

THE PACIFIC NORTHWEST RESIDENTIAL ENERGY SURVEY

REPORT TO THE
BONNEVILLE POWER ADMINISTRATION
AND THE PACIFIC NORTHWEST
UTILITIES CONFERENCE COMMITTEE
JULY 1980

MASTER

Volume 1: Executive Summary

DISTRIBUTION OF THIS REPORT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

PREFACE

This report was prepared as an account of work by Elrick and Lavidge, Inc., under contract number DE-AC79-79BP13061 with the Bonneville Power Administration.

There are a total of twelve reports which present the results of the survey. Titles of these reports, along with a brief description of the contents, are listed below:

- Volume 1 - Executive Summary (approximately 85 pages) - survey highlights.
- Volume 2 - Technical Appendix (approximately 140 pages) - includes the sampling plan, the questionnaire, exhibit cards, interviewer instructions, and a description of sampling error.
- Volume 3 - Question-by-Question Results (approximately 165 pages) - responses to each question, tabulated by Pacific Northwest total, four states, and four climate zones.
- Volume 4 - Pacific Northwest Cross-Tabulations (approximately 250 pages) - provides cross-tabulations of about 30 major questions by nine categories: own/rent, dwelling type, age of dwelling, square feet, main heating fuel, income, electric rate level, annual electricity consumption, and annual gas consumption.
- Volume 5 - Washington Cross-Tabulations (approximately 250 pages)
- Volume 6 - Oregon Cross-Tabulations (approximately 250 pages)
- Volume 7 - Idaho Cross-Tabulations (approximately 250 pages)
- Volume 8 - Montana Cross-Tabulations (approximately 250 pages)
- Volume 9 - Climate Zone 1 Cross-Tabulations (approximately 250 pages)
- Volume 10 - Climate Zone 2 Cross-Tabulations (approximately 250 pages)
- Volume 11 - Climate Zone 3 Cross-Tabulations (approximately 250 pages)
- Volume 12 - Climate Zone 4 Cross-Tabulations (approximately 250 pages)

A limited number of copies of these reports may be obtained free of charge by writing to the following address. (Note: Volumes 2 through 12 will not be available until late November 1980).

Branch of Power Requirements - PRR
Bonneville Power Administration
P. O. Box 3621
Portland, OR. 97208

PACIFIC NORTHWEST
RESIDENTIAL ENERGY SURVEY

Report for
BONNEVILLE POWER ADMINISTRATION AND
PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE
August 1980

DAK/jm:sk

#82-0122 (5467)

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

ELRICK and LAVIDGE, inc.

Marketing Research  For Management Decisions

eb
DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED



INTRODUCTION

This management report describes the results of a carefully planned survey conducted by Elrick and Lavidge, Inc. (E&L) to secure a substantial amount of information about individually metered residential customers' characteristics, as they relate to the consumption of electricity and natural gas. The 4,030 residential customers interviewed were selected from the billing records of 37 electric utilities in the states of Washington, Oregon, Idaho and Montana.

This study was planned and conducted in close cooperation with the Bonneville Power Administration (BPA), the Pacific Northwest Utilities Conference Committee (PNUCC), the Federal Department of Energy and the 37 electric utilities. We are particularly indebted to Mr. Terence G. Esvelt and Mr. Mark L. Roberts of BPA and to the members of the PNUCC End-Use Data Subcommittee for their counsel and assistance, without which this study could not have been executed.

Special recognition is due the following electric utilities and their representatives for providing carefully drawn samples of their residential customers, and to the electric and natural gas companies and fuel oil dealers for providing consumption data for the customers interviewed:

Washington

Puget Sound Power and Light	Robert H. Spencer
Seattle City Light	Steve Aos
Washington Water Power Company	Tom Dukich
Snohomish County P.U.D.	Robert K. Schneider
Cowlitz County P.U.D.	R. G. Worthington
Tacoma City Light	Mark Crisson
Pacific Power and Light Company	Lorie Glidden
Clark County P.U.D.	Craig McCollum
Grant County P.U.D.	Ken Crow
Lewis County P.U.D.	Sue Moeller
City of Richland	Paul Kessie
Okanogan P.U.D.	Robert W. Chiles
City of Centralia	Bud Taylor
Pend Oreille County P.U.D.	George Kennett
Benton Rural Electric Association	Joe Chiara
Town of McCleary	Dale R. Seaman

Oregon

Portland General Electric Company	Fred I. Weber, Jr.
Pacific Power and Light Company	Lorie Glidden
Eugene Water and Electric Board	Norman Stone
Springfield Utility Board	Dave Coon
Coos-Curry Electric Cooperative	Denver Nance
Northern Wasco County P.U.D.	George Scheradella
City of Ashland	Robert Nelson
Midstate Electric Cooperative	John L. Sims

Idaho

Idaho Power Company	Mike Prendergast
Washington Water Power Company	Tom Dukich
Utah Power and Light Company	A. R. Dunn
City of Idaho Falls	William R. Jones
Clearwater Power Company	Sandra Huling
Pacific Power and Light Company	Lorie Glidden
City of Burley	Jan Christian
City of Soda Springs	John C. Darrington

Montana

Montana Power Company	Gene Lewis
Flathead Irrigation Project	George L. Moon
Pacific Power and Light Company	Lorie Glidden
Montana-Dakota Utilities Company	Warren Satterlee
Tongue River Electric Cooperative	Melanie Quaring
Beartooth Electric Cooperative	Raymond Hyvonen
Lincoln Electric Cooperative	Bob Mason

In addition to this management report, E&L has provided BPA with computer print-outs containing tabulations of all the survey data, and two computer tapes which contain both the data secured from the residential customers interviewed and the electric, gas and fuel oil consumption data for customers who consented to have the utilities and fuel oil dealers release these data.

The Report Digest section describes the management purpose/study objectives and the survey procedure and presents a summary of the key findings. The body of the report presents all of the findings organized in seven chapters. The appendix contains comments about the sampling errors and a complete list of the tabular exhibits included in the findings.

TABLE OF CONTENTS

	<u>Page</u>
REPORT DIGEST	
Study Purpose and Objectives.	1
Summary of Key Findings	2
Survey Procedure.	5
THE FINDINGS	
Introduction.	9
I. Demographic and Family Characteristics.	11
II. Dwelling Characteristics	17
III. Weatherization.	25
IV. Heating and Air Conditioning Systems.	39
V. Water Heating	53
VI. Presence and Use of Major Appliances.	57
VII. Characteristics of Customers with Various Consumption Patterns	67
APPENDIX	
Comments About Sampling Errors	75
List of Exhibits Included in The Findings.	78
List of Graphs Included in The Findings.	81



REPORT DIGEST

STUDY PURPOSE AND OBJECTIVES

This study was planned and authorized by BPA and PNUCC to secure a substantial amount of information from residential customers with individually metered electric service. These data will be of use primarily in forecasting energy demand and in measuring conservation practices and weatherization factors to assess energy savings potential and the need for new conservation programs.

The study objectives were to provide a data base which would describe the principal demographic, family, dwelling, weatherization and appliance characteristics of residential customers within each of the four states and four climate zones and the Pacific Northwest. Electricity, natural gas and fuel oil consumption data of customers interviewed were appended to the survey data collected so that these characteristics could be related to the amount of electricity or natural gas consumed.

Approximately one half of the data items in the questionnaire were crosstabulated by whether the dwelling was owned or rented, dwelling type, the age of the dwelling, the type of main heating fuel used, five income levels, five electricity rate levels, annual electricity consumption quartiles, and by annual natural gas consumption quartiles. Nine tabulations of the data were performed in this manner: a Pacific Northwest weighted total (weighted to represent the proportion of customers residing in each state), the four states, and the four climate zones. These data are particularly useful in regional analyses and in determining the differences among customers based on these major characteristics.

SUMMARY OF KEY FINDINGS

The following statements have been developed by Elrick and Lavidge, Inc. based primarily on the findings of the 4,030 interviews with residential electric customers.

1. There are opportunities for owners and builders of single-family houses in the Pacific Northwest to...
 - Upgrade ceiling or underside of roof insulation: ten percent of the customers have no insulation and another 22 percent have low levels of insulation (R-14 or less). In addition, eight percent of the customers were unsure whether the ceiling or underside of roof was insulated.
 - Insulate the underside of the ground floor: 2/3 of the homes with crawl spaces or unheated basements are not insulated. Insulate basement walls: 1/2 are not insulated, and insulate attached garage: 1/3 have no insulation.
 - Add double glazed or storm windows: 55 percent of the customers have none.
 - Install storm doors: 1/2 of the customers have none.
 - Add weatherstripping: 29 percent have none.
 - Add caulking to windows and doors: 37 percent have no caulking.
 - Install extra insulation on water heaters and hot water pipes: 4/5 of the customers do not have extra insulation on water heaters or hot water pipes located in unheated areas.

It is important to recognize that many households are mobile, as nearly one-half of the customers moved into their current dwelling within the past three years.

2. To increase the efficiency of their main heating equipment, customers could have their heating systems inspected and maintained on an annual basis. Of those heating with natural gas and fuel oil, 65 and 41 percent respectively, do not have their equipment professionally checked and serviced annually.
3. Of the customers who use the fireplace for heating (two percent as the main heating system and an additional 29 percent as the secondary heating system), only one-fourth have a heat exchanger and about one-half have a glass door. During the past year, three percent of the customers in the Pacific Northwest changed their primary source of heating fuel to wood. However, most of these customers use a wood burning stove rather than the fireplace.

- 4. The mean winter daytime temperature in residential dwellings in the Pacific Northwest is 66 degrees. In addition, the mean evening temperature is 68 degrees and the mean nighttime temperature is only 62 degrees.
- 5. Forty-four percent of the residential customers in the Pacific Northwest have electric space heating systems. Concerning the use of residential customers' water heating systems, 81 percent have electric water heaters, 78 percent have clothes washers and 50 percent have electric dishwashers.
- 6. Of the customers who have resided at the same location since August 1978, the characteristics which distinguish the high users of electricity (the customers in the highest quartile of annual electricity usage: more than 22,230 kilowatt hours) from all other customers are...

	<u>High Users</u>	<u>Others</u>
Annual household income exceeding \$20,000	57%	35%
Head of household between the ages 35 and 54	47	27
Three or more persons in household	66	38
Reside in multi-family dwelling	3	12
Building built between 1970 and 1979	43	23
Primary space heating system is electric	79	24
Electric water heating	98	73
Clothes washer	97	83
Electric clothes dryer	93	73
Electric dishwasher	70	47

- 7. Of all dwellings in the Pacific Northwest, 44 percent are heated electrically. The proportion of electrically heated dwellings varies widely by state, dwelling type, age of the dwelling, whether the dwelling is owned or rented, and annual household electricity consumption level.

Discriminating Characteristic and Proportion of Main Heating Systems Using Electricity

<u>State</u>	
Washington	53%
Oregon	42
Idaho	40
Montana	14

<u>Dwelling Type</u>	
Single-family, detached	32%
Single-family, attached	53
Multi-family dwelling	76
Mobile home	63

<u>Year Dwelling Built</u>	
Before 1950	22%
1950 to 1964	29
1965 to 1974	53
1975 to 1979	79

<u>Dwelling Ownership</u>	
Own	38%
Rent	60

<u>Annual Electricity Consumption Level</u>	
Low quartile	10%
Below average quartile	18
Above average quartile	42
High quartile	79

Of the single-family detached dwellings, nearly as many are heated with natural gas (31 percent) as with electricity. However, the trend is to install electric heating systems in homes, since, of the homes built within the past five years, 79 and 12 percent, respectively, are heated with electricity and natural gas.

SURVEY PROCEDURE

During July 1979, Elrick and Lavidge prepared a sample plan for the Bonneville Power Administration (BPA) which specified the method of selecting residential dwelling units with individually metered electric service, within the states of Washington, Oregon, Idaho and Montana, that were to be surveyed. As a result, one sample would be drawn from each of the four states rather than drawing a single sample from the Pacific Northwest.

A three-stage cluster sample was used in which the primary sampling unit was the electric utility. In selecting the utilities, 13 were purposely chosen because they serve a high proportion of customers within their state. The remaining 24 utilities, for a total of 37, were randomly chosen to assure a reasonable representation of smaller utilities and to ensure that the four climate zones were represented proportionate to the number of residential customers in each zone. For the purpose of sample selection, an electric utility is counted once for each state/climate zone in which it is represented. For instance, a utility located in climate zones one and two in Washington and climate zones one and three in Oregon is counted as four electric utilities for the purpose of sample selection. As a result, although the actual number of utilities participating in the survey was 37, 48 "partitioned" utilities are included in the sample. The total number of partitioned utilities located in each state, the number of "certain" (purposely chosen) and other utilities included in the survey, and the proportion of customers in each state served by the "certain" and other utilities are shown in Table 1. It is interesting that the 13 "certain" utilities (20 partitioned utilities) serve three-quarters of the individually metered residential electric customers in the Pacific Northwest.

Table 1

SELECTION OF ELECTRIC UTILITIES

State	Number of Partitioned Utilities	"Certain" Utilities		Other Utilities	
		Number in Survey	% of State's Customers	Number in Survey	% of State's Customers
Washington	64	9	78%	10	7%
Oregon	39	3	71	6	11
Idaho	43	5	73	7	13
Montana	29	3	78	5	7
Total	175	20	75%	28	9%

The second stage of the cluster sample involved requesting each utility to select a sample of meter reading routes. As an average of ten customers on each route were ultimately to be interviewed, the number of meter reading routes to be selected was equal to one-tenth of the number of customers to be interviewed. All customers on the routes selected constituted the subsample from which the customers to be surveyed would be taken.

The third stage of the cluster sample involved selecting the customers to be interviewed. Every n^{th} customer in a utility's subsample, where n equals the total number of customers in the subsample divided by the number of customers to be interviewed, was designated as a "primary" residence to be interviewed. The back-up sample consisted of two alternate customers for each primary residence. These alternates were the customers in the subsample located immediately before and immediately following the primary customer.

The 4,005 interviews scheduled to be conducted were allocated to the four states based on the level of precision desired (slightly higher for Washington and Oregon than for Idaho and Montana) and the number of customers residing in the state. The actual number of interviews conducted within each state and climate zone shown in Table 2.

Table 2

	<u>Number of Residential Customers Interviewed</u>				
		<u>Climate Zone</u>			
	<u>Total</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Washington	1,468	959	306	203	0
Oregon	1,165	914	22	117	112
Idaho	827	0	357	160	310
Montana	570	0	0	0	570
Total	4,030	1,873	685	480	992

All of the 37 utilities asked to participate in the survey agreed to do so. The questionnaire, which underwent numerous drafts, was approved by the BPA, the Pacific Northwest Utilities Conference Committee (PNUCC) Subcommittee on End-Use Data, and the Federal Department of Energy.

Between October 23 and November 2, 1979 the Elrick and Lavidge National Field Supervisor conducted a series of two-day training sessions with the local supervisors and field interviewers, who received complete written instructions for administering the questionnaire. As part of the survey, a comprehensive 15 minute insulation inspection was conducted.

The interviewers made personal visits to the residences of customers between October 25, 1979 and January 31, 1980. Information was obtained from either the male or female head of the household. Two "call-backs," for a total of three attempts, were made to interview each "primary" residence before an alternate household was contacted. All field interviewing was conducted during the late afternoon, evenings, and weekends to ensure a proper representation of single-adult households (in which that adult is employed) and also two-adult households in which both spouses are employed. Of the customers interviewed, 57 percent were "primary" households, 26 percent were first alternates, and 17 percent were second alternates.

