	67	33
Wood (n=719)	76	24
Electricity (n=659)	87	14
Other (n=582)	72	28

Of the residences that currently have a heat pump furnace, the majority use electricity as primary heating fuel (68%) (see Table 4.6). This finding is consistent with the fact that heat pump furnaces are currently marketed to residences that use electricity. Residences using electricity also most frequently have an automatic or setback thermostat installed (see Table 4.7). Residences using wood as the primary fuel are least likely to have an automatic or setback thermostat in their residence. This would be expected since wood heating can not be controlled by such a thermostat.

Table 4.8 shows the distribution of residences that currently have basement-floors or crawlspaces insulated according to the type of primary

TABLE 4.6. Heat Pump Furnace Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Heat Pump Furnace in the Residence (n=2083)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=421)	3%	97%
Oil (n=254)	7	93
Wood (n=710)	4	96
Electricity (n=643)	21	79
Other (n=54)	10	91

TABLE 4.7. Automatic or Setback Thermostat Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Automatic or Setback Thermostat in the Residence (n=2067)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=422)	50%	50%
Oil (n=261)	45	55
Wood (n=694)	32	68
Electricity (n=632)	53	47
Other (n=582)	43	58

TABLE 4.8. Insulated Basement, Floor or Crawl Space Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Basement, Floor or Crawl Space Insulated (n=2014)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=418)	48%	52%
Oil (n=238)	53	47
Wood (n=670)	61	39
Electricity (n=634)	63	37
Other (n=54)	62	38

heating fuel used. Over 60% of the residences using wood, electricity or a heating fuel categorized as "other", currently have their basement-floors or crawl spaces insulated.

Over 70% of the residences using each type of primary heating fuel have the outside walls insulated (see Table 4.9). Residences using electricity (92%) and wood (88%) have the greatest percentages having the outside walls insulated. Almost all residences using each type of heating fuel have the roof or attic currently insulated (see Table 4.10). A potential problem when asking respondents about the specific insulated areas of their residences was that they only answered accurately about the presence or absence of insulation,

TABLE 4.9. Insulated Outside Walls Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Outside Walls Insulated (n=1998)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=400)	81%	19%
Oil (n=243)	72	28
Wood (n=682)	88	12
Electricity (n=617)	92	8
Other (n=56)	72	28

TABLE 4.10. Insulated Roof or Attic Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Roof or Attic Insulated (n=2090)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=432)	90%	10%
Oil (n=257)	94	6
Wood (n=706)	93	7
Electricity (n=643)	96	4
Other (n=54)	92	8

and not the amount or R-value. Therefore, the numbers dealing with insulation-related questions need to be interpreted with caution because there may be more opportunity for additional insulation in these residences than the results would suggest.

The distribution of primary heating fuels according to whether a residence currently has solar panels for water heating is shown in Table 4.11. Less than 4% of the residences using any of the primary heating fuels currently have solar panels. Like solar panels, heat pump water heaters are not installed very often by residences in the Pacific Northwest. Less than 5% of the residences using any type of primary heating fuel have a heat pump water heater.

TABLE 4.11. Solar Panels Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Solar Panels in the Residence (n=2137)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=439)	1%	99%
Oil (n=261)	0	100
Wood (n=719)	3	97
Electricity (n=660)	2	98
Other (n=58)	0	100

Of those residences that do have a heat pump water heater, the largest segment (50%) are those using electricity as their primary heating fuel (see Table 4.12).

The largest proportion of residences having storm or insulated doors are residences using a primary heating fuel categorized as "other" (87%) (see Table 4.13). Residences using electricity as the primary heating fuel were the second largest segment of residences to have storm or insulated doors (63%). Eighty percent of the residences using wood as the primary heating fuel currently have a wood stove or wood furnace (see Table 4.14). This finding was expected. However, what is more interesting is the proportion of residences having a wood stove or wood furnace using one of the other types of heating

TABLE 4.12. Heat Pump Water Heater Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Heat Pump Water Heater in the Residence? (n=2025)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=422)	0%	100%
Oil (n=251)	2	98
Wood (n=676)	3	97
Electricity (n=624)	4	96
Other (n=53)	0	100

TABLE 4.13. Storm or Insulated Doors Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Homeowners (in 1000s) Storm or Insulated Doors in the Residence (n=2087)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=434)	57%	43%
Oil (n=257)	46	54
Wood (n=710)	59	41
Electricity (n=627)	63	37
Other (n=58)	87	13

TABLE 4.14. Wood Stove or Wood Furnace Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Homeowners (in 1000s) Wood Stove or Wood Furnace in the Residence (n=2140)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=442)	17%	83%
Oil (n=261)	15	85
Wood (n=719)	80	20
Electricity (n=660)	19	81
Other (n=58)	40	60

fuels. Over 15% of the residences using each of the remaining types of primary heating fuel report having a wood stove or wood furnace. This indicates a potential source for secondary heating.

Residences using wood also had the largest proportion (27%) using fireplace inserts followed by residences using oil (21%) (see Table 4.15). If it were possible to look only at residences that have fireplaces, the proportion of residences having fireplace inserts would most likely increase.

TABLE 4.15. Fireplace Insert Currently in the Residence, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Fireplace Insert in the Residence (n=2140)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=442)	20%	80%
Oil (n=261)	21	79
Wood (n=719)	27	73
Electricity (n=660)	13	87
Other (n=58)	18	82

4.3 PRIMARY HEATING FUELS AND THE TIME OF INSTALLATION OF MAJOR ENERGY CONSERVATION MEASURES

One way to assess the potential investment in ECMs in the Pacific Northwest is to look at time of installation of the current ECMs in the residence. It is important not only to see what proportion of the respondents actually installed the ECMs themselves, but also to see when the current residents installed the measures. This information is particularly useful in assessing the effectiveness of specific marketing efforts that may have occurred during the same time periods. It should be noted that many of the residences had already installed several ECMs when the present occupants moved in. Therefore, the possible frequency of installation by current occupant in the residence was reduced at the time they moved in because there was no need to install these ECMs.

Of the respondents that reported having weatherproofing in their residences, almost 70% of them installed it since they moved into the residence (see Table 4.16). The most frequent weatherproofing activity during the past two years occurred in residences using natural gas or wood as their primary heating fuels. Over 40% of these residences installed weatherproofing within the last two years.

The type of primary heating fuel used by a residence was related to the time when storm windows were installed. Approximately 50% of the residences

TABLE 4.16. Time When Weatherproofing Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s)		
	Time When Weatherproofing Was Installed (n=1699)		
	Within the Last 2 Years	More than 2 Years Ago, but Since Respondent Moved in	There When Respondent Moved into the Home
Natural Gas (n=334)	46%	24%	30%
Oil (n=194)	35	47	18
Wood (n=561)	41	36	24
Electricity (n=555)	37	33	31
Other (n=54)	34	41	25

using wood and electricity as their primary heating fuels had storm windows in the residences before the current occupants moved in. Storm windows were installed by over 80% of the occupants in residences using oil since they moved into the residence (see Table 4.17).

Less than 10% of the respondents reported having heat pump furnaces in their residences when the survey was conducted. However, of those who did have a heat pump furnace and who use electricity as their primary heating fuel, over 50% had the furnace installed since moving into the residence. The distribution of when the heat pump furnace was installed according to primary heating fuels is shown in Table 4.18.

TABLE 4.17. Time When Storm Windows Were Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s)		
	Time When Storm Windows Were Installed (n=1620)		
	Within the Last 2 Years	More than 2 Years Ago, but Since Respondent moved in	There When Respondent Moved Into the Home
Natural Gas (n=291)	26%	33%	41%
Oil (n=172)	27	54	19
Wood (n=549)	17	34	49
Electricity (n=566)	15	32	53
Other (n=19)	22	36	42

TABLE 4.18. Time When Heat Pump Furnace Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Heat Pump Furnace was Installed (n=193)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved in	Respondent Moved into the Home
Natural Gas (n=11)	0%	61%	39%
Oil (n=17)	0	59	41
Wood (n=25)	8	8	84
Electricity (n=134)	11	46	42
Other (n=5)	0	61	39

Automatic or setback thermostats were installed in over 40% of the residences before the respondents moved into the residences. Of the residents who installed the thermostats themselves, between 24% and 44% installed it more than two years ago. The absence of recent activity of installing automatic or setback thermostats may be because of a lack of marketing efforts (see Table 4.19).

Of the residences that have an insulated basement-floor or crawlspace, almost 50% of the respondents reported that it was there when they moved into

TABLE 4.19. Time When Automatic or Setback Thermostat Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Automatic or Setback Thermostat Was Installed (n=897)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved in	Respondent Moved into the Home
Natural Gas (n=201)	14%	43%	43%
Oil (n=115)	9	44	47
Wood (n=219)	13	31	57
Electricity (n=336)	16	24	59
Other (n=25)	8	41	51

their current residences (see Table 4.20). The largest proportion of respondents to insulate after they moved in but more than two years ago were those using natural gas (38%) and oil (38%). Residences using a primary heating fuel categorized as "other" were the largest group to insulate within the last two years (26%).

A similar scenario can be seen for residences that have insulated outside walls and insulated roofs or attics. Over 50% of these residences had already installed insulation when the current occupants moved in (see Tables 4.21 and 4.22). Of the residents who did insulate their outside walls, roof or

TABLE 4.20. Time When Basement, Floor, or Crawlspace Was Insulated, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Basement, Floor or Crawl Space was Insulated (n=1162)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved into the Home
Natural Gas (n=199)	14%	38%	48%
Oil (n=121)	13	38	49
Wood (n=411)	20	33	47
Electricity (n=398)	18	37	45
Other (n=32)	26	15	59

TABLE 4.21. Time When Outside Walls Were Insulated, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Outside Walls Were Insulated (n=1697)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved into the Home
Natural Gas (n=319)	6%	27%	66%
Oil (n=170)	11	34	55
Wood (n=600)	8	23	69
Electricity (n=568)	8	18	74
Other (n=41)	5	31	64

TABLE 4.22. Time When the Roof or Attic Was Insulated, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When the Roof or Attic was Insulated (n=1952)		
	Within the Last 2 Years	More than 2 Years Ago, but Since Respondent Moved In	There When Respondent Moved into the Home
Natural Gas (n=383)	9%	34%	57%
Oil (n=240)	11	39	50
Wood (n=659)	14	29	57
Electricity (n=620)	18	27	55
Other (n=50)	9	41	52

attic since they moved in, most of this activity occurred more than two years ago. These results may indicate the importance homeowners place on insulation especially during the initial years in a residence.

Less than 2% of the residences in the sample had solar panels or heat pump water heaters in their residences. Tables 4.23 and 4.24 show the distribution of time periods when solar panels and heat pump water heaters were installed according to the primary heating fuel used in the residences. Residences using oil or a primary heating fuel categorized as "other" are the least frequent to have storm or insulated doors installed before the respondents moved in. How

TABLE 4.23. Time When Solar Panels Were Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Solar Panels Were Installed (n=37)		
	Within the Last 2 Years	More than 2 Years Ago, but Since Respondent Moved In	There When Respondent Moved into the Home
Natural Gas (5)	35%	65%	0%
Oil (n=0)	--	--	--
Wood (n=21)	24	76	0
Electricity (n=11)	42	15	42
Other (n=0)	--	--	--

TABLE 4.24. Time When Heat Pump Water Heater Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (n=1000s) Time When Heat Pump Water Heater Was Installed (n=48)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved into the Home
Natural Gas (n=2)	0%	100%	0%
Oil (n=5)	0	0	100
Wood (n=15)	13	0	87
Electricity (n=27)	8	31	61
Other (n=0)	--	--	--

ever, they are also the largest proportion of residences to have storm or insulated doors installed after the occupants moved into the residence (more than two years ago) (see Table 4.25).

Nearly 70% of all occupants using a wood stove or wood furnace had installed them themselves since moving into the residence (see Table 4.26). Occupants using natural gas have frequently installed a wood stove or wood

TABLE 4.25. Time When Storm or Insulated Doors Were Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Storm or Insulated Doors Were Installed (n=1219)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved into the Home
Natural Gas (n=245)	18%	42%	40%
Oil (n=116)	12	44	34
Wood (n=418)	18	34	48
Electricity (n=389)	16	32	53
Other (n=51)	16	57	27

TABLE 4.26. Time When Wood Stove or Wood Furnace Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Wood Stove or Wood Furnace Was Installed (n=834)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved into the Home
Natural Gas (n=76)	35%	60%	5%
Oil (n=38)	8	75	17
Wood (n=573)	19	57	24
Electricity (n=124)	17	52	32
Other (n=23)	0	84	16

furnace during the past two years (35%). Similar to the case of wood stoves and furnaces, over 70% of the current occupants having a fireplace insert had it installed themselves (see Table 4.27).