To ensure quality control of the field procedures, a form was developed for use by interviewers to record the name and address of every contact attempted, the dates and times of all contacts, and the disposition of every household contacted. Twenty percent of the interviews were verified by the local supervisors. Concurrent with the interviewing and continuing through March, the questionnaire data were coded and edited for completeness and consistency. The percentages shown in the exhibits in the findings section of the report are based on raw data, except that for the Pacific Northwest, a weighted total was developed by applying weights to each state so that the proportion of residential electric customers in each state was accurately represented. The weights are: Washington - 1.331, Oregon - 1.072, Idaho - 0.5142, and Montana - 0.7035.

As part of the survey, respondents were asked to sign an authorization form permitting release of electricity, natural gas, and fuel oil usage data at their residence for the period August 1978 through July 1979 (fuel oil data was obtained through November 1979). All 37 electric utilities, all 10 gas companies, and 51 percent of the fuel oil dealers, representing 61 percent of the customers using fuel oil, supplied Elrick and Lavidge with energy usage data. These data were appended to the survey data and a single computer tape has been furnished to BPA.



THE FINDINGS



INTRODUCTION TO THE FINDINGS

The following seven chapters of this report discuss the detailed findings of the data obtained from the 4,030 personal interviews with individually metered residential electric customers in the Pacific Northwest. In the Appendix are comments about sampling errors and lists of the exhibits and graphs included in The Findings.

Each chapter is organized in the same manner: a text followed by exhibits and graphs. The text presents the highlights of the findings contained in the chapter and clarifies the material shown in the exhibits.

Many of the exhibits show a "Pacific Northwest total," which is calculated by weighting the data in each of the states such that the proportion of customers residing in each state is accurately represented in the total.

In the exhibits, each column of numbers totals to 100% except for rounding errors and where multiple responses to the question were allowed. The number of customers responding to each question is shown in parentheses at the bottom of each column of numbers. When a "don't know" response was considered an important piece of information, the proportion is included in the percentage distribution. However, most often the "don't know" responses and without exception the customers who did not respond to a question have been excluded from the computation of percentages. A dash in the percentage columns signifies that less than 0.5 percent of the customers gave the response. Attention has been drawn to the important findings in the exhibits by circling the appropriate percentages. An arrow along the left-hand margin leading from one or more response categories to one or more data items signifies that only the customers who gave the designated response(s) were asked the following question(s).

Detailed definitions of all terms can be found in the technical appendix (Volume 2 of this series of reports described in the Preface to this report).

I. DEMOGRAPHICS AND FAMILY CHARACTERISTICS

The exhibits in this chapter show the characteristics of the households interviewed such as annual income levels and the number of persons in the household. These data are consistent with census data available from the United States government and show that the demographics do not differ widely among the four states included in the survey.

Forty-six percent of the customers moved into their dwelling within the past three years (see Exhibit 3). As the residents of all four states in the Pacific Northwest are highly mobile, it is possible that some customers may be reluctant to make capital investments in insulation and weatherization products that have a long-term payback. However, there are numerous inexpensive items which customers may purchase and install themselves, while the builders of homes and apartments have the opportunity to install increased R-levels of ceiling, exterior wall, and attached garage wall insulation. As virtually all customers interviewed occupy their homes year-round, the benefits from conservation activities and increased weatherization will be derived throughout the year.

The data presented in Exhibits 1 and 2 show that there is a good representation of all income levels, education levels, and age brackets of the head of the household. Nearly one-half of the household heads had at least some college education and slightly more than half of the households are one or two-person households.

Nearly 60 percent of the customers interviewed were designated as a primary residence in the sample plan (see Exhibit 4). The preponderance of female respondents reflects the fact that there are more female than male heads of household and, secondly, the greater likelihood that the female respondents were at home and available for an interview when the visit was made.

Exhibit 1

DEMOGRAPHICS/FAMILY CHARACTERISTICS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Household Income in 1978</u>					
Less than \$5,000	11	11	11	12	11
\$5,000 to \$7,999	11	12	10	11	7
\$8,000 to \$11,999	15	13	16	15	15
\$12,000 to \$14,999	11	10	11	12	12
\$15,000 to \$19,999*	16	15	17	16	20
\$20,000 to \$24,999	15	17	14	15	12
\$25,000 to \$34,999	14	13	14	12	13
\$35,000 or more	9	9	7	8	10
*Median lies in this group					
(Number of respondents)	(3,356)	(1,199)	(976)	(719)	(462)
<u>Education of Head of Household</u>					
Not a high school grad	20	19	21	21	19
High school grad	34	33	35	31	34
Some college	26	27	25	28	25
College graduate	20	20	19	20	21
(Number of respondents)	(3,954)	(1,435)	(1,144)	(814)	(561)
<u>Age of Head of Household</u>					
Under 25	10	10	10	8	6
25 to 34	24	25	23	25	23
35 to 44	17	17	17	20	19
45 to 54	13	13	12	14	13
55 to 64	15	14	15	14	18
65 or over	21	21	22	19	22
(Number of respondents)	(3,972)	(1,449)	(1,148)	(817)	(558)

Exhibit 2

DEMOGRAPHICS/FAMILY CHARACTERISTICS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Number of Persons in Household</u>					
One	18	20	18	14	17
Two	36	36	38	33	35
Three	17	17	18	18	15
Four	16	15	15	20	19
Five	7	7	7	9	9
Six or more	5	5	4	7	5
(Number of respondents)	(3,978)	(1,450)	(1,152)	(818)	(558)
Average	2.8	2.7	2.7	3.1	2.9
<u>Proportion of Households With at Least One Person in the Age Category</u>					
Under 6	21	20	22	24	21
6 to 12	20	19	20	26	23
13 to 18	18	17	16	22	22
19 to 24	21	21	21	21	16
25 to 34	32	33	31	35	30
35 to 44	21	21	21	24	22
45 to 64	32	32	31	32	33
65 or older	22	22	24	21	22
(Number of households)	(3,990)	(1,453)	(1,154)	(821)	(562)

Exhibit 3

YEAR MOVED INTO DWELLING AND
WHETHER OCCUPIED YEAR-ROUND

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Year Moved Into Home</u>					
Prior to 1970	30	30	29	28	33
1970 to 1974	14	13	13	15	16
1975 to 1976	10	10	10	14	11
1977	11	11	11	10	12
1978	(14)	14	13	15	12
1979/1980	(21)	22	23	18	16
(Number of respondents)	(4,025)	(1,468)	(1,161)	(827)	(569)
<u>Time Period Occupied</u>					
Year-round	99	99	99	99	99
Seasonally	1	1	1	1	1
(Number of respondents)	(4,015)	(1,460)	(1,161)	(825)	(569)



RESPONDENTS' CHARACTERISTICS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Whether Designated As Primary or Alternate Residence</u>					
Primary	57	53	61	64	57
First Alternate	26	28	25	22	26
Second Alternate	17	19	14	14	17
(Number of respondents)	(4,030)	(1,468)	(1,165)	(827)	(570)
<u>Sex of Respondent</u>					
Female	59	59	59	62	62
Male	41	41	41	38	38
(Number of respondents)	(4,029)	(1,468)	(1,165)	(827)	(569)
<u>Whether Authorized Release of Energy Consumption Data</u>					
Yes - moved into home before July 1979	80	77	81	83	83
Yes - moved into home July 1979 or later	11	11	12	11	10
No	9	12	7	6	7
(Number of respondents)	(3,896)	(1,421)	(1,133)	(796)	(546)

II. DWELLING CHARACTERISTICS

The data items described in this chapter are the physical characteristics of the dwelling, whether the housing is owned or rented, the age of the dwelling and whether the dwelling is located in an urban or rural area. A "multi-family" dwelling is defined as a house or building with two or more units, where the living quarters of one dwelling are above the living quarters of another.

Nearly one-half of the dwellings in each of the four states are at least 20 years old (see Exhibit 5). Approximately two-thirds of the dwellings are single-family, detached homes and seventy percent of the customers own their dwelling.

Nearly one-half of the dwellings have either four or five rooms and approximately one-quarter of the customers close off at least one room, which is unheated during the winter (see Exhibit 6). Nearly all multi-family dwellings and four-fifths of the mobile homes have less than 1,200 square feet of living space, while 40 percent of the single-family dwellings are in this size category.

DWELLING CHARACTERISTICS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Type of Dwelling</u>					
Single family, detached	64	63	62	70	71
Single family, attached	10	9	14	6	8
Mobile home	8	7	7	13	13
Multi-family, 2 - 4 units	6	6	8	6	6
Multi-family, 5 or more units	11	15	10	6	2
(Number of respondents)	(4,030)	(1,468)	(1,165)	(827)	(570)
 <u>Payment for Dwelling</u>					
Own	70	67	70	77	78
Rent	30	33	30	21	21
Occupied without payment	1	1	-	1	1
(Number of respondents)	(4,028)	(1,468)	(1,164)	(826)	(570)
 <u>Year Dwelling Built</u>					
Before 1950	31	32	29	27	34
1950 to 1959	16	16	16	14	18
1960 to 1964	8	9	8	7	7
1965 to 1969	11	13	9	12	7
1970 to 1974	14	12	15	15	16
1975 to 1979	20	18	23	25	19
(Number of respondents)	(3,295)	(1,152)	(942)	(710)	(491)
 <u>Location</u>					
Urban	81	83	85	73	68
Rural: population under 2,500	19	17	15	27	32
(Number of respondents)	(4,021)	(1,465)	(1,160)	(826)	(570)



Exhibit 6

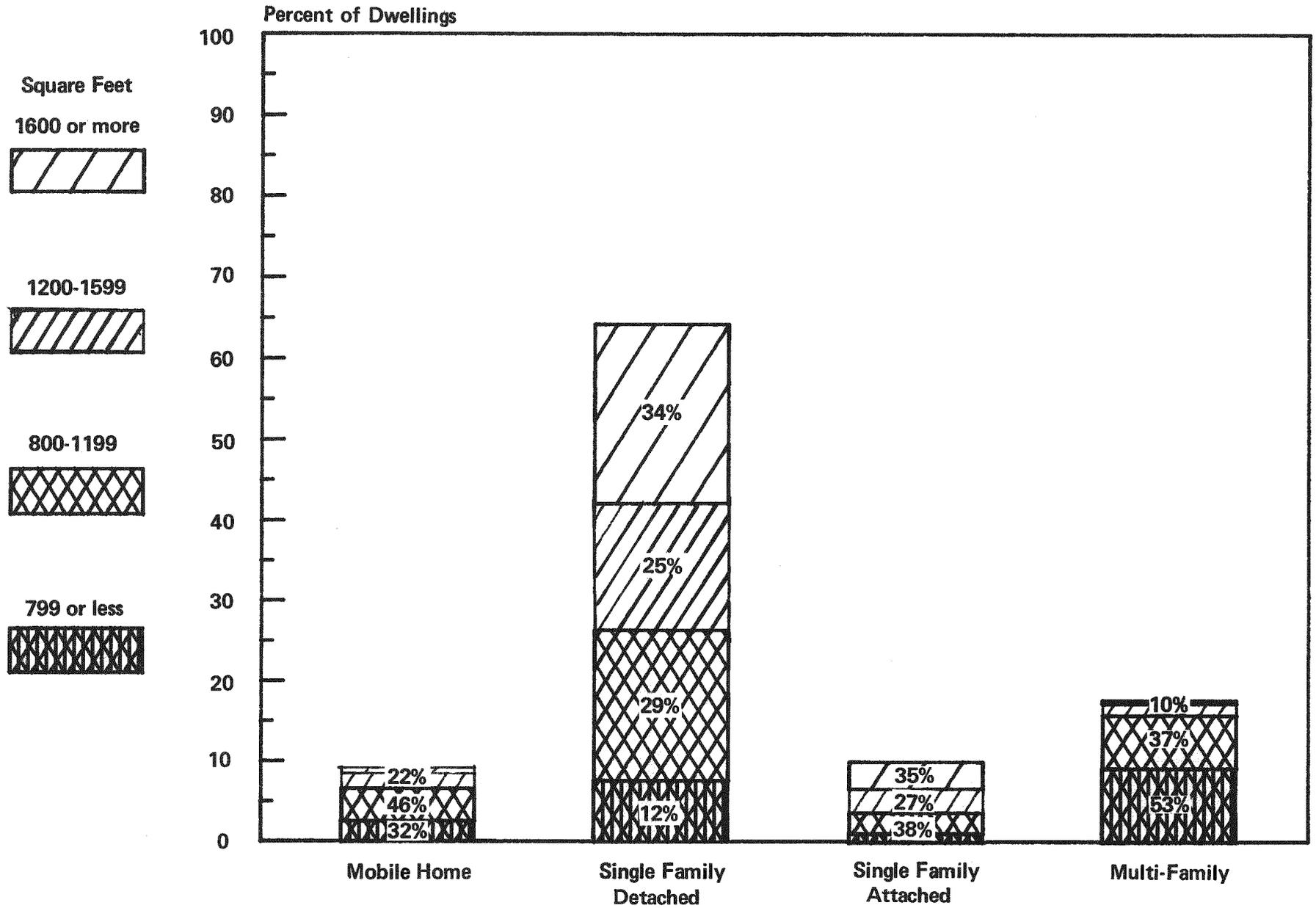
SQUARE FOOTAGE
OF LIVING SPACE

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Total Square Footage</u>					
Less than 800	21	22	22	18	16
800 to 1,199	32	32	30	31	36
1,200 to 1,599	21	19	23	22	24
1,600 to 1,999	11	10	13	13	7
2,000 or more	15	17	12	16	16
(Number of respondents)	(3,994)	(1,454)	(1,152)	(822)	(566)
<u>Proportion of Living Space That is Heated</u>					
Entire area heated	73	73	72	73	73
91% to 99%	6	6	5	8	5
81% to 90%	8	8	7	9	9
71% to 80%	5	4	5	4	7
70% or less	9	9	10	7	6
(Number of respondents)	(2,393)	(844)	(702)	(504)	(343)
<u>Number of Rooms in the Home</u>					
One or two	3	4	2	2	2
Three	11	12	10	9	9
Four	24	23	24	25	25
Five	23	21	25	25	25
Six	17	17	19	15	14
Seven	11	11	11	11	11
Eight	6	6	6	7	7
Nine or more	6	7	3	7	7
(Number of respondents)	(4,030)	(1,468)	(1,165)	(827)	(570)

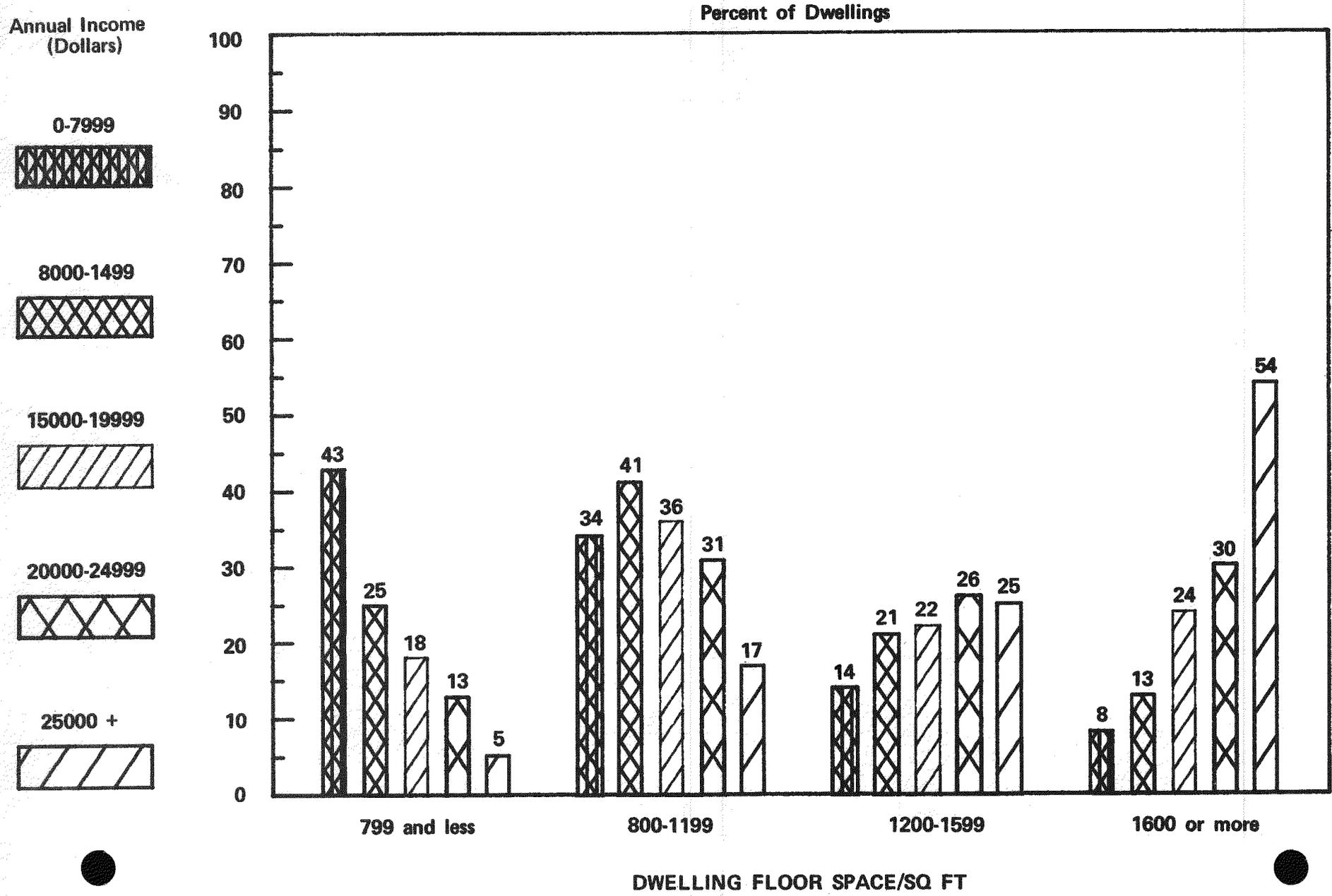
RELATIONSHIP BETWEEN TYPE OF DWELLING
AND SQUARE FOOTAGE OF LIVING SPACE
IN PACIFIC NORTHWEST

Square Footage of Living Space	Dwelling Type			
	Single Family Detached	Single Family Attached	Multi- Family	Mobile Home
	%	%	%	%
Less than 800	12	12	53	32
800 to 1,199	29	26	37	47
1,200 to 1,599	25	27	8	16
1,600 to 1,999	15	14	1	5
2,000 to 2,399	8	8	1	1
2,400 or more	11	13	-	-
(Number of respondents)	(2564)	(399)	(698)	(330)

GRAPH 1
LIVING SPACE BY DWELLING TYPE



GRAPH 2
DWELLING FLOOR SPACE BY INCOME



STRUCTURAL CHARACTERISTICS
OF DWELLING

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Number of Stories</u>					
One story	63	57	68	67	67
Two stories	28	29	25	24	25
Three or more stories	5	8	3	4	2
Split level	5	5	4	5	5
(Number of respondents)	(4,026)	(1,466)	(1,163)	(827)	(570)
<u>Type of Foundation</u>					
Full crawl space	39	36	50	35	18
Full basement	25	25	17	35	42
All on slab	17	21	15	10	7
Combination of these types	19	18	18	20	33
(Number of respondents)	(3,977)	(1,453)	(1,140)	(820)	(564)



III. WEATHERIZATION

Exhibits 9 through 12 and Graphs 4 through 7 describe the levels of ceiling, underside of roof, exterior wall, attached garage wall and underside of ground floor insulation in single family dwellings. Twenty-eight percent of the homes were inspected for ceiling and underside of roof insulation by the interviewers while the remaining insulation data were reported by the respondents.

"Ceiling" insulation generally refers to the areas immediately above the upper rooms' ceilings. Some homes have cathedral ceilings in some rooms, or use their attic for living space, and therefore those homes were checked for "underside of roof" insulation. Most homes that have insulation in one of those places won't have insulation in the other place, although some homes may have both kinds of ceilings with insulation in both places. The most valuable table for evaluating insulation above the living space is the first one in Exhibit 9, "R-Value of Insulation in Ceiling/Underside of Roof."

Exhibits 13 and 14 show the extent to which all types of dwellings are weatherized with storm windows or double glazed windows, windows with plastic covering, weatherstripping, and caulking. The weatherization data have been analyzed by state, climate zone, whether the dwelling is owned or rented, age of the dwelling, and dwelling type.

Graph 3 shows the locations of the climate zones in the four states. Climate zones are determined by summing the number of annual heating degree days and cooling degree days. In the Pacific Northwest, more than 90 percent of this sum is heating degree days. In general, the wider the temperature variation in the winter (and accompanying severity of weather), the higher the number of heating degree days. The number of degree days which determine each of the four climate zones are as follows:

- Climate zone 1 - 4,000 to 5,999 degree days
- Climate zone 2 - 6,000 to 6,999 degree days
- Climate zone 3 - 7,000 to 7,999 degree days
- Climate zone 4 - 8,000 to 8,999 degree days

While 10 percent of the respondents residing in single-family homes indicated that they have no ceiling or underside of roof insulation, only 17 percent of the customers have R-27 insulation or greater (see Exhibit 9). This suggests that there are opportunities for many home owners in the Pacific Northwest to upgrade ceiling or underside of roof insulation. Homes in climate zones 2, 3 and 4, compared with homes in climate zone 1, are more likely to have ceiling or underside of roof insulation and have higher R-levels of insulation.

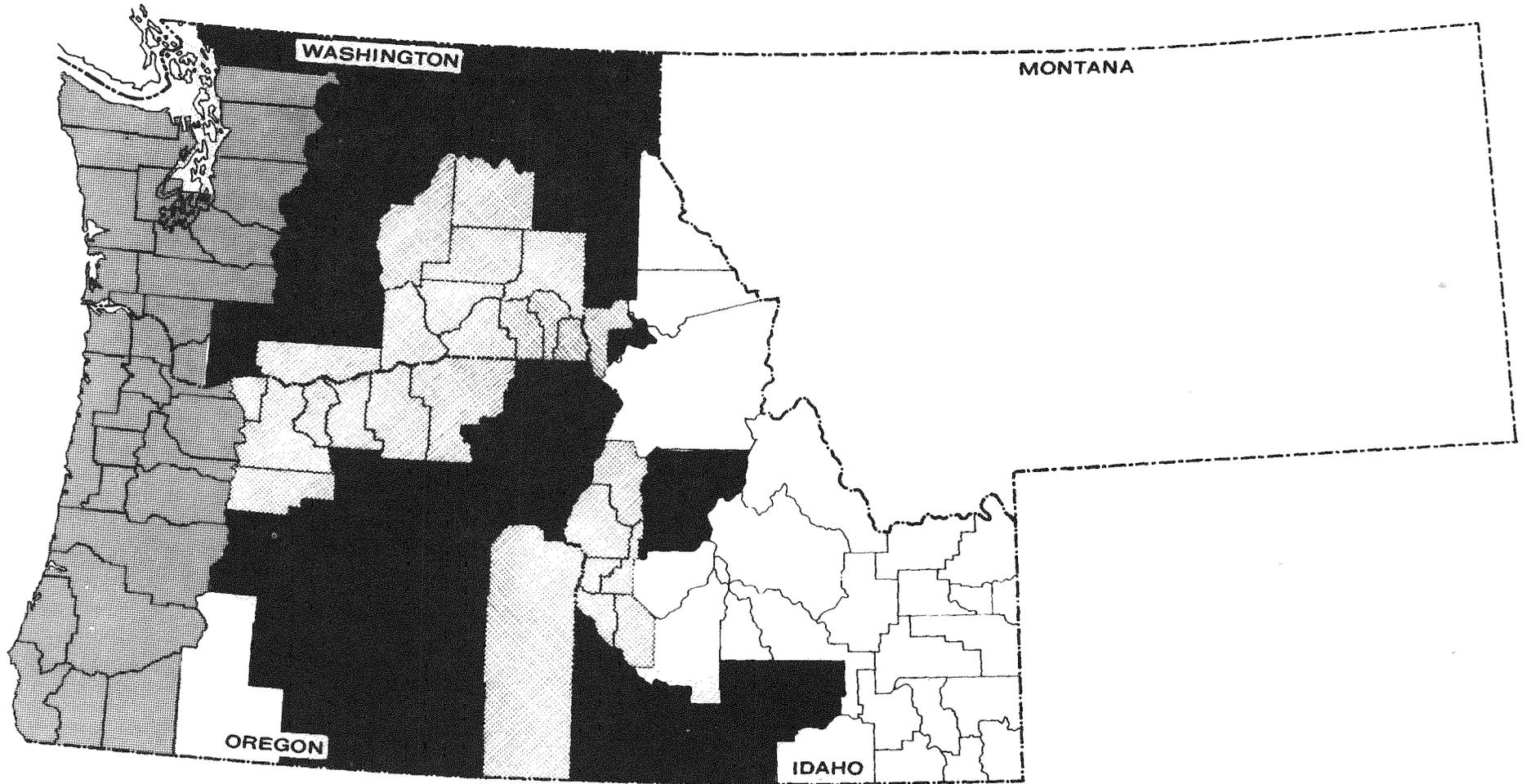
Sixty-two percent of the single-family dwellings in the Pacific Northwest have at least some first floor exterior wall insulation (see Exhibit 10). Primarily, the insulation is made of batt/blanket, while 20 percent of the dwellings have either loose fill, rigid foam, or plastic insulation. In addition, only 33 percent of the basements and 49 percent of the attached garages have at least some insulation. This suggests that there are opportunities for owners and builders of single-family homes to install or upgrade insulation.

Compared with homes built within the past five years, older homes are less well insulated and have fewer weatherization products. Electrically heated homes are better insulated than others (see Exhibit 11). Higher income groups generally are better insulated than lower income groups (see Graph 4).

There are opportunities for many owners and builders of single-family houses to add double glazed or storm windows, as 55 percent of the customers have neither, to install storm doors (one-half have none) and add weatherstripping or caulking to windows and doors (29 and 37 percent, respectively, have none).

With respect to weatherization of windows and doors in the Pacific Northwest, owners as opposed to renters, houses built within the past five years, and single-family dwellings are better weatherized than others (see Exhibit 14).

GRAPH 3
HEATING PLUS COOLING DEGREE DAYS



 4,000-5,999
CLIMATE ZONE 1

 6,000-6,999
CLIMATE ZONE 2

 7,000-7,999
CLIMATE ZONE 3

 8,000-8,999
CLIMATE ZONE 4

CEILING AND UNDERSIDE OF ROOF
INSULATION IN
SINGLE FAMILY HOUSES

	Pac North west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>R Value of Insulation in Ceiling/Underside of Roof</u>									
No insulation	10	15	11	3	4	15	4	8	3
R-1 to R-8	3	4	3	2	2	5	2	2	2
R-9 to R-14	19	20	21	13	17	22	16	17	18
R-15 to R-20	13	15	14	13	10	13	17	14	10
R-21 to R-26	22	21	21	23	25	18	23	29	23
R-27 to R-33	9	4	7	16	13	5	12	6	14
R-34 to R-40	5	2	4	11	7	3	7	6	9
R-41 or greater	3	2	2	7	5	2	4	4	5
Don't know type and/or thickness of insulation	8	8	7	9	10	8	9	7	9
Unsure whether insulated	8	9	9	4	8	8	7	8	8
(Number of respondents)	(2988)	(1053)	(867)	(622)	(446)	(1365)	(541)	(322)	(760)
<u>Amount of Ceiling Insulation</u>									
100% insulated	71	68	68	85	77	65	81	75	80
Partially insulated	6	4	8	4	6	7	4	4	6
Not insulated	13	17	14	5	7	18	6	11	6
Don't know	10	11	11	5	10	10	9	11	9
(Number of respondents)	(2988)	(1053)	(867)	(622)	(446)	(1365)	(541)	(322)	(760)
<u>Amount of Roof Insulation</u>									
100% insulated	12	16	10	7	10	15	6	8	9
Partially insulated	3	2	4	2	5	4	1	3	4
Not insulated	69	65	72	81	67	66	79	75	70
Don't know	15	17	14	11	18	15	13	14	17
(Number of respondents)	(2923)	(1026)	(829)	(623)	(445)	(1310)	(535)	(319)	(759)



EXTERIOR WALL INSULATION
IN SINGLE FAMILY DWELLINGS

	Pac North- west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>First Floor</u>									
100% insulated	(52)	49	47	(68)	(69)	46	59	57	(68)
Partially insulated	10	11	10	8	7	10	8	8	9
Not insulated	20	21	24	9	11	25	13	19	10
Don't know	18	19	19	15	14	19	19	15	14
(Number of respondents)	(2966)	(1047)	(855)	(616)	(448)	(1351)	(535)	(319)	(761)
<u>Type of Insulation</u>									
Batt/blanket	80	79	80	85	81	79	83	86	82
Loose fill	14	14	16	11	13	14	13	12	13
Rigid foam or plastic	6	7	4	4	6	7	4	3	6
(Number of respondents)	(1764)	(569)	(439)	(446)	(310)	(683)	(343)	(196)	(542)
<u>Basement</u>									
100% insulated	20	25	10	19	18	20	13	21	21
Partially insulated	13	14	8	14	15	11	12	10	16
Not insulated	54	47	69	56	54	54	63	62	49
Don't know	13	14	13	11	14	15	12	6	13
(Number of respondents)	(1325)	(436)	(235)	(367)	(287)	(461)	(257)	(140)	(467)
<u>Attached Garage</u>									
100% insulated	30	28	30	32	38	28	34	41	32
Partially insulated	19	23	12	26	20	17	28	19	20
Not insulated	36	32	42	34	30	40	27	28	35
Don't know	15	16	16	9	12	16	11	12	12
(Number of respondents)	(1172)	(385)	(389)	(247)	(151)	(598)	(191)	(95)	(288)