4.4 PRIMARY HEATING FUELS AND THE LIKELIHOOD OF FUTURE INVESTMENT IN MAJOR ENERGY CONSERVATION MEASURES

Thus far, the results have shown that the type of primary heating fuel used in a residence seems to have an influence on the types of major ECMs

TABLE 4.27. Time When Fireplace Insert Was Installed, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Time When Fireplace Insert Was Installed (n=417)		
	Within the	More than 2 Years	There When
	Last 2 Years	Ago, but Since Respondent Moved In	Respondent Moved Into the Home
Natural Gas (n=80)	13%	67%	20%
Oil (n=54)	12	58	30
Wood (n=192)	20	63	16
Electricity (n=80)	15	59	26
Other (n=10)	0	100	0

that are currently in the residences. This section is concerned with the likelihood that the same residences will invest in ECMs during the next couple of years.

In terms of weatherproofing, residences using oil as their primary heating fuel were the least likely to invest (24%), whereas residences using a primary heating fuel categorized as "other" were most likely to invest in weatherproofing (see Table 4.28). Residences using electricity as the primary heating fuel were the most likely segment to indicate a likelihood of installing storm windows during the next two years (41%), followed by residences that use wood (40%) (see Table 4.29).

TABLE 4.28. Likelihood of Installing Weatherproofing, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing Weatherproofing (n=413)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=104)	46%	54%
Oil (n=60)	24	76
Wood (n=155)	39	61
Electricity (n=91)	33	67
Other (n=3)	50	50

TABLE 4.29. Likelihood of Installing Storm Windows, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing Storm Windows (n=504)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=144)	37%	63%
Oil (n=86)	25	75
Wood (n=167)	40	60
Electricity (n=91)	41	59
Other (n=16)	30	70

Twelve percent or less of residences using any of the primary heating fuels indicated a likelihood of installing a heat pump furnace during the next two years (see Table 4.30). Homeowners using electricity were the most likely segment to indicate a willingness to install a heat pump furnace. These homeowners were the same who most frequently had heat pump furnaces already in their residences.

Between 14% and 19% of the residences using any of the fuels, except for wood, indicated a likelihood of installing an Automatic or Setback Thermostat (see Table 4.31). As previously mentioned, residences that use wood as the primary heating fuel have little use for a thermostat.

TABLE 4.30. Likelihood of Installing a Heat Pump Furnace, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing a Heat Pump Furnace (n=1917)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or No At All Likely</u>
Natural Gas (n=422)	10%	91%
Oil (n=244)	7	93
Wood (n=682)	5	95
Electricity (n=518)	12	88
Other (n=51)	10	90

TABLE 4.31. Likelihood of Installing an Automatic or Setback Thermostat, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing An Automatic or Setback Thermostat (n=1174)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=200)	18%	82%
Oil (n=147)	19	81
Wood (n=488)	8	92
Electricity (n=306)	16	84
Other (n=33)	14	86

In terms of insulating the basement, floor or crawlspace, or outside walls, between 10% and 30% of the residences indicated a likelihood of installing some either for the first time or as an additional amount (see Tables 4.32 and 4.33.). Residences using wood most frequently indicated their willingness to invest in insulation (29% for basement, floor or crawlspace, and 34% for outside walls). A similar relationship can be seen for insulating the roof or attic. Between 19% and 50% of the residences indicated a likelihood of installing some or additional insulation during the next few years (see Table 4.34). Again, residences using wood as the primary heating fuel were the most likely segment to indicate a willingness to invest in insulation.

TABLE 4.32. Likelihood of Insulating Basement, Floor, or Crawlspace, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Insulating Basement Floor or or Crawlspace (n=913)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=231)	16%	84%
Oil (n=127)	16	84
Wood (n=291)	29	71
Electricity (n=239)	22	78
Other (n=25)	15	85

TABLE 4.33. Likelihood of Insulating Outside Walls, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Insulating Outside Walls (n=407)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=114)	28%	72%
Oil (n=86)	11	89
Wood (n=117)	34	66
Electricity (n=72)	21	79
Other (n=18)	26	74

TABLE 4.34. Likelihood of Insulating the Roof or Attic, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Insulating the Roof or Attic (n=173)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=51)	38%	62%
Oil (n=21)	38	62
Wood (n=58)	50	50
Electricity (n=36)	19	81
Other (n=8)	24	76

Less than 10% of the respondents using all types of primary heating fuels, except for wood, indicated that they were likely to install solar panels during the next two years (see Table 4.35). Approximately 17% of the respondents using wood as the primary heating fuel indicated a likelihood of installing solar panels.

Between 31% and 39% of the residences using all types of primary heating fuels, except for "other" types, indicated that they were likely to install storm or insulated doors during the next two years (see Table 4.36). The category of "other" for heating fuels was a very small sample and therefore should be interpreted with caution. Less than 10% of the residences using all of the

TABLE 4.35. Likelihood of Installing Solar Panels, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing Solar Panels (n=2086)	
	<u>Somewhat or Very Likely</u>	<u>Not Very or Not At All Likely</u>
Natural Gas (n=433)	4%	96%
Oil (n=261)	5	95
Wood (n=693)	17	83
Electricity (n=642)	7	93
Other (n=58)	3	97

TABLE 4.36. Likelihood of Installing Storm or Insulated Doors, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing Storm or Insulated Windows (n=886)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=188)	38%	62%
Oil (n=143)	31	69
Wood (n=299)	39	61
Electricity (n=249)	32	68
Other (n=7)	50	50

primary heating fuels except for "other" types of fuel, indicated that they were likely to install a heat pump water heater during the next two years (see Table 4.37). Again, the category of "other" has a small sample size and the results should be interpreted with caution.

In the case of installing a wood stove or wood furnace, occupants who use electricity (19%) or natural gas (18%) indicated that they were likely to invest in the next few years (see Table 4.38). Fewer than 20% of the residences using all types of primary heating fuels indicated a likelihood of

TABLE 4.37. Likelihood of Installing a Heat Pump Water Heater, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing a Heat Pump Water Heater (n=2017)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=146)	4%	96%
Oil (n=82)	4	96
Wood (n=244)	7	93
Electricity (n=219)	7	93
Other (n=24)	17	83

TABLE 4.38. Likelihood of Installing a Wood Stove or Wood Furnace, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing A Wood Stove or Wood Furnace (n=1300)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=359)	18%	82%
Oil (n=223)	9	91
Wood (n=144)	4	96
Electricity (n=540)	19	81
Other (n=35)	15	85

installing a fireplace insert during the next two years (see Table 4.39). Residences using oil (18%) or natural gas (17%) were the most likely to install a fireplace insert.