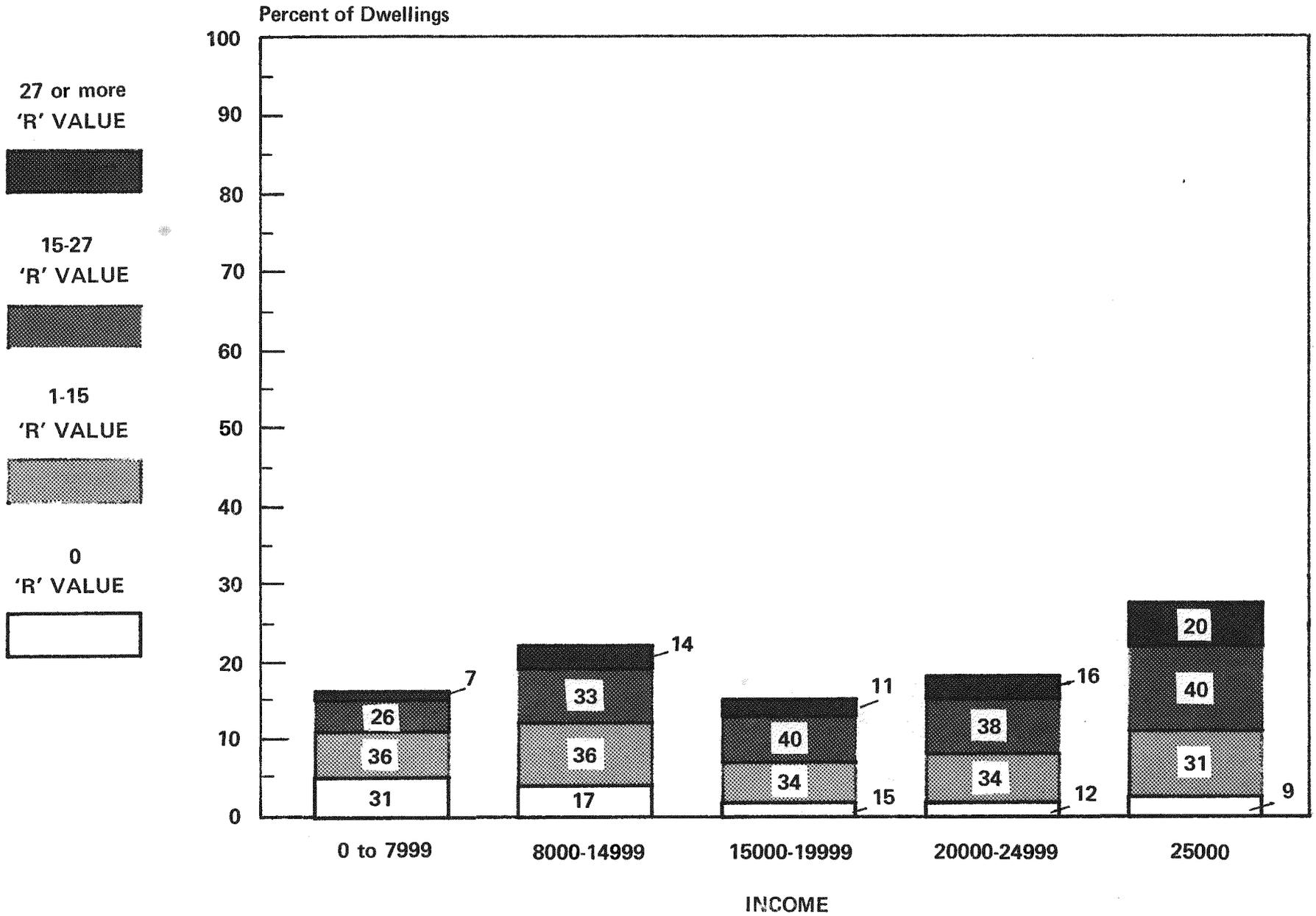
CEILING AND EXTERIOR WALL INSULATION
IN SINGLE FAMILY HOUSES
IN PACIFIC NORTHWEST

	Own Dwelling	Rent Dwelling	Year Dwelling Built			
			Before 1950	1950 to 1964	1965 to 1974	1975 to 1979
			%	%	%	%
<u>R Value of Ceiling Insulation</u>						
No insulation	12	20	(23)	8	5	(3)
R-1 to R-8	7	7	9	10	5	3
R-9 to R-14	22	15	23	24	19	17
R-15 to R-20	15	6	10	15	17	20
R-21 to R-26	18	7	(13)	16	20	(26)
R-27 to R-33	6	1	3	6	7	9
R-34 or greater	8	2	(5)	6	8	(12)
Don't know type and/or thickness of insulation	7	10	6	8	9	5
Unsure whether insulated	6	32	8	7	10	5
(Number of respondents)	(2,421)	(520)	(894)	(705)	(516)	(391)

	Type of Main Heating Fuel			
	Electricity	Natural Gas	Fuel Oil	Wood
	%	%	%	%
<u>Amount of Ceiling Insulation</u>				
100% insulated	(75)	71	65	64
Partially insulated	3	6	7	6
Not insulated	8	13	19	23
Don't know	13	10	10	7
(Number of respondents)	(1,031)	(900)	(588)	(362)
<u>Amount of First Floor Wall Insulation</u>				
100% insulated	(61)	53	38	48
Partially insulated	8	9	11	13
Not insulated	11	21	30	25
Don't know	21	16	21	13
(Number of respondents)	(1,013)	(899)	(586)	(363)

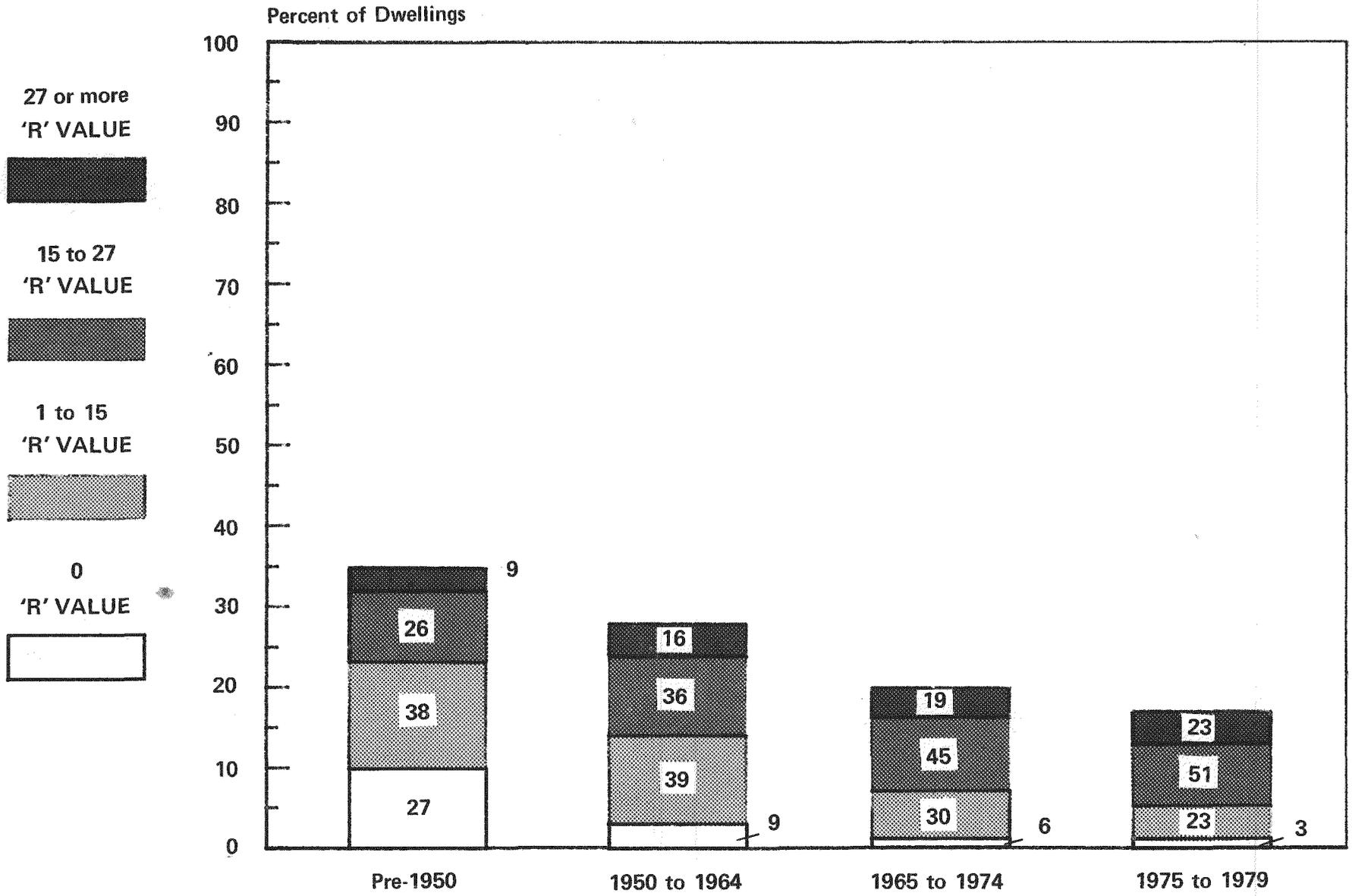
GRAPH 4
CEILING INSULATION BY INCOME

Single Family Dwellings in Pacific NW



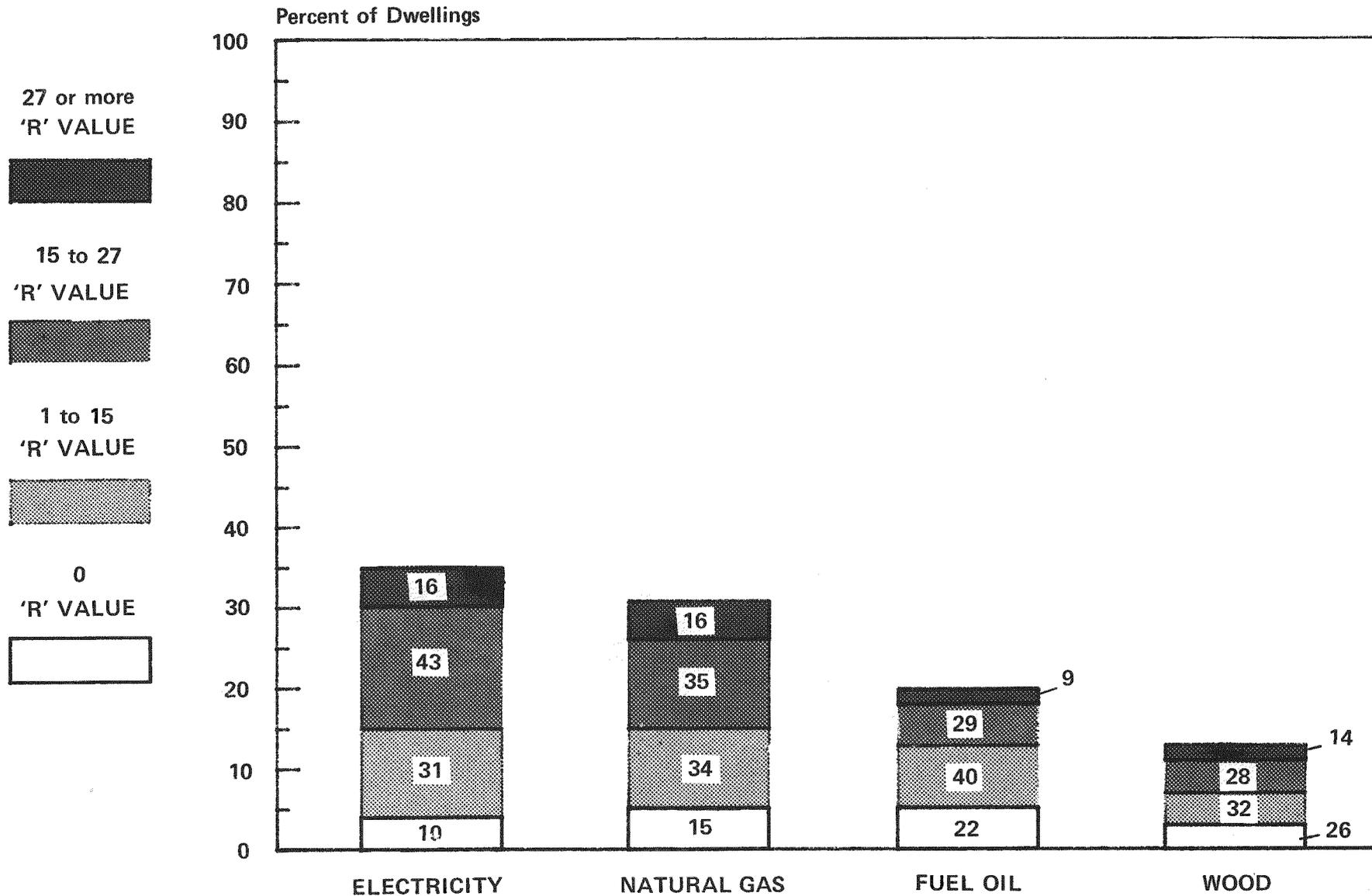
GRAPH 5
CEILING INSULATION BY DWELLING AGE

Single Family Dwellings Pacific NW

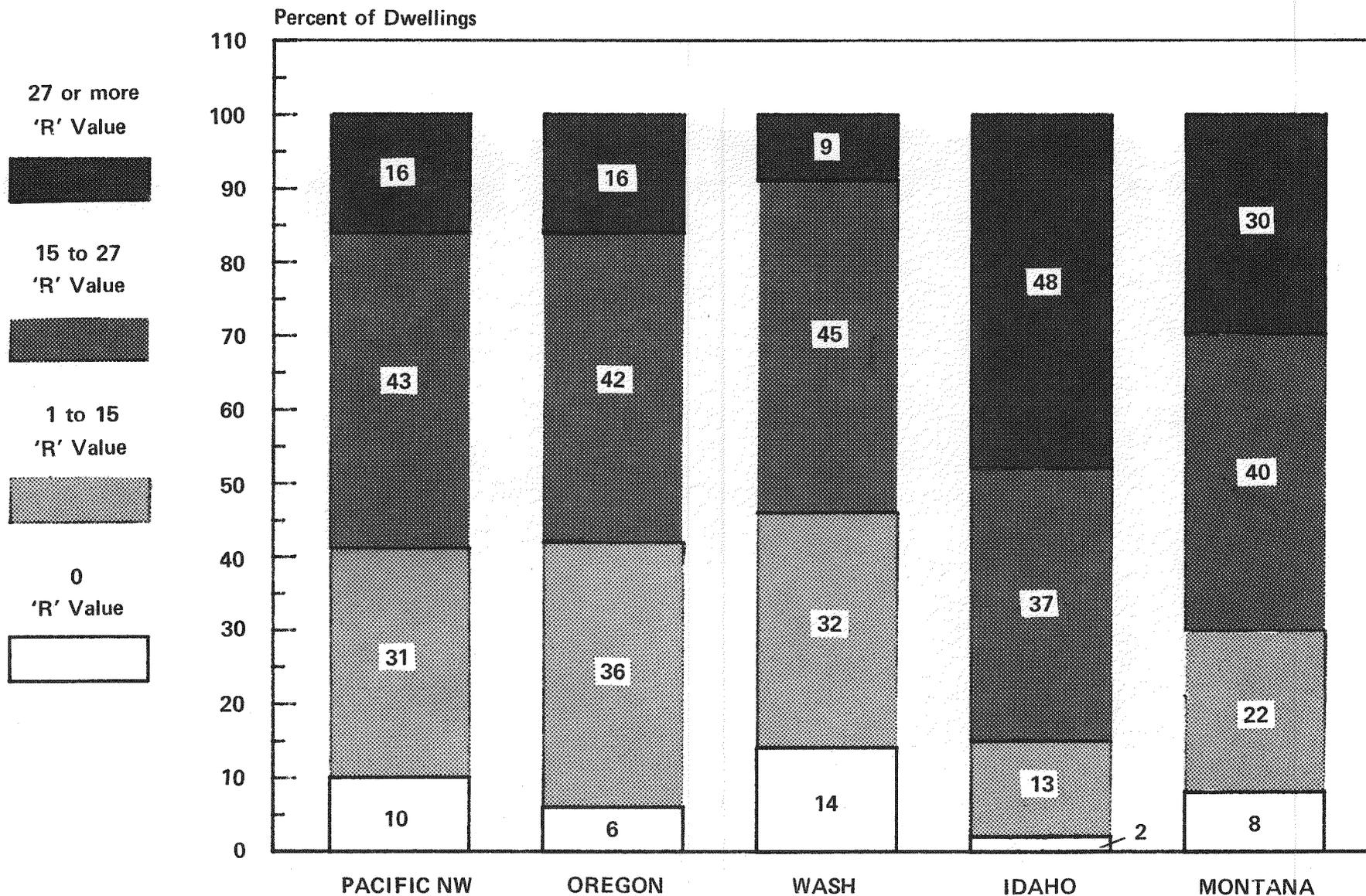


GRAPH 6
 CEILING INSULATION BY MAIN HEATING FUEL

Single Family Dwellings in Pacific NW



GRAPH 7
CEILING INSULATION OF ELECTRICALLY HEATED HOMES
Single Family Dwellings



INSULATION OF UNDERSIDE
OF GROUND FLOOR IN
SINGLE FAMILY DWELLINGS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Amount of Insulation</u>					
100% insulated	16	15	17	19	10
Partially insulated	6	5	5	5	8
Not insulated	67	66	68	64	72
Don't know	11	13	9	11	11
(Number of respondents)	(2,636)	(892)	(767)	(556)	(421)
<u>R Value of Insulation</u>					
No insulation	67	66	68	64	72
R-1 to R-8	1	-	1	1	1
R-9 to R-14	8	8	8	7	8
R-15 to R-20	1	1	1	1	-
R-21 to R-26	5	5	3	9	5
R-27 or greater	1	-	-	2	-
Don't know type and/or thickness of insulation	7	8	9	5	4
Unsure whether insulated	11	13	9	11	11
(Number of respondents)	(2,636)	(892)	(767)	(556)	(421)
<u>Whether Moisture Control Cover Is Under Dwelling (If Dwelling Not on Concrete Slab)</u>					
Yes	32	32	36	35	12
No	51	47	54	46	66
Don't know	17	21	11	19	23
(Number of respondents)	(1,892)	(619)	(616)	(348)	(229)