4.5 PRIMARY HEATING FUELS AND LOW/NO COST ENERGY CONSERVATION ACTIONS

The distribution of primary heating fuels by several low/no cost energy conservation actions can be seen in Tables 4.40 through 4.46. Residents using any of the low/no cost ECMs may do so for several reasons one of which may be

TABLE 4.39. Likelihood of Installing a Fireplace Insert, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Likelihood of Installing a Fireplace Insert (n=1649)	
	<u>Somewhat or Very Likely</u>	<u>Not Very Or Not At All Likely</u>
Natural Gas (n=352)	17%	83%
Oil (n=207)	18	82
Wood (n=518)	2	98
Electricity (n=569)	13	87
Other (n=48)	4	96

TABLE 4.40. Thermostat Setting Lowered in the Heating Season, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Lower Thermostat Setting (n=2050)	
	Yes	No
Natural Gas (n=442)	93%	7%
Oil (n=259)	93	7
Wood (n=635)	73	27
Electricity (n=656)	92	8
Other (n=58)	85	15

TABLE 4.41. Energy-Efficient Appliances Selected when Purchasing a New Appliance, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Select Energy Efficient Appliances (n=1898)	
	Yes	No
Natural Gas (n=384)	66%	34%
Oil (n=240)	65	35
Wood (n=655)	75	25
Electricity (n=568)	72	28
Other (n=52)	60	40

TABLE 4.42. Shades and Drapes Used to Aid Heating or Cooling, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Use Shades and Drapes (n=2127)	
	Yes	No
Natural Gas (n=437)	86%	14%
Oil (n=261)	93	7
Wood (n=714)	91	9
Electricity (n=657)	88	12
Other (n=58)	97	3

TABLE 4.43. Flow Restrictors Used in the Shower, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Use Flow Restrictors (n=2088)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=439)	39%	61%
Oil (n=256)	35	65
Wood (n=706)	43	57
Electricity (n=636)	34	66
Other (n=52)	9	91

TABLE 4.44. Plastic Put Over Windows, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Put Plastic Over Windows (n=2071)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=432)	28%	72%
Oil (n=249)	21	79
Wood (n=683)	33	67
Electricity (n=649)	23	77
Other (n=58)	56	44

TABLE 4.45. Received an Energy Analysis/Audit, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Homeowners (in 1000s) Received and Energy Analysis/Audit (n=2114)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=432)	25%	75%
Oil (n=257)	21	79
Wood (n=712)	33	67
Electricity (n=654)	42	58
Other (n=58)	26	74

TABLE 4.46. Water Heater Wrapped, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Homeowners (in 1000s)</u> <u>Wrap Water Heater (n=2110)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=427)	52%	48%
Oil (n=257)	64	36
Wood (n=709)	69	31
Electricity (n=658)	73	27
Other (n=58)	44	56

that they are more concerned about energy conservation in general. Another reason may be that these are low income households and these are the only conservation measures they could afford.

A relationship is apparent between the primary heating fuel used and whether the household lowers the thermostat setting during the heating season. Residences using wood as the primary heating fuel have the smallest proportion that lowers the thermostat (see Table 4.40). This result is expected since these residences would only use a thermostat when using a secondary heating source. There appear to be no differences between the primary heating fuel used by a residence and whether the householders select energy-efficient appliances when purchasing a new appliance. There are also no differences between primary heating fuel and the use of shades and drapes to aid heating or cooling (see Tables 4.41 and 4.42).

Using flow restrictors in the shower appears related to a residence's primary heating fuel. Fewer than 10% of the residences with primary heating fuel categorized as "other" use flow restrictors, whereas over 30% of the residences in each of the remaining categories of primary heating fuel do use water restrictors in their showers (see Table 4.43). The type of primary heating fuel used by a residence is also related to the householders use of plastic over the windows. Over 50% of the residences using an "other" type of primary heating fuel put plastic over their windows, whereas fewer than 35% of the residences using natural gas, oil, wood or electricity put plastic over their windows (see Table 4.44).

Receiving an energy audit/analysis is related to the primary heating fuel used by a residence. Over 40% of the residences using electricity as the primary heating fuel have received an energy analysis/audit (see Table 4.45). This finding demonstrates the importance of marketing since electric utilities have strongly advocated energy audits for their customers for a long time. Wrapping the water heater is also related to the primary fuel used by a residence. Again, residences using electricity have the largest proportion of those who wrap their water heaters (see Table 4.46). This result may be a reflection of information that was presented to homeowners after receiving an energy audit.

4.6 PRIMARY HEATING FUELS AND SECONDARY HEATING FUELS

The distribution of a residence's primary heating fuel according to their secondary heating fuel is shown in Table 4.47. Residences using natural gas most frequently use wood as their secondary fuel. The same is true for residences using oil and "other" types of primary heating fuels. Residences that use wood as the primary heating fuel most frequently use electricity as their secondary heating fuel. Finally, residences using electricity as their primary heating fuel most frequently used no secondary heating fuel.

4.7 SUMMARY

As mentioned in the previous chapter, wood and electricity are the primary heating fuels used most frequently by homeowners. When considering only

TABLE 4.47. Secondary Heating Fuel, by Primary Heating Fuel

Primary Heating Fuel	Homeowners (in 1000s) Secondary Fuel (n=2122)					
	Natural Gas	Oil	Wood	Electricity	None	Other
Natural Gas (n=434)	0%	2%	52%	18%	28%	0%
Oil (n=261)	0	0	38	26	36	0
Wood (n=714)	10	7	1	62	14	6
Electricity (n=655)	1	1	39	2	55	2
Other (n=58)	0	0	63	22	12	3

homeowners, the distribution of heating fuels changes across geographic quadrants. Wood is the most frequently used heating fuel in the Southeast and Southwest quadrants, whereas electricity is most frequently used in the Northwest quadrant. Heating fuels used most frequently in the Northwest quadrant include electricity (32%) and wood (31%). Wood is the most frequently used heating fuel used in single family detached homes, while electricity is used most frequently in all other types of residences.

The type of primary heating fuel used by a residence that is owned appears to be related to whether different types of major ECMs have been installed. The ECMs whose installation appears most affected include storm windows, heat pump furnaces, automatic or setback thermostats, insulated outside walls, storm doors, wood stoves or furnaces and fireplace inserts. Except for storm doors, wood stoves or furnaces, and fireplace inserts, residences using electricity most frequently had major ECMs already installed.