Exhibit 13

WEATHERIZATION OF
WINDOWS AND DOORS

	Pac North- west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>Windows/Sliding Glass Doors With Storm Windows or Double Glazing</u>									
All double glazed	36	26	32	57	76	(24)	40	50	(69)
Some double glazed	9	7	9	13	13	(7)	9	14	(13)
None double glazed	55	67	59	30	11	69	51	36	18
(Number of respondents)	(4026)	(1467)	(1162)	(827)	(570)	(1869)	(685)	(480)	(992)
<u>Windows/Doors with Plastic Covering</u>									
All	(6)	7	6	5	4	5	7	8	4
Some	15	12	17	18	16	14	17	15	17
None	79	81	77	77	81	81	76	76	78
(Number of respondents)	(3982)	(1451)	(1142)	(822)	(567)	(1852)	(682)	(477)	(971)
<u>Windows/Doors with Weatherstripping</u>									
All	(37)	32	40	52	37	35	46	37	43
Some	29	29	29	27	37	28	25	31	34
None	34	40	32	21	26	37	29	31	23
(Number of respondents)	(3874)	(1409)	(1117)	(798)	(550)	(1803)	(664)	(458)	(949)
<u>Windows/Doors Caulked</u>									
All	(45)	41	44	61	49	44	50	42	53
Some	14	14	13	11	19	13	13	14	16
None	41	45	44	28	32	43	37	44	30
(Number of respondents)	(3624)	(1321)	(1038)	(744)	(521)	(1683)	(624)	(422)	(895)
<u>Outside Doors, Not Inclu- ding Sliding Glass Doors</u>									
All/some have storm doors	(48)	42	41	(67)	(81)	37	57	59	(75)
None have storm doors	52	58	59	33	19	63	43	41	25
(Number of respondents)	(3941)	(1425)	(1146)	(819)	(551)	(1832)	(681)	(464)	(964)

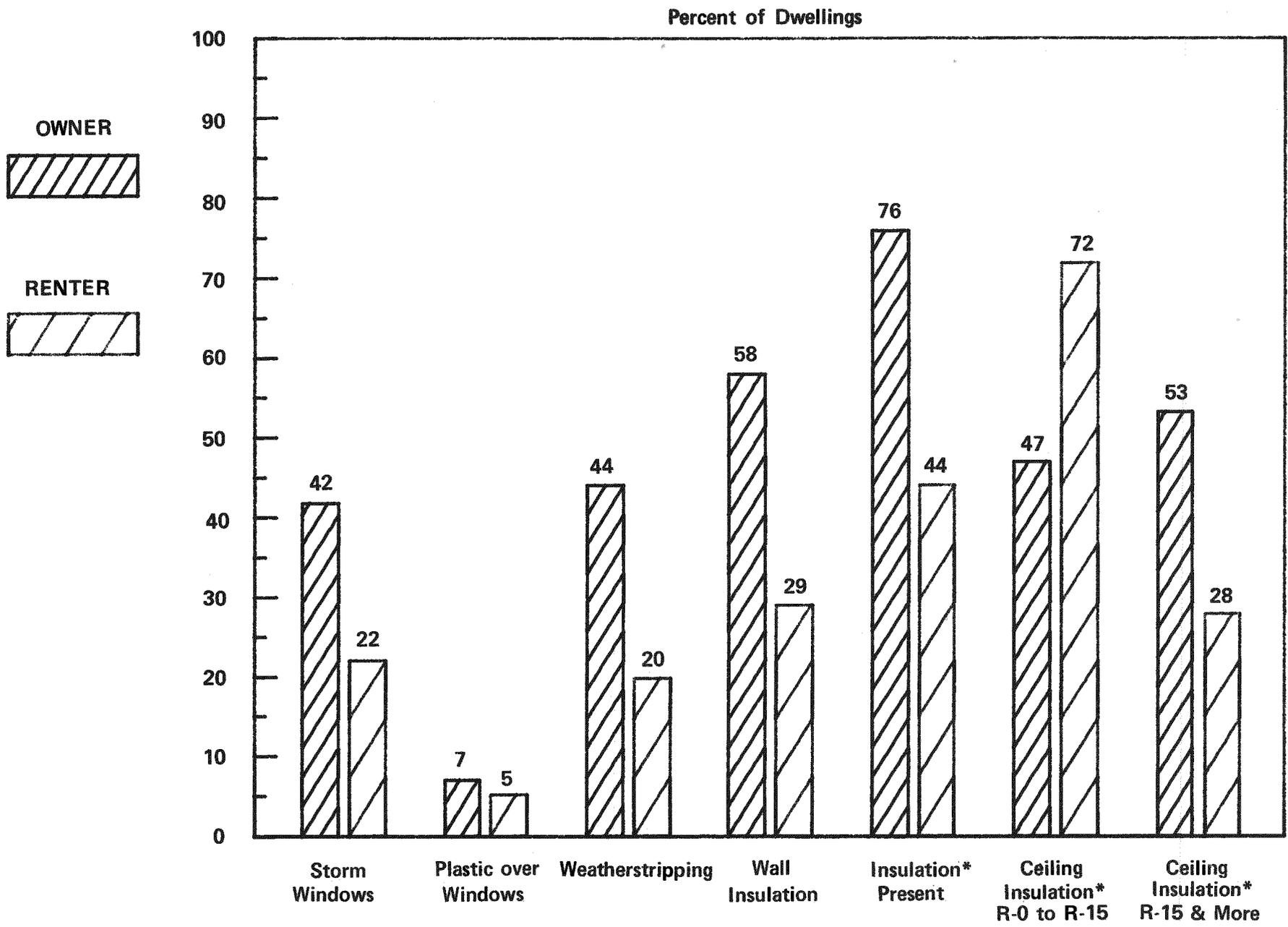
Exhibit 14

WEATHERIZATION OF
WINDOWS AND DOORS
IN THE PACIFIC NORTHWEST

	Own Dwelling %	Rent Dwelling %	Year Dwelling Built			
			Before 1950 %	1950 to 1964 %	1965 to 1974 %	1975 to 1979 %
			<u>Windows/Sliding Glass Doors With Storm Windows or Double Glazing</u>			
All double glazed	(42)	(22)	(28)	33	42	(66)
Some double glazed	11	5	13	9	8	4
None double glazed	47	73	59	58	50	29
(Number of respondents)	(2,808)	(1,188)	(996)	(788)	(806)	(661)
<u>Windows/Doors With Weatherstripping</u>						
All	(44)	(20)	(30)	41	44	(53)
Some	31	24	35	31	27	25
None	25	56	35	28	30	22
(Number of respondents)	(2,744)	(1,101)	(976)	(774)	(784)	(623)

	Dwelling Type			
	Sin.Fam. Detached %	Sin.Fam. Attached %	Multi-Family %	Mobile Home %
	<u>Windows/Doors Caulked</u>			
All	47	51	33	41
Some	16	13	10	10
None	37	36	57	49
(Number of respondents)	(2,368)	(362)	(587)	(304)

GRAPH 8
 WEATHERIZATION DIFFERENCES BETWEEN OWNER AND RENTER OCCUPIED DWELLINGS



* Single-family dwellings only

IV. HEATING AND AIR CONDITIONING SYSTEMS

Exhibits 15 through 23 describe the main and secondary heating equipment, winter temperature settings, usage of stoves and fireplaces for heating, and the air conditioning equipment.

Of all dwellings in the Pacific Northwest, 44 percent are heated electrically (see Exhibit 15). The proportion of electrically heated dwellings varies widely by state, dwelling type, age of the dwelling, whether the dwelling is owned or rented, and annual household electricity consumption level.

Discriminating Characteristic and Proportion of Main Heating Systems Using Electricity

<u>State</u>	
Washington	53%
Oregon	42
Idaho	40
Montana	14
<u>Dwelling Type</u>	
Single-family, detached	32%
Single-family, attached	53
Multi-family dwelling	76
Mobile home	63
<u>Year Dwelling Built</u>	
Before 1950	22%
1950 to 1964	29
1965 to 1974	53
1975 to 1979	79
<u>Dwelling Ownership</u>	
Own	38%
Rent	60
<u>Annual Electricity Consumption Level</u>	
Low quartile	10%
Below average quartile	18
Above average quartile	42
High quartile	79

Of the single-family detached dwellings, nearly as many are heated with natural gas (31 percent) as with electricity. However, the trend is to install electric heating systems in homes, since, of the homes built within the past five years, 79 and 12 percent, respectively, are heated with electricity and natural gas (see Exhibit 16).

To increase the efficiency of the main heating equipment, many customers could have their heating systems inspected and maintained on an annual basis. Of those heating with natural gas and fuel oil, 65 and 41 percent, respectively, do not have their equipment professionally checked and serviced annually.

Although only five percent of the customers have changed the fuel used in their main heating system during the past year, 60 percent of these customers are currently using wood as their source of main heating fuel. Of those who have changed the fuel used, 41 percent used fuel oil before the change, while virtually no customers are changing to fuel oil (see Exhibits 18 and 19).

The mean winter daytime temperature in dwellings in the Pacific Northwest is 66 degrees and nearly two-thirds of the customers maintain their temperature at 68 degrees or lower during the day (see Exhibit 20). It is interesting that the mean nighttime temperature is only 62 degrees and 87 percent of the customers maintain an indoor nighttime temperature of 68 degrees or lower. These temperature setting patterns are similar among the four states.

Forty-five percent of the customers in the Pacific Northwest use wood as their main or secondary source of heating fuel (see Exhibit 21). Of these customers, one-half burned two or more cords of wood during the past year and 60 percent of the customers cut the wood themselves.

Of all households in the Pacific Northwest, 2 and 31 percent, respectively, use fireplaces as their main or secondary heating system. Of these customers, 44 percent have a glass door for the main fireplace and 28 percent have a heat exchanger. Higher proportions of customers in climate zones 3 and 4, compared with customers in climate zones 1 and 2, have these two devices (see Exhibit 22).

Only seven percent of the customers in the Pacific Northwest have central electric air conditioning and an additional 12 percent have window or wall air conditioning units.

Exhibit 15

TYPE OF FUEL USED BY HEATING SYSTEMS

	Pac North-west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>Main Heating System</u>									
Electricity	44	53	42	40	14	47	54	42	23
Natural gas	26	22	22	28	60	24	21	19	47
Fuel oil	16	16	18	15	11	18	15	16	12
Wood	10	8	15	12	8	10	7	21	10
Bottled gas	2	1	1	2	7	1	1	2	5
Coal or coke	1	-	-	3	1	-	1	-	2
Other fuels	1	1	1	1	1	1	1	-	1
(Number of respondents)	(4010)	(1454)	(1163)	(824)	(569)	(1862)	(682)	(476)	(990)
<u>Secondary Heating System</u>									
No second system	47	49	42	46	51	45	48	45	49
Electricity	14	13	15	15	14	13	13	22	13
Natural gas	2	1	2	2	3	1	1	2	3
Fuel oil	1	1	1	2	2	1	1	2	2
Wood	36	36	39	33	29	39	35	28	32
Other fuels	1	-	1	1	1	1	1	-	1
(Number of respondents)	(4025)	(1466)	(1162)	(827)	(570)	(1869)	(685)	(480)	(991)
<u>Use* and Availability of Natural Gas for Heating</u>									
Gas is used for heating	28	23	24	30	63	25	22	21	50
Gas not used for heating:									
Gas is available	29	26	41	34	7	38	27	19	20
Gas is not available	25	27	16	25	29	21	24	36	24
Unsure of availability	19	24	19	11	1	17	28	24	6
(Number of respondents)	(3967)	(1445)	(1147)	(814)	(561)	(1844)	(674)	(472)	(977)
*Main or secondary heating system									