Besides knowing which ECMs have already been installed in a residence it is also important to know the likelihood of future installations and which ECMs are most likely to be installed. The results showed that weatherproofing, storm windows, insulation in the roof or attic, and storm doors are the ECMs most likely to be installed by homeowners in the next two to three years. Residences using electricity were the ones most likely to indicate that they are going to install storm windows, heat pump furnaces, and a wood stove or wood furnace.

The results indicate that in some instances having a specific ECM in a residence is related to the type of primary heating fuel used. Therefore, the hypothesis that there is no relationship between investing in ECMs and the type of primary heating fuel used by a residence can be rejected for certain ECMs. Some of the relationships between a specific ECM and type of heating fuel are relatively easy to explain, such as residences using wood being the most frequent to have a wood stove or wood furnace. Other relationships, such as residences using electricity being the most frequent to have storm windows, are not so easily explained.

5.0 PRIMARY HEATING FUEL USED BY RENTERS

Renters are not generally considered likely candidates for investing in major ECMs. Many factors such as a lower average "length of occupancy", limited income, and lack of ownership contribute to this impression. The length of occupancy is very important because it relates to the payback period of an ECM. In many instances renters don't expect to occupy a structure long enough to see a return on the investment that an ECM will yield. With this in mind, it is still of interest to note the characteristics of renters and the primary heating fuels used in their residences.

5.1 PRIMARY HEATING FUELS AND RELATED DEMOGRAPHICS

Renters represent over one third of the housing units in the northwest, and over 50% of these residences use electricity as their primary heating fuel. Thus, renters present a real conservation resource if developed and pursued. The distribution of primary heating fuels used in rented residences is shown in Figure 5.1.

The distribution of primary heating fuels used by a rental residence and the geographic quadrant in which the residence is located is shown in Table 5.1. Electricity is the most frequently used primary heating fuel in all geographic quadrants. The results help to confirm the previously mentioned influence that ownership status of a residence has in relation to primary heating fuel.

The type of rental home in which residents and the primary heating fuel used by them are found in Table 5.2. Electricity is the most frequent type of primary heating fuel in all types of rental homes except for single family detached homes. The primary heating fuels used in single family detached homes are wood (32%), electricity (32%), natural gas (23%) and oil (12%). Wood appears to be the most frequently used primary heating fuel in single family detached homes whether they are owned or being rented.

The amount of money spent by renters to reduce energy use in the home during the past two years and the primary heating fuels used in their residences are shown in Table 5.3. The majority of renters spent less than \$500 during

FIGURE 5.1. Distribution of Primary Fuels, Renters (n=862)

TABLE 5.1. Primary Heating Fuel, by Geographic Quadrant of Rental Residences

Geographic Quadrant	Renters (in 1000s) Primary Heating Fuel (n=862)				
	Natural Gas	Oil	Wood	Electricity	Other
Northwest (n=361)	10%	3%	15%	72%	0%
Southwest (n=266)	18	14	14	51	4
Northeast (n=137)	24	9	18	47	3
Southeast (n=98)	28	5	31	33	3

TABLE 5.2. Primary Heating Fuel, by Type of Rental Home Where Respondents Currently Live

Type of Residence	Renters (in 1000s) Primary Heating Fuel (n=862)				
	Natural Gas	Oil	Wood	Electricity	Other
Single family detached home (n=402)	23%	12%	32%	32%	2%
2-4 family home-duplex-townhouse (n=238)	12	6	7	74	1
Building with more than 4 units (n=199)	10	1	0	86	3
Mobile Home-Trailer (n=23)	7	0	16	70	7

TABLE 5.3. Amount of Money Spent During the Past Two Years to Reduce Energy Use in the Rental Residence, by Primary Heating Fuel

Primary Heating Fuel	Renters (in 1000s) Amount Spent (n=728)				
	\$0.00	\$1-\$500	\$501-\$1000	\$1001-\$2000	\$2000+
Natural Gas (n=113)	62%	25%	7%	0%	6%
Oil (n=46)	43	47	0	10	0
Wood (n=115)	46	37	6	5	7
Electricity (n=437)	78	18	1	1	3
Other (n=17)	68	32	0	0	0

the past two years which strengthens the argument that renters are not likely candidates for investing in major ECMs.

5.2 PRIMARY HEATING FUELS AND LOW/NO COST ENERGY CONSERVATION ACTIONS

The distribution of primary heating fuels by several low/no cost ECMs can be seen in Tables 5.4 through 5.10. Nearly 50% of the renters lower their thermostats, select energy-efficient appliances when purchasing them, and use shades or drapes to aid heating or cooling in their residences. With the exception of residences using a primary heating fuel categorized as 'other', over 30% of the remaining residences use flow restrictors in their showers.

TABLE 5.4. Renter Thermostat Settings Lowered in the Heating Season, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Lower Thermostat Setting (n=854)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=144)	96%	4%
Oil (n=61)	95	5
Wood (n=141)	89	11
Electricity (n=490)	92	8
Other (n=11)	51	49

TABLE 5.5. Energy-Efficient Appliances Selected when Renter Purchasing a New Appliance, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Select Energy-Efficient Appliances (n=740)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=117)	81%	19%
Oil (n=57)	57	43
Wood (n=126)	68	32
Electricity (n=428)	50	50
Other (n=12)	46	54

TABLE 5.6. Shades and Drapes of Renters Used to Aid Heating or Cooling, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Use Shades and Drapes (n=859)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=143)	93%	7%
Oil (n=64)	97	3
Wood (n=144)	87	13
Electricity (n=490)	92	8
Other (n=17)	71	29

TABLE 5.7. Flow Restrictors Used by Renters in the Shower, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Use Flow Restrictors (n=831)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=135)	39%	61%
Oil (n=61)	43	57
Wood (n=148)	44	56
Electricity (n=470)	33	67
Other (n=17)	0	100

TABLE 5.8 Plastic Put Over Windows of Renters, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Put Plastic Over Windows (n=852)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=141)	50%	50%
Oil (n=64)	64	36
Wood (n=144)	55	45
Electricity (n=486)	30	70
Other (n=17)	32	68

TABLE 5.9. Renters Receiving an Energy Analysis/Audit, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Renters (in 1000s) Received an Energy Analysis/Audit (n=828)</u>	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=137)	20%	80%
Oil (n=61)	33	67
Wood (n=143)	14	86
Electricity (n=470)	11	89
Other (n=17)	0	100

TABLE 5.10. Water Heater Wrapped, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Renters (in 1000s) Wrap Water Heater (n=809)	
	<u>Yes</u>	<u>No</u>
Natural Gas (n=136)	57%	43%
Oil (n=61)	77	24
Wood (n=136)	64	36
Electricity (n=459)	65	35
Other (n=17)	22	78

The most frequent type of residence to put plastic over their windows (64%) and to wrap water heaters (77%) use oil as the primary heating fuel. Fewer than 35% of the rental residences using any type of heating fuel have received an energy analysis/audit. The residences using oil as their primary heating fuel were the largest segment to have received an audit (77%).

5.3 PRIMARY HEATING FUELS AND SECONDARY HEATING FUELS

The distribution of primary heating fuels and secondary heating fuels used by the residences is shown in Table 5.11. The majority of residences using natural gas, oil, electricity or "other" do not have a secondary heating fuel. Over 58% of the households using wood as their primary heating fuel use electricity as their secondary heating fuel.

TABLE 5.11. Secondary Heating Fuel, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	Renters (in 1000s) Secondary Fuel (n=849)					
	<u>Natural Gas</u>	<u>Oil</u>	<u>Wood</u>	<u>Electricity</u>	<u>None</u>	<u>Other</u>
Natural Gas (n=143)	0%	2%	28%	12%	57%	0%
Oil (n=64)	0	0	24	17	59	0
Wood (n=143)	17	10	0	58	13	2
Electricity (n=483)	1	1	21	2	74	1
Other (n=17)	0	0	12	31	57	0

5.4 SUMMARY

Over 50% of the renters in the Pacific Northwest use electricity as their primary heating fuel. Almost 50% of the renters in each geographic quadrant use electricity with the exception of the Southeast quadrant. In the Southeast quadrant, electricity is used by 33% of the renters and wood is used by 31%. Electricity is the most frequently used heating fuel for all types of rental residences except for the single family detached home which most frequently uses wood and electricity.

Almost 50% of the renters lower their thermostat, select energy-efficient appliances when purchasing them and use shades or drapes to improve heating or cooling in their residences. The majority of residences that are rented reported using no secondary heating fuel with the exception of residences that use wood. Over 50% of the residences using wood as a primary heating fuel report electricity as their secondary heating fuel.

Since over one third of the housing units in the Pacific Northwest are rentals, this segment presents an excellent real conservation resource if developed and pursued. As mentioned, the tenants of rental units are not usually considered likely candidates for investing in major ECMs. Therefore, marketing plans must continue to gear strategies towards the owners of the buildings.

6.0 RESIDENCES THAT SWITCHED PRIMARY HEATING FUELS

Information related to a consumer's fuel-switching behavior is directly beneficial to BPA as input to the policy/decision making process. Accurate forecasting of electricity demand in the Pacific Northwest depends, to a great extent, on an understanding of consumer behavior patterns such as fuel switching. This section will review the types of fuel switching that occurred in the Pacific Northwest during the past two years and the relevant demographics associated with the residences. An overall objective of this chapter is to test the hypothesis that there is no relationship between the decision to switch to a new primary heating fuel during 1983-85 and the original type of primary heating fuel used in the residence.

6.1 PROFILE OF RESIDENCES THAT SWITCHED PRIMARY HEATING FUELS

Approximately 8% of the residences in the Phase II survey sample switched primary heating fuels during the past two years (see Table 6.1). There appears to be a relationship between the primary heating fuel currently used and the question of whether the primary fuel changed during the past two years. Residences currently using wood as the primary heating fuel had the largest proportion to have switched primary heating fuel during the past two years.

TABLE 6.1. Residences that Changed Primary Heating Fuel During the Past Two Years, by Primary Heating Fuel

<u>Primary Heating Fuel</u>	<u>Residences that Changed Heating Fuel During the Past Two Years Full Sample (in 1000s) Changed Fuel (n=2954)</u>	
	<u>Yes</u>	<u>No</u>
Wood (n=860)	17%	83%
Other (n=73)	11	89
Natural Gas (n=522)	7	93
Electricity (n=1124)	3	97
Oil (n=320)	3	97

The distribution of a residence's current primary heating fuel and the former primary heating fuel can be seen in Table 6.2. Households using electricity before the switch had the largest proportion to have switched primary fuel during the past two years. Almost all (97%) of these residences switched from electricity to wood as the primary heating fuel.

The most frequent reason given for changing primary heating fuel was that the new primary heating fuel was believed to be less expensive than the former fuel (see Figure 6.1). The largest proportion of residences to change primary fuels were located in the Northwest quadrant (see Figure 6.2). Over 80% of the residences that switched primary fuels were single family detached homes (see Figure 6.3). This result is not surprising considering that these types of residences generally have higher incomes and are more able to switch heating fuels. Also, since the largest proportion of switching was from electricity to wood single family detached homes are the most likely to have a chimney in the residence.

Almost 80% of the residences that switched primary heating fuels reported spending some money during the past two years to reduce energy use in the home (see Figure 6.4). The largest proportion of homes to switch primary heating fuels had yearly incomes greater than \$30,000 (see Figure 6.5), and over 75% of those residences that switched primary heating fuels are owned (see Figure 6.6).

TABLE 6.2. Current Primary Heating Fuel, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel (in 1000s) Current Primary Heating Fuel (n=235)				
	Natural Gas	Oil	Wood	Electricity	Other
L P Gas (n=7)	0%	0%	100%	0%	0%
Natural Gas (n=45)	0	10	39	41	10
Oil (n=65)	44	0	39	18	0
Wood (n=15)	43	33	0	13	13
Electricity (n=103)	3	0	97	0	0

FIGURE 6.1. Reason for Changing Primary Heating Fuel, Residences that Changed Primary Heating Fuel (n=222)

Generally, respondents who switched their primary heating fuel are concerned or very concerned about energy conservation, the cost of energy and energy use in the home (see Figures 6.7, 6.8, and 6.9).

6.2 RESIDENCES THAT SWITCHED PRIMARY HEATING FUEL TO ELECTRICITY

Of the residences that switched primary fuel during the past two years, 14% of them switched to electricity. The most frequent type of former primary heating fuel was natural gas (57%), followed by oil (38%) and wood (6%).

The reasons given for the change from the previous primary heating fuel to electricity are shown in Table 6.3. "Less expensive" was the most frequent response for residences using natural gas or oil and "safety" was the reason given for changing from wood.

FIGURE 6.2. Geographic Quadrant of Residences, Residences that Changed Primary Heating Fuel (n=240)

The largest proportion of homes that switched to electricity are located in the Southeast quadrant (see Table 6.4). The type of home the householders currently live in and their former primary heating fuel is shown in Table 6.5. Single family detached homes are the most frequent type of residence that switched to electricity.