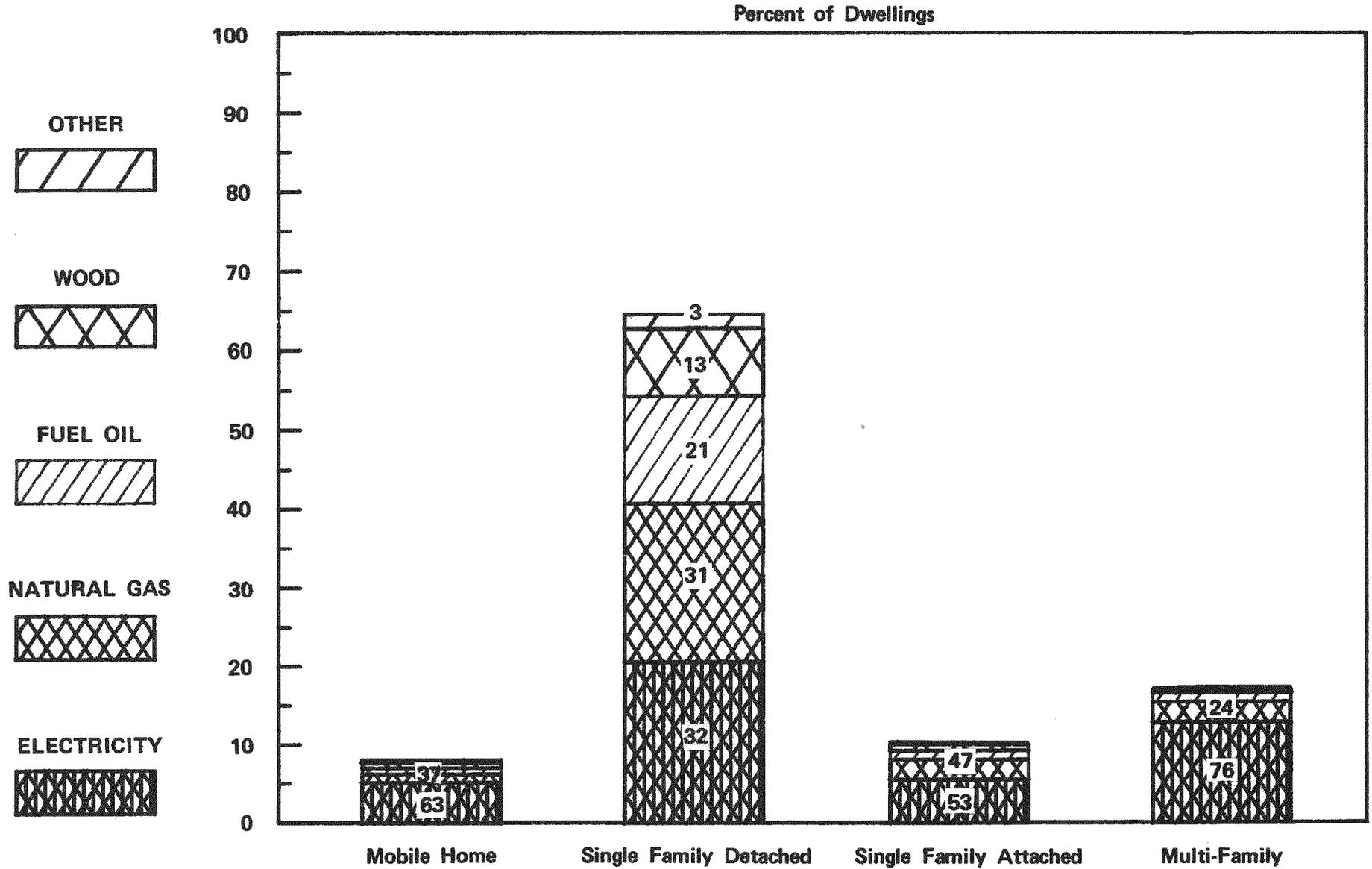
Exhibit 16

TYPE OF FUEL USED BY
MAIN HEATING SYSTEMS
IN PACIFIC NORTHWEST

Type of Fuel	Dwelling Type			
	Single Family Detached	Single Family Attached	Mult-Family	Mobile Home
	%	%	%	%
Electricity	32	53	76	63
Natural gas	31	25	15	14
Fuel oil	21	12	6	5
Wood	13	7	1	11
Bottled gas	1	1	-	6
Coal or coke	1	-	-	-
Other fuels	1	1	1	-
(Number of respondents)	(2586)	(404)	(683)	(333)

Type of Fuel	Year Dwelling Built			
	Before 1950	1950 to 1964	1965 to 1974	1975 to 1979
	%	%	%	%
Electricity	22	29	53	79
Natural gas	31	30	30	12
Fuel oil	29	28	5	1
Wood	14	9	11	8
Bottled gas	1	1	2	1
Coal or coke	1	1	-	-
Other fuels	1	1	-	-
(Number of respondents)	(990)	(783)	(806)	(661)

GRAPH 9
 MAIN HEATING FUEL BY DWELLING TYPE



GRAPH 10
TRENDS IN MAIN HEATING FUEL AMONG DWELLING AGE GROUPS

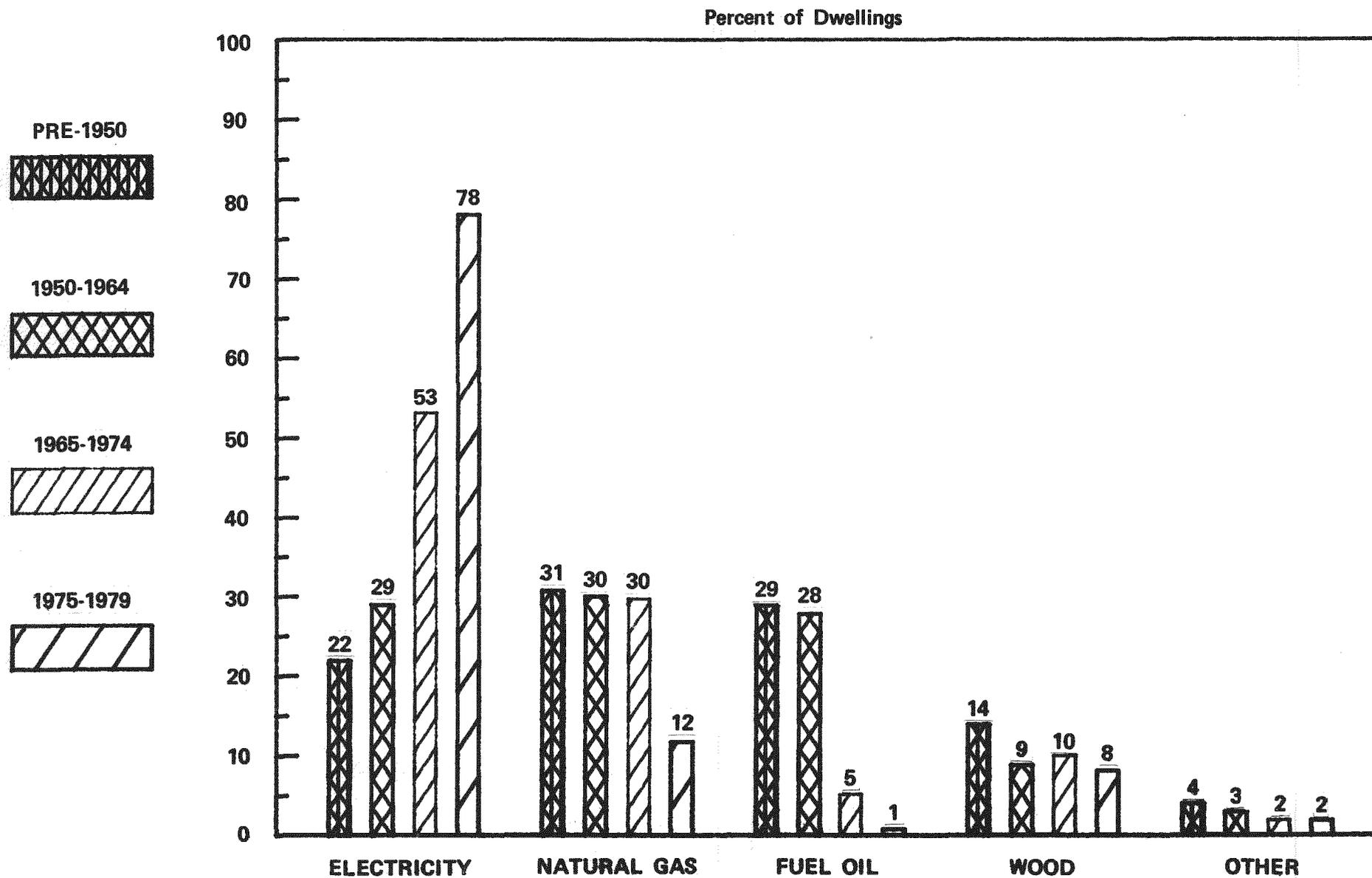


Exhibit 17

TYPE OF MAIN
HEATING SYSTEM

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
Central warm air furnace with ducts to individual rooms	45	44	38	55	59
Built-in electric units in wall, ceiling, or baseboard	28	33	31	21	9
Stove burning wood, coal or coke	9	6	13	9	7
Steam or hot water system with radiator	4	5	3	3	10
Room heater with flue or vent burning gas, oil or kerosene	4	3	6	4	6
Floor, wall, or pipeless furnace	3	3	3	2	5
Electric heat pump	2	2	2	3	1
Wood fireplace	2	2	2	3	1
Other heating systems	3	3	3	1	1
(Number of respondents)	(4,021)	(1,464)	(1,163)	(824)	(570)

PAST HISTORY OF
MAIN HEATING EQUIPMENT

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Age of Heating Equipment</u>					
Less than one year	9	10	9	9	5
1 to 4 years	27	26	28	32	27
5 to 9 years	20	20	20	20	20
10 to 14 years	15	16	13	18	15
15 to 19 years	10	11	11	8	10
20 years or more	18	17	19	13	24
(Number of respondents)	(3,368)	(1,183)	(972)	(719)	(494)
<u>Frequency of Maintenance</u>					
Annually	29	30	26	29	35
Seldom	20	20	19	23	22
Never	50	49	55	48	42
(Number of respondents)	(3,581)	(1,255)	(1,052)	(754)	(520)
<u>Whether Fuel Used Was Changed During Past Year</u>					
No	95	95	94	94	96
Yes	5	5	6	6	4
(Number of respondents)	(4,015)	(1,462)	(1,161)	(823)	(569)
<u>Fuel Used Before Change</u>					
Fuel oil	41	49	31	43	36
Electricity	28	22	31	23	44
Natural gas	19	15	27	15	12
Other fuels	13	13	11	19	8
(Number of respondents)	(203)	(67)	(64)	(47)	(25)

Exhibit 19

COMPARISON OF PRESENT AND FORMER TYPE
OF MAIN HEATING FUEL AMONG THOSE WHO CHANGED
FUEL DURING PAST YEAR

	All Fuels	Present Type of Heating Fuel			
		Wood	Elec- tricity	Natural Gas	Fuel Oil
	%	%	%	%	%
<u>Fuel Used Before Change</u>					
Fuel oil	41	21	12	9	
Electricity	28	23		1	2
Natural gas	19	13	6		-
Wood	3		3	1	1
Kerosene	3	2	1	-	-
Bottled gas	4	1	1	1	-
Other fuel	2	-	2	1	-
	100	60	24	12	4
(Number of respondents)	(193)	(116)	(46)	(23)	(8)

WINTER TEMPERATURE SETTINGS

	Pacific North-west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Daytime</u>					
Less than 65°	21	20	23	18	17
65° to 67°	22	22	22	22	23
68°	21	22	20	20	22
69° to 71°	24	23	23	27	27
More than 71°	8	8	9	11	8
Varies	3	4	2	1	3
Turned off	1	1	2	-	-
(Number of respondents)	(3,934)	(1,429)	(1,141)	(803)	(561)
Mean temperature	66°	66°	64°	67°	67°
<u>Between Sunset and 11 p.m.</u>					
Less than 65°	10	11	11	6	6
65° to 67°	21	22	20	18	21
68°	22	22	22	21	24
69° to 71°	32	31	31	37	33
More than 71°	12	11	13	17	12
Varies	3	3	2	1	3
(Number of respondents)	(3,935)	(1,425)	(1,145)	(806)	(559)
Mean temperature	68°	68°	68°	69°	69°
<u>Between 11 p.m. and 7 a.m.</u>					
Less than 60°	21	22	23	13	13
60° to 64°	31	30	31	31	29
65° to 67°	22	21	20	27	29
68°	10	10	8	12	14
More than 68°	10	10	8	16	11
Varies	4	5	4	1	3
Turned off	3	2	7	-	-
(Number of respondents)	(3,914)	(1,418)	(1,133)	(804)	(559)
Mean temperature	62°	62°	62°	64°	63°

Exhibit 21

USAGE OF WOOD

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Use in Heating Systems</u>					
Main fuel source:					
Wood burning stove	9	6	13	9	7
Fireplace	2	2	2	3	1
Secondary fuel source:					
Wood burning stove	11	8	12	17	15
Fireplace	31	32	33	25	22
Not used	55	56	46	55	63
(Number of respondents)	(4,010)	(1,454)	(1,163)	(824)	(569)
→ <u>Number of Cords Burned During Past Year</u>					
Less than one	26	29	22	24	30
One	23	27	21	13	17
Two	18	19	18	17	13
Three	11	9	11	15	8
Four	8	5	11	11	7
Five	6	4	7	9	9
Six or more	9	7	10	11	16
(Number of respondents)	(1,670)	(609)	(561)	(322)	(178)
→ <u>Means of Obtaining Wood</u>					
Self-cut on other land	44	35	49	64	55
Purchased from wood dealer	25	26	26	18	21
Given the wood	17	20	15	12	15
Self-cut on own land	16	20	13	11	14
Scrap or mill end	13	12	13	11	18
Other sources	4	4	5	2	6
(Number of respondents)	(1,761)	(627)	(589)	(354)	(191)

USAGE OF FIREPLACES
FOR HEATING

	Pac North-west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>Whether Used for Heating</u>									
Main heating system	2	2	2	3	1	2	1	1	2
Secondary heating system	31	32	33	25	22	34	29	22	23
Not used	69	67	67	74	78	65	71	78	77
(Number of respondents)	(4021)	(1464)	(1163)	(824)	(570)	(1867)	(684)	(479)	(991)
<u>Number of Fireplaces</u>									
One	81	77	87	89	72	82	83	82	78
Two	18	22	12	11	27	17	16	16	21
Three or four	1	1	1	-	2	1	1	2	1
(Number of respondents)	(1187)	(481)	(375)	(211)	(120)	(654)	(200)	(101)	(232)
<u>Whether Main Fireplace Has Glass Door</u>									
Yes	44	38	46	55	61	38	44	62	64
No	56	62	54	45	39	62	56	38	36
(Number of respondents)	(1187)	(481)	(375)	(211)	(120)	(654)	(200)	(101)	(232)
<u>Whether Main Fireplace Has Heat Exchanger</u>									
Yes	28	23	30	42	38	23	30	50	41
No	72	77	70	58	62	77	70	50	59
(Number of respondents)	(1172)	(477)	(366)	(211)	(118)	(644)	(200)	(101)	(227)

AIR CONDITIONING EQUIPMENT

	Pacific North-west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Type of Air Conditioning</u>					
None	81	84	81	67	79
One window/wall unit	11	9	11	18	13
Two window/wall units	1	1	2	1	2
Central Electric	7	6	6	13	5
Central gas	-	-	-	1	1
(Number of respondents)	(4,027)	(1,468)	(1,163)	(827)	(569)
<u>Proportion of Rooms That Are Air Conditioned</u>					
All rooms	45	52	35	51	32
61% to 99%	9	8	8	7	19
41% to 60%	13	14	13	14	11
21% to 40%	18	14	25	14	20
20% or less	15	13	19	13	18
(Number of respondents)	(811)	(228)	(210)	(263)	(110)
<u>Age of Equipment</u>					
Less than one year	9	13	7	9	2
1 to 4 years	41	42	36	40	50
5 to 9 years	31	27	36	32	32
10 to 14 years	16	15	18	16	14
15 years or older	3	3	4	4	3
(Number of respondents)	(747)	(199)	(190)	(247)	(111)

V. WATER HEATING

Eighty-one percent of the dwellings in the Pacific Northwest have electric water heaters. Depending on the state, between 38 and 88 percent of the water heaters are electric (see Exhibit 24). Three-fifths of the water heaters are less than ten years old.

Of the water heaters which are located in an unheated area, only 20 percent have an insulation blanket and 23 percent have hot water pipes which are insulated. In addition, only 19 percent of the showerheads in the Pacific Northwest are equipped with flow restrictors. Adding insulation blankets, insulating hot water pipes and installation of flow restrictors are inexpensive ways for individuals to conserve energy.

CHARACTERISTICS OF
WATER HEATER

	Pac North west	State				Climate Zone			
		WA	OR	ID	MT	1	2	3	4
	%	%	%	%	%	%	%	%	%
<u>Fuel Used</u>									
Electricity	(81)	88	84	84	(38)	86	89	91	(53)
Natural gas	16	10	12	14	56	12	8	7	41
Fuel oil	1	1	2	-	1	1	-	1	1
Bottled gas	1	-	1	1	5	-	1	1	3
Other fuels	1	1	1	1	-	1	1	-	1
(Number of respondents)	(3965)	(1430)	(1154)	(819)	(562)	(1845)	(674)	(463)	(983)
<u>Age of Water Heater</u>									
Less than one year	8	8	7	8	8	7	9	9	8
1 to 4 years	33	33	31	34	33	30	37	33	35
5 to 9 years	28	28	27	26	31	28	27	31	27
10 to 14 years	18	17	18	19	17	20	14	13	18
15 years or older	15	14	17	13	11	15	14	14	12
(Number of respondents)	(3178)	(1078)	(918)	(704)	(478)	(1449)	(527)	(374)	(828)

Exhibit 25

WATER HEATING SYSTEM INSULATION
AND USE OF FLOW RESTRICTORS
IN SHOWERHEADS

	Pacific North- west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Location of Water Heater</u>					
Heated area	55	55	52	62	58
Unheated area	45	45	48	38	42
(Number of respondents)	(3,822)	(1,358)	(1,122)	(798)	(544)
▶ <u>Whether Water Heater Has Extra Layer of Insulation</u>					
Yes	20	19	22	17	16
No	74	73	74	78	78
Don't know	6	7	4	5	6
(Number of respondents)	(1,669)	(611)	(522)	(306)	(230)
▶ <u>Whether Hot Water Pipes Are Insulated</u>					
Yes	23	22	27	21	16
No	65	65	62	70	75
Don't know	11	13	11	9	9
(Number of respondents)	(1,168)	(610)	(522)	(306)	(230)
<u>Proportion of Showerheads with Flow Restrictors</u>	19	21	15	14	24
(Number of respondents)	(3,168)	(1,147)	(961)	(638)	(422)



VI. PRESENCE AND USE OF MAJOR APPLIANCES

The data presented in this chapter show the proportion of customers which have a clothes washer, clothes dryer, electric dishwasher, oven/range or microwave oven (Exhibits 26, 27, 28, 29), refrigerator or freezer (Exhibit 30), well water pump, attic fan, medical equipment, pool filter pump, color television set, or black and white television set (Exhibit 32), and electrical business equipment on the household meter (Exhibit 33). In addition to whether these appliances are present, some exhibits show the type of fuel used by the appliances while others show the time of day the equipment is used. With respect to the presence of appliances, households that are high users of electricity (annual usage of more than 22,230 kilowatt hours) are compared with all other customers in the text to Chapter VII.

Of the customers that have a clothes washing machine, 36 percent wash one or more loads of clothes daily (see Exhibit 27). Nearly half of the clothes are washed between 7 a.m. and noon on weekdays and nearly half of the customers wash some of their loads in cold water. Similarly, 36 percent of the customers dry seven or more loads of clothes weekly and 41 percent dry their clothes between 7 a.m. and noon on weekdays (see Exhibit 28).

Two-thirds of the households' primary refrigerators are frostfree. Of the customers that have more than one refrigerator, 27 percent of the second refrigerators are frostfree.

Fifty-three percent of the customers in the Pacific Northwest have a separate food freezer, of which the majority are non-frostfree.

As shown in Exhibit 31, ownership of clothes washers, electric clothes dryers, and electric dishwashers is highly correlated to annual household income.

Ninety-three percent of the customers have no electrical business equipment operating on the household meter.

PRESENCE AND FUEL SOURCES OF
MAJOR HOUSEHOLD APPLIANCES

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Clothes Washer</u>					
Have	78	74	78	84	87
Do not have	22	26	22	16	13
(Number of respondents)	(4,028)	(1,468)	(1,163)	(827)	(570)
<u>Clothes Dryer</u>					
Have - electric	70	68	70	76	74
Have - natural gas	1	1	1	1	3
Do not have	28	31	28	23	23
(Number of respondents)	(4,030)	(1,468)	(1,165)	(827)	(570)
<u>Electric Dishwasher</u>					
Have	50	50	53	45	45
Do not have	50	50	47	55	55
(Number of respondents)	(4,029)	(1,468)	(1,165)	(826)	(570)
<u>Oven/Range</u>					
Have - electric	93	96	93	93	84
Have - gas	6	4	6	7	16
Do not have	-	-	1	-	-
(Number of respondents)	(4,011)	(1,457)	(1,163)	(822)	(569)
<u>Microwave Oven</u>					
Have	18	17	19	20	20
Do not have	82	83	81	80	80
(Number of respondents)	(4,011)	(1,457)	(1,163)	(822)	(569)

CLOTHES WASHING MACHINE

	Pacific North-west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Clothes Washer Ownership</u>					
Have	(78)	74	78	84	87
Do not have	22	26	22	16	13
(Number of respondents)	(4,028)	(1,468)	(1,163)	(827)	(570)
▶ <u>Number of Loads Washed Each Week</u>					
One or two	19	19	20	16	17
Three or four	26	25	28	22	25
Five or six	20	20	19	25	21
Seven to nine	14	14	13	15	12
Ten or more	22	22	19	23	25
(Number of respondents)	(3,122)	(1,064)	(897)	(678)	(483)
▶ <u>Time of Day Clothes Washing Is Done</u>					
Weekends	23	22	21	26	24
Weekdays:					
7 am to noon	43	42	44	41	42
noon to 5 pm	14	14	13	14	13
5 pm to 10 pm	18	18	19	17	19
10 pm to 7 am	2	3	3	2	1
(Number of respondents)	(3,028)	(1,039)	(865)	(656)	(468)
▶ <u>Whether Some Loads Done Entirely In Cold Water</u>					
No	54	54	50	54	61
Yes	(46)	46	50	46	39
(Number of respondents)	(3,076)	(1,048)	(885)	(669)	(474)

CLOTHES DRYER USAGE

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Number of Loads Dried Each Week</u>					
One or two	18	18	19	14	19
Three or four	26	25	28	24	26
Five or six	20	20	20	25	19
Seven to nine	14	14	14	14	13
Ten or more	22	23	19	23	23
 (Number of respondents)	 (2,832)	 (982)	 (814)	 (616)	 (420)
 <u>Time of Day Drying Clothes Is Done</u>					
Weekends	23	22	21	26	26
Weekdays:					
7 am to noon	41	42	42	41	41
noon to 5 pm	14	15	14	14	11
5 pm to 10 pm	19	18	20	17	21
10 pm to 7 am	2	3	3	2	1
 (Number of respondents)	 (2,789)	 (971)	 (799)	 (604)	 (415)



ELECTRIC DISHWASHER

	Pacific North-west	State			
		Wash.	Oregon	Idaho	Montana
	%	%	%	%	%
<u>Dishwasher Ownership</u>					
Have	50	50	53	45	45
Do not have	50	50	47	55	55
(Number of respondents)	(4,029)	(1,468)	(1,165)	(826)	(570)
→ <u>Number of Loads Washed Each Week</u>					
One or two	20	20	23	17	15
Three	18	19	17	14	17
Four to six	26	28	26	22	20
Seven	29	27	27	37	33
Eight or more	7	6	7	9	15
(Number of respondents)	(1,918)	(699)	(605)	(367)	(247)
→ <u>Time of Day Dishwashing Is Done</u>					
Weekends	18	20	15	17	19
Weekdays:					
7 am to noon	16	18	16	14	15
noon to 5 pm	8	6	9	8	4
5 pm to 10 pm	52	51	53	58	58
10 pm to 7 am	6	6	7	3	3
(Number of respondents)	(1,879)	(685)	(585)	(363)	(246)

REFRIGERATORS AND FREEZERS

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Number of Electric Refrigerators</u>					
One	85	85	85	84	89
Two	14	14	14	15	11
Three or more (none or gas <0.5%)	1	1	1	-	-
(Number of respondents)	(4,030)	(1,468)	(1,165)	(827)	(570)
<u>Whether (Primary) Refrigerator Is Frostfree</u>					
Frostfree	64	62	65	66	65
Not frostfree	36	38	35	34	35
(Number of respondents)	(4,010)	(1,456)	(1,160)	(826)	(568)
<u>Whether Second Refrigerator Is Frostfree</u>					
Frostfree	27	27	30	18	29
Not frostfree	73	73	70	82	71
(Number of respondents)	(561)	(202)	(169)	(127)	(63)
<u>Type of Separate Food Freezer</u>					
Have - frostfree	13	13	13	15	14
Have - not frostfree	40	36	41	48	51
Do not have	47	51	46	37	35
(Number of respondents)	(3,993)	(1,452)	(1,145)	(826)	(570)



Exhibit 31

ANNUAL HOUSEHOLD INCOME AND
PRESENCE OF APPLIANCES

	Annual Household Income				
	Under \$8,000	\$8,000- \$14,999	\$15,000- \$19,999	\$20,000- \$24,999	\$25,000- Or More
	%	%	%	%	%
<u>Proportion That Have</u>					
Electric water heater	84	84	80	83	78
Gas water heater	11	13	17	15	20
Clothes washer	(58)	73	81	90	94
Electric clothes dryer	(43)	66	75	87	90
Electric dishwasher	(19)	(36)	55	64	79
More than one refrigerator	9	9	12	17	20
Separate food freezer	40	47	56	61	66
Electric oven/range	90	92	94	94	97
Gas oven/range	9	8	6	6	3
Central electric air conditioning	3	6	5	7	12
(Number of respondents)	(709)	(836)	(542)	(503)	(744)

GRAPH 11
PRESENCE OF APPLIANCES BY INCOME

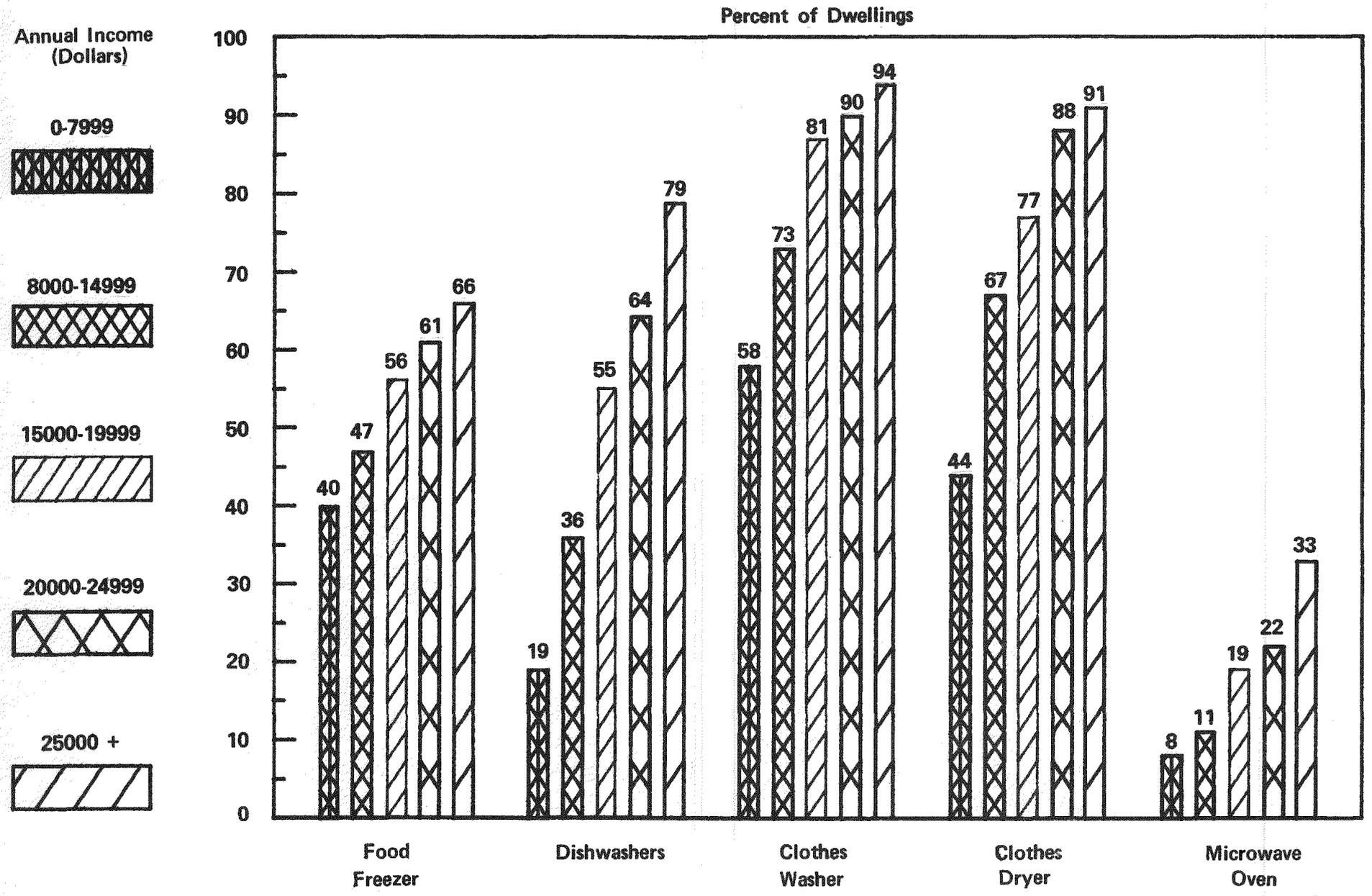


Exhibit 32

PRESENCE OF ELECTRICAL
HOUSEHOLD APPLIANCES

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Proportion of Dwellings With Each Appliance</u>					
Well water pump	10	7	10	19	17
Attic fan	5	3	5	8	6
Medical equipment	1	1	1	-	1
(Number of respondents)	(4,018)	(1,465)	(1,158)	(825)	(570)
<u>Proportion of Single Family Homes With</u>					
Pool filter pump	3	3	3	1	-
Pool sweep with electric pump	1	1	1	-	-
(Number of respondents)	(2,923)	(978)	(873)	(623)	(449)
<u>Color Television Sets</u>					
None	20	19	22	20	15
One	68	67	66	69	71
Two or more	13	14	12	11	14
(Number of respondents)	(4,027)	(1,467)	(1,164)	(827)	(569)
<u>Black & White Television Sets</u>					
None	56	58	52	56	60
One	39	38	42	39	36
Two or more	5	4	6	5	4
(Number of respondents)	(4,026)	(1,467)	(1,163)	(827)	(569)

ELECTRICAL BUSINESS EQUIPMENT
ON HOUSEHOLD METER

	Pacific North- west %	State			
		Wash. %	Oregon %	Idaho %	Montana %
<u>Have Any Business Equipment On Household Meter</u>					
No	93	95	92	86	89
Yes	7	5	8	14	11
(Number of respondents)	(3,998)	(1,450)	(1,156)	(825)	(567)
<u>Equipment *</u>					
Welding equipment	29	35	21	39	25
Power tools	29	26	29	41	15
Irrigation pumps	24	14	37	23	19
Office machines	22	22	19	12	46
Miscellaneous	29	33	21	39	24
(Number of respondents)	(334)	(69)	(95)	(111)	(59)
(Number of responses)	(460)	(92)	(121)	(171)	(76)

* Multiple answers

VII. CHARACTERISTICS OF CUSTOMERS WITH
VARIOUS CONSUMPTION PATTERNS

Presented in this chapter are tabulations of data obtained only from the customers who authorized their electric and/or natural gas utilities to provide E&L with consumption data and lived at their current residence for the entire period August 1978 through July 1979. This includes 2,578 respondents for electricity, or 64 percent of those surveyed, and 807 respondents for natural gas, or 71 percent of those customers with natural gas service. Each customer was assigned to one of four electricity consumption quartiles and one of four natural gas consumption quartiles (if the household was a gas customer). In the exhibit headings, quartiles are designated as low, below average, above average and high. The actual annual consumption ranges for each of these quartiles are shown below.

Annual Consumption Quartiles				
	Low	Below Average	Above Average	High
Electricity (kwh)	<8,420	8,420 to 13,500	13,506 to 22,220	>22,220
Natural gas (therms)	<833	833 to 1,162	1,163 to 1,584	>1,584

The main intent of this chapter is to show the distinguishing characteristics of the high users of electricity and natural gas. Comparisons of these characteristics, between the customers in the highest quartile of annual electricity usage and all other customers, are shown below.