The residences whose previous primary heating fuel was wood are the only ones to spend more than \$2,000 during the past two years to reduce energy use in the home (see Table 6.6). Households that had an income of less than \$16,000 were the most frequent group to switch their primary heating fuel to electricity (see Table 6.7). These homes may have already been equipped for electricity. Therefore, very little money, if any, would need to have been spent to convert to electricity from wood. Forty-seven percent of the homes that switched to electricity are owned (see Table 6.8).

FIGURE 6.3. Type of Residence Where Respondents Currently Live, Residences that Changed Primary Heating Fuel (n=240)

FIGURE 6.4. Amount of Money Spent During the Past Two Years to Reduce Energy Use in the Residence, Residences that Changed Primary Heating Fuel (n=69)

FIGURE 6.5. Annual Household Income, Residences that Changed Primary Heating Fuel (n=226)

Seventy-five percent of the residences that formerly used natural gas and 100% of the residences that formerly used oil believed that electricity rates will increase during the next five years (see Table 6.9). The majority of these householders expect the electricity rate to increase over 20% during the next five years (see Table 6.10).

Respondents in households that switched the primary heating fuel to electricity generally are concerned or very concerned about energy conservation, the cost of energy, and energy use in the home (see Tables 6.11, 6.12, and 6.13).

6.3 RESIDENCES THAT DISCONTINUED USING ELECTRICITY AS THEIR PRIMARY HEATING FUEL

Of the residences that switched primary heating fuels during the past two years, 45% of them discontinued using electricity as their primary heating fuel. Nearly all of these residences switched from electricity to wood. The most frequent reason given for changing to wood or natural gas was that the new

FIGURE 6.6. Ownership Status of Residences, Residences that Changed Primary Heating Fuel (n=240)

fuel would be "less expensive" (see Table 6.14). The largest proportion of homes that switched from electricity are located in the Northeast quadrant (see Table 6.15). The majority of the homes that switched from electricity are single family detached homes (see Table 6.16).

Over 70% of the residences that switched from electricity to wood spent over \$500 during the past two years to reduce energy use in the residence (see Table 6.17). The largest proportion of residences that switched from electricity had incomes between \$16,000 and \$30,000 (see Table 6.18). Less than 20% of the residences that switched from electricity are rented (see Table 6.19).

FIGURE 6.7. Level of Concern for Energy Conservation, Residences that Changed Primary Heating Fuel (n=239)

Almost all of the residences that switched from electricity to a new primary fuel felt that electricity rates would increase in the next five years (see Table 6.20). All of these respondents felt that the electricity rate would increase by 5% or more in the next five years (see Table 6.21). Less than 10% of the respondents that discontinued using electricity felt the electricity rate would decrease by 5% or more (see Table 6.22).

Respondents that switched from electricity to wood generally were concerned or very concerned about energy conservation, the cost of energy, and energy use in the home (see Tables 6.23, 6.24, and 6.25).

FIGURE 6.8. Level of Concern for Cost of Energy, Residences that Changed Primary Heating Fuel (n=240)

6.4 SUMMARY

The largest proportion of residences to have switched primary heating fuel during the past two years were those that previously used electricity. Nearly all of the residences previously using electricity as the primary heating fuel switched to wood. Overall, the most frequently given reason for switching heating fuels was that the new fuel was believed to be less expensive. The largest proportion of residences to change primary heating fuels were located in the Southeast quadrant. These results can partially explain why wood is the most frequent type of primary heating fuel in the Southeast quadrant overall.

FIGURE 6.9. Level of Concern for Energy Use in the Residence, Residences that Changed Primary Heating Fuel (n=240)

TABLE 6.3. Reason for Changing Primary Fuel to Electricity, by Former Primary Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Reason For Change (n=32)				
	Less Expensive	Easier/Cheaper	More Efficient Heating System	Cleaner	Safety
Natural Gas (n=19)	91%	9%	0%	0%	0%
Oil (n=11)	68	18	0	15	0
Wood (n=2)	0	0	0	0	100

Approximately 14% of the residences that switched their primary heating fuel during the past two years switched to electricity. The most frequent types of former primary heating fuels were natural gas (57%), oil (38%), and wood (6%). The largest proportion of homes that switched to electricity are located in the Northeast quadrant. The majority of respondents who switched to electricity felt that electricity rates are going to increase in the next five

TABLE 6.4. Residences Changed from Former to Electric Primary Fuel, by Geographic Quadrant

Geographic Quadrant	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Former Primary Heating Fuel (n=32)		
	Natural Gas	Oil	Wood
Northwest (n=19)	75%	25%	0%
Southwest (n=6)	50	50	0
Northeast (n=4)	0	50	50
Southeast (n=3)	50	50	0

TABLE 6.5. Residences Changed from Former to Electric Primary Fuel, by Type of Residence

Type of Residence	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Former Primary Heating Fuel (n=32)		
	Natural Gas	Oil	Wood
Single family detached home (n=15)	42%	45%	13%
2-4 family home-duplex-townhouse (n=5)	0	100	0
Building with more than 4 units (n=8)	100	0	0
Mobile Home-Trailer (n=5)	100	0	0

TABLE 6.6. Amount of Money Spent During the Past Two Years by Residences that Changed Primary Fuel to Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Amount Spent (n=24)				
	\$0	\$1-\$500	\$501-\$1000	\$1001-\$2000	\$+2000
Natural Gas (n=14)	22%	78%	0%	0%	0%
Oil (n=8)	24	56	20	0	0
Wood (n=2)	0	0	0	0	100

years and the increase will be more than 20%. However, the most frequent reason given by these respondents for switching their primary heating fuel to electricity was that it would be less expensive than the former type of heating fuel.