	<u>High Users of Electricity</u>	<u>Other Customers</u>
Annual household income exceeding \$20,000	57%	35%
Head of household between the ages 35 and 54	47	27
Reside in multi-family dwelling	3	12
Building built between 1970 and 1979	43	23
Electric space heating	79	24
Electric water heating	98	73
Clothes washer	97	83
Electric clothes dryer	93	73
Electric dishwasher	70	47
Electric oven/range	99	92

It is interesting that the high users of electricity are similar to low users with respect to ceiling and wall insulation levels and weatherization factors, such as presence of storm windows, use of weatherstripping and caulking of windows and doors (see Exhibit 36).

Exhibit 34

DEMOGRAPHIC CHARACTERISTICS

	Annual Consumption Quartiles							
	Electricity				Natural Gas			
	Low	Below Avg	Above Avg	High	Low	Below Avg	Above Avg	High
%	%	%	%	%	%	%	%	
<u>Household Income in 1978</u>								
Less than \$5,000	19	10	9	3	16	6	6	3
\$5,000 to \$7,999	16	10	12	5	13	8	8	6
\$8,000 to \$11,999	18	17	10	10	17	21	11	6
\$12,000 to \$14,999	9	9	11	8	7	12	10	7
\$15,000 to \$19,999	16	15	16	16	18	16	19	15
\$20,000 to \$24,999	(9)	17	16	(21)	(12)	13	15	(16)
\$25,000 to \$34,999	(10)	14	15	(21)	(13)	19	21	(21)
\$35,000 or more	(5)	8	11	(15)	(3)	5	11	(28)
(Number of respondents)	(491)	(549)	(554)	(552)	(159)	(174)	(150)	(134)
<u>Age of Head of Household</u>								
Under 25	4	4	4	3	5	1	3	1
25 to 34	18	17	20	23	16	23	20	12
35 to 44	(10)	15	19	(28)	(15)	22	23	(29)
45 to 54	(9)	13	15	(19)	(10)	16	19	(20)
55 to 64	19	22	18	12	20	16	17	20
65 or over	(41)	28	24	(15)	(33)	22	19	(19)
(Number of respondents)	(564)	(634)	(653)	(664)	(185)	(191)	(185)	(169)

DWELLING CHARACTERISTICS

	Annual Consumption Quartiles							
	Electricity				Natural Gas			
	Low	Below Avg	Above Avg	High	Low	Below Avg	Above Avg	High
%	%	%	%	%	%	%	%	
<u>Type of Dwelling</u>								
Single family, detached	69	75	69	73	81	81	82	79
Single family, attached	7	9	13	14	7	12	11	14
Mobile home	6	4	11	11	3	4	4	4
Multi-family, 2 to 4 units	6	4	4	2	7	2	3	3
Multi-family, 5 or more units	12	8	3	1	1	1	-	1
(Number of respondents)	(579)	(640)	(658)	(667)	(188)	(193)	(186)	(170)
<u>Payment for Dwelling</u>								
Own	74	81	83	91	76	90	89	92
Rent	26	19	16	8	24	9	11	8
Occupied without payment	1	-	1	-	-	-	-	-
(Number of respondents)	(579)	(640)	(658)	(666)	(188)	(193)	(186)	(170)
<u>Year Building Built</u>								
Before 1950	47	39	32	20	53	35	26	30
1950 to 1959	19	22	18	14	16	13	18	17
1960 to 1964	8	8	11	9	5	11	15	12
1965 to 1969	7	10	11	14	17	13	12	16
1970 to 1974	11	13	14	16	6	19	17	18
1975 to 1979	8	8	14	27	4	9	12	7
(Number of respondents)	(494)	(538)	(574)	(614)	(152)	(171)	(170)	(158)

Exhibit 36

INSULATION AND WEATHERIZATION

	Annual Consumption Quartiles							
	Electricity				Natural Gas			
	Low	Below Avg	Above Avg	High	Low	Below Avg	Above Avg	High
<u>Amount of Ceiling Insulation</u>	%	%	%	%	%	%	%	%
100% insulated	71	70	73	83	67	85	75	72
Partially insulated	7	6	7	3	8	4	6	6
Not insulated	14	17	12	7	16	7	7	14
Don't know	8	6	8	6	8	5	11	8
(Number of respondents)	(437)	(533)	(530)	(573)	(167)	(181)	(172)	(156)
<u>Amount of First Floor Wall Insulation</u>								
100% insulated	50	45	55	63	41	62	62	67
Partially insulated	8	12	12	9	14	8	8	9
Not insulated	29	25	18	11	27	19	19	13
Don't know	13	18	15	17	18	11	12	10
(Number of respondents)	(435)	(531)	(529)	(566)	(166)	(181)	(170)	(157)
<u>Windows/Sliding Glass Doors With Storm Windows or Double Glazing</u>								
All double glazed	39	33	35	43	27	38	43	53
Some double glazed	10	11	12	9	12	11	12	7
None double glazed	51	56	53	48	61	51	45	39
(Number of respondents)	(578)	(639)	(657)	(667)	(187)	(193)	(186)	(170)
<u>Windows/Doors With Weatherstripping</u>								
All	33	41	37	44	34	50	44	40
Some	34	31	33	28	32	33	33	36
None	33	28	30	28	33	17	23	24
(Number of respondents)	(564)	(623)	(639)	(649)	(184)	(191)	(179)	(167)
<u>Windows/Doors Caulked</u>								
All	41	48	47	53	39	58	56	55
Some	15	13	15	12	19	13	15	13
None	44	38	38	35	42	29	29	32
(Number of respondents)	(526)	(583)	(601)	(623)	(172)	(172)	(166)	(162)

Exhibit 37

FUEL USED IN MAIN
HEATING SYSTEM
RELATED TO ANNUAL CONSUMPTION

	Annual Consumption Quartiles							
	Electricity				Natural Gas			
	Low	Below Avg	Above Avg	High	Low	Below Avg	Above Avg	High
%	%	%	%	%	%	%	%	
<u>Fuel Used</u>								
Electricity	(10)	18	42	(79)	4	2	2	2
Natural gas	59	38	21	3	(84)	90	95	(96)
Fuel oil	16	30	20	6	1	-	-	-
Wood	9	11	14	11	9	8	3	1
Other fuels	5	3	2	1	2	1	-	1
(Number of respondents)	(566)	(640)	(658)	(667)	(188)	(193)	(186)	(170)
<u>Type of Main Heating System</u>								
Central warm air furnace with ducts to rooms	55	57	50	36	(53)	73	85	(80)
Built-in electric units in wall, ceiling or baseboard	(7)	13	25	(44)	3	1	1	1
Stove burning wood, coal or coke	7	10	13	9	7	6	3	-
Steam or hot water system with radiator	11	5	2	1	(1)	3	6	(15)
Electric heat pump	(-)	-	2	(4)	-	1	-	1
Other heating systems	20	15	9	5	36	17	5	4
(Number of respondents)	(579)	(638)	(657)	(667)	(188)	(193)	(186)	(170)

Exhibit 38

OWNERSHIP OF MAJOR
HOUSEHOLD APPLIANCES

	Annual Consumption Quartiles							
	Electricity				Natural Gas			
	Low	Below Avg	Above Avg	High	Low	Below Avg	Above Avg	High
%	%	%	%	%	%	%	%	
<u>Proportion That Have</u>								
Electric water heater	46	79	91	98	70	50	29	17
Gas water heater	48	18	7	1	29	50	70	82
Clothes washer	74	84	89	97	86	94	96	97
Electric clothes dryer	59	76	83	93	71	86	91	87
Electric dishwasher	30	53	55	70	34	51	64	66
More than one refrigerator	10	16	18	20	15	15	14	19
Separate food freezer	50	63	65	74	58	65	63	69
Electric oven/range	83	96	97	99	84	88	83	87
Gas oven/range	17	4	3	1	16	12	17	13
Central electric air conditioning	4	6	7	12	5	8	9	10
(Number of respondents)	(579)	(639)	(658)	(667)	(188)	(193)	(186)	(170)



APPENDIX



COMMENTS ABOUT SAMPLING ERRORS

The results of any survey which involves "sampling" (rather than interviewing or observing all members or units in the population being studied) contain sampling errors.

When the sample is selected using "probability" methods (each unit in the population has the same chance of being selected), the sampling error can be estimated mathematically.

Sampling error is the difference between a sample statistic (usually a percentage) and the "true value" in a population that occurs because a sample of the population is taken rather than a census.

The absolute size of the sampling error for percentages (proportions) is dependent primarily on three factors:

The sample size

The larger the sample size, the smaller the sampling error.

The level of confidence

Decision makers require different "levels of confidence" about the results of surveys. Some, for example, want to be sure the sampling error is as stated "95 out of 100 times". Others settle for less . . . say being right 68 of 100 times.

For a given sample size, the size of the sampling error increases as the level of confidence desired increases.

Size of the percentage or proportion for which the error is being estimated.

Large and small proportions (for example, 90 percent or 10 percent) have smaller sampling errors than proportions which are closer to 50 percent. This is due to the fact that large and small proportions have smaller variances than proportions around 50 percent; thus, there is less chance for error in estimating them at a given level of confidence.

The table below shows the sampling error for single percentages (any observed finding). The chances are 95 in 100 that the "true value" in the population is the reported percentage plus or minus the number of percentage points shown.

<u>Observed Findings</u>					<u>Sample Size</u>
<u>10%</u>	<u>20%</u>	<u>30%</u>	<u>40%</u>	<u>50%</u>	
2%	2%	3%	3%	3%	2,000
2%	3%	3%	3%	3%	1,500
2%	3%	4%	4%	4%	1,000
2%	3%	4%	4%	4%	900
3%	3%	4%	4%	4%	800
3%	4%	4%	5%	5%	700
3%	4%	5%	5%	5%	600
3%	4%	5%	5%	5%	500
3%	5%	5%	6%	6%	450
4%	5%	6%	6%	6%	400
4%	5%	6%	7%	7%	350
4%	6%	6%	7%	7%	300
5%	6%	7%	8%	8%	250
5%	7%	8%	8%	8%	200
6%	8%	9%	10%	10%	150
7%	10%	11%	12%	12%	100

Here's an example of how to read the above table. Let's assume that 22 percent of the customers said "yes" to a certain question. We want to be 95 percent confident that we know the percentage range in which the "true value" of the "yes" lies.

If there were about 200 residential customers responding to the question, look under that sample size and find that with an observed proportion of 20 percent, the sampling error is ± 7 percent. Or, the true value is in the range of 15 percent to 29 percent ($22\% \pm 7\%$).

Another type of sampling error is present when we wish to know whether there is a "statistically significant" difference (a real difference) between two samples.

In that case, use the table below. There is a statistically significant difference between two percentages if the difference is equal to or more than the percentages in the table.

Observed Findings					Size of Samples Compared
50%	40%	30%	20%	10%	
60%	70%	80%	90%		
4%	4%	4%	3%	2%	2,000 & 2,000
5%	5%	4%	4%	3%	1,000
6%	6%	6%	5%	4%	500
13%	12%	11%	10%	7%	100
4%	4%	4%	4%	3%	1,500 & 1,500
5%	5%	5%	4%	3%	750
6%	6%	6%	5%	4%	500
13%	12%	12%	10%	8%	100
6%	5%	5%	4%	4%	1,000 & 1,000
6%	6%	5%	5%	4%	750
7%	7%	6%	5%	4%	500
13%	13%	12%	10%	8%	100
6%	6%	6%	5%	4%	750 & 750
7%	7%	6%	6%	4%	500
13%	13%	12%	10%	8%	100
8%	8%	7%	6%	5%	500 & 500
14%	14%	13%	11%	8%	100
11%	11%	10%	8%	7%	250 & 250
14%	14%	13%	12%	9%	100
17%	17%	16%	14%	10%	100 & 100



LIST OF EXHIBITS

The title, exhibit number and page number of all the exhibits included in each chapter in the Findings are listed below.

<u>Title</u>	<u>Exhibit Number</u>	<u>Page Number</u>
<u>I. Demographics and Family Characteristics</u>		
Demographics/Family Characteristics	1	12
Demographics/Family Characteristics	2	13
Year Moved Into Dwelling and Whether Occupied Year-Round	3	14
Respondents' Characteristics	4	15
<u>II. Dwelling Characteristics</u>		
Dwelling Characteristics	5	18
Square Footage of Living Space	6	19
Relationship Between Type of Dwelling and Square Footage of Living Space in Pacific Northwest	7	20
Structural Characteristics of Dwelling	8	23
<u>III. Weatherization</u>		
Ceiling and Underside of Roof Insulation in Single Family Houses	9	28
Exterior Wall Insulation in Single Family Dwellings	10	29
Ceiling and Exterior Wall Insulation in Single Family Houses in Pacific Northwest	11	30
Insulation of Underside of Ground Floor in Single Family Dwellings	12	35

	<u>Exhibit Number</u>	<u>Page Number</u>
Weatherization of Windows and Doors	13	36
Weatherization of Windows and Doors in the Pacific Northwest	14	37
<u>IV. Heating and Air Conditioning Systems</u>		
Type of Fuel Used by Heating Systems	15	41
Type of Fuel Used by Main Heating Systems in Pacific Northwest	16	42
Type of Main Heating System	17	45
Past History of Main Heating Equipment	18	46
Comparison of Present and Former Type of Main Heating Fuel Among Those Who Changed Fuel During Past Year	19	47
Winter Temperature Settings	20	48
Usage of Wood	21	49
Usage of Fireplace for Heating	22	50
Air Conditioning Equipment	23	51
<u>V. Water Heating</u>		
Characteristics of Water Heater	24	54
Water Heating System Insulation and Use of Flow Restrictors in Showerheads	25	55
<u>VI. Presence and Use of Major Appliances</u>		
Presence and Fuel Sources of Major Household Appliances	26	58
Clothes Washing Machine	27	59
Clothes Dryer Usage	28	60

	<u>Exhibit Number</u>	<u>Page Number</u>
Electric Dishwasher	29	61
Refrigerators and Freezers	30	62
Annual Household Income and Presence of Appliances	31	63
Presence of Electrical Household Appliances	32	65
Electrical Business Equipment on Household Meter	33	66
<u>VII. Characteristics of Customers with Various Consumption Patterns</u>		
Demographic Characteristics	34	69
Dwelling Characteristics	35	70
Insulation and Weatherization	36	71
Fuel Used in Main Heating System Related to Annual Consumption	37	72
Ownership of Major Household Appliances	38	73

LIST OF GRAPHS

The title, graph number and page number of all the graphs included in chapters II, III, IV and VI of The Findings are listed below.

<u>Title</u>	<u>Graph Number</u>	<u>Page Number</u>
<u>II. Dwelling Characteristics</u>		
Living Space By Dwelling Type	1	21
Dwelling Floor Space by Income	2	22
<u>III. Weatherization</u>		
Heating Plus Cooling Degree Days	3	27
Ceiling Insulation by Income	4	31
Ceiling Insulation by Dwelling Age	5	32
Ceiling Insulation by Main Heating Fuel	6	33
Ceiling Insulation of Electrically Heated Homes	7	34
Weatherization Differences Between Owner and Renter Occupied Dwellings	8	38
<u>IV. Heating and Air Conditioning Systems</u>		
Main Heating Fuel by Dwelling Type	9	43
Trends in Main Heating Fuel Among Dwelling Age Groups	10	44
<u>VI. Presence and Use of Major Appliances</u>		
Presence of Appliances by Income	11	64