TABLE 6.7. Residences that Changed Former Primary Heating Fuel to Electricity, by Total Annual Household Income

Annual Income	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Former Primary Heating Fuel (n=26)		
	Natural Gas	Oil	Wood
Less than \$16,000 (n=11)	55%	45%	0%
\$16,000 - \$30,000 (n=16)	73	27	0
More than \$30,000 (n=8)	40	60	0

TABLE 6.8. Ownership Status of Residence by Primary Heating Fuel

Ownership Status	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Old Primary Heating Fuel (n=32)		
	Natural Gas	Oil	Wood
Own (n=15)	42%	47%	13%
Rent/Lease (n=17)	66	40	0

TABLE 6.9. Expected Electricity Rate Change in the Next Five Years by Primary Heating Fuel

Old Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Expected Change (n=32)		
	Increase	Decrease	Stay the Same
Natural Gas (n=19)	75%	0%	25%
Oil (n=11)	100	0	0
Wood (n=2)	0	0	100

TABLE 6.10. Expect Electricity Rate to Increase During the Next Five Years by Primary Heating Fuel

Old Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Percent Increase (n=22)			
	Less than 5%	5%-10%	10%-20%	Over 20%
Natural Gas (n=11)	0%	42%	0%	58%
Oil (n=11)	0	27	18	55
Wood (n=0)	--	--	--	--

TABLE 6.11. Level of Concern for Energy Conservation of Residences Changing to Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Level of Concern (n=28)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=14)	33%	67%	0%	0%
Oil (n=11)	85	15	0	0
Wood (n=2)	100	0	0	0

TABLE 6.12. Level of Concern for Cost of Energy of Residences Changing to Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Level of Concern (n=32)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=19)	25%	75%	0%	0%
Oil (n=11)	68	32	0	0
Wood (n=2)	0	0	100	0

TABLE 6.13. Level of Concern for Energy Use in the Residences Changing to Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Changed Primary Heating Fuel to Electricity (in 1000s) Level of Concern (n=10)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=19)	50%	50%	0%	0%
Oil (n=11)	68	32	0	0
Wood (n=2)	0	0	100	0

Approximately 45% of the residences that switched primary heating fuel during the past two years switched from electricity to a new fuel. The majority of residences that discontinued electricity switched to wood. This is particularly important because these residences as well as the other residences

TABLE 6.14. Reasons for Changing Primary Fuel from Electricity to Natural Gas or Wood, by New Primary Heating Fuel

New Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Reason for Change (n=99)				
	Less Expensive	Prefer It	Conserves Resources	Easier/ Cheaper	More Efficient Heating System
Natural Gas (n=3)	100%	0%	0%	0%	0%
Wood (n=96)	83	8	5	0	4

TABLE 6.15. New Primary Heating Fuel of Residences Discontinuing Electricity, by Geographic Quadrant of Residences

Geographic Quadrant	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) New Primary Fuel (n=103)	
	Natural Gas	Wood
Northwest (n=37)	0%	100%
Southwest (n=13)	10	90
Northeast (n=14)	0	100
Southeast (n=20)	0	100

TABLE 6.16. New Primary Heating Fuel of Residences Discontinuing Electricity, by Type of Home Where Respondents Currently Live

Type of Residence	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) New Primary Fuel (n=103)	
	Natural Gas	Wood
Single family detached home (n=87)	0%	100%
2-4 family home-duplex-townhouse (n=7)	46	54
Building with more than 4 units (n=0)	--	--
Mobile Home-Trailer (n=9)	0	100

TABLE 6.17. Amount of Money Spent During the Past Two Years by Residences Discontinuing Electricity, by New Primary Heating Fuel

New Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Amount Spent (n=24)				
	\$0	\$1-\$500	\$501-\$1000	\$1001-\$2000	\$+2000
Natural Gas (n=3)	0%	0%	0%	0%	100%
Wood (n=62)	5	22	20	20	33

TABLE 6.18. New Primary Heating Fuel in Residences Discontinuing Electricity, by Total Annual Household Income

Annual Income	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) New Primary Fuel (n=101)	
	Natural Gas	Wood
Less than \$16,000 (n=14)	0%	100%
\$16,000 - \$30,000 (n=45)	7	93
More than \$30,000 (n=42)	0	100

TABLE 6.19. New Primary Heating Fuel of Residences Discontinuing Electricity, by Ownership Status of Residence

Ownership Status	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) New Primary Fuel (n=103)	
	Natural Gas	Wood
Own (n=86)	0%	100%
Rent/Lease (n=16)	19	81

TABLE 6.20. Respondents Discontinuing Electricity Who Expected Electricity Rate Change in the Next Five Years, by New Primary Heating Fuel

New Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Expected Change (n=103)		
	Increase	Decrease	Stay the Same
Natural Gas (n=3)	0%	100%	0%
Wood (n=100)	94	5	2

TABLE 6.21. Respondents Discontinuing Electricity Who Expect Electricity Rate to Increase During the Next Five Years, by New Primary Heating Fuel

New Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Percent Increase (n=67)			
	Less than 5%	5%-10%	10%-20%	Over 20%
Natural Gas (n=0)	-%	--%	--%	--%
Wood (n=67)	0	29	44%	28

TABLE 6.22. Respondents Discontinuing Electricity Who Expect Electricity Rate to Decrease During the Next Five Years, by New Primary Heating Fuel

New Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Percent Decrease (n=8)			
	Less than 5%	5%-10%	10%-20%	Over 20%
Natural Gas (n=3)	0%	100%	0%	0%
Wood (n=5)	0	0	100	0%

TABLE 6.23. Level of Concern for Energy Conservation of Residents Discontinuing Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Level of Concern (n=103)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=3)	0%	0%	100%	0%
Wood (n=100)	40	60	0	0%

TABLE 6.24. Level of Concern for Cost of Energy of Residents Discontinuing Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Level of Concern (n=103)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=3)	100%	0%	0%	0%
Wood (n=100)	61	37	2	0

TABLE 6.25. Level of Concern for Energy Use in the Residences that Discontinued Electricity, by Former Primary Heating Fuel

Former Primary Heating Fuel	Residences that Discontinued Using Electricity as Primary Heating Fuel (in 1000s) Level of Concern (n=37)			
	Very Concerned	Concerned	Not Very Concerned	Not At All Concerned
Natural Gas (n=3)	100%	0%	0%	0%
Wood (n=100)	34	43	21	2

using wood as the primary heating fuel could easily switch back to electricity. This in turn could affect electricity demand in the region.

Nearly all of the residences that discontinued using electricity felt that electricity rates will increase during the next five years; and of these, all felt that the increase would be at least 5% or more. The most frequently given reason for switching primary heating fuels was that the new fuel would be less expensive.

These results suggest that the decision to change to a new primary heating fuel is related to the old type of primary heating fuel. Therefore, the hypothesis that there is no relationship between the decision to switch to a new primary heating fuel during 1983-1985 and the original type of primary heating fuel used in the residence can be tentatively rejected. The survey did not ask questions specifically related to the decision process regarding switching fuels other than to ask the reasons for switching. To fully answer the hypothesis, it would be necessary to ask more detailed questions regarding the decision to switch to a new primary heating fuel.

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