DOE/EIA-0321(90)
Distribution Category UC-950

Household Energy Consumption and Expenditures 1990

February 1993

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Office of Energy Markets and End Use
U.S. Department of Energy
Washington, DC 20585

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The EEUISD would also like to acknowledge Jason Freelin and Christy Hall for their contributions to the overall quality of the data, especially their editing and reviewing of the tables. Also, we would like to acknowledge David Cotta for the analysis concerning changes in wood consumption.

Support was received from the U.S. Department of Health and Human Services, Administration for Children and Families (ACF), and the Office of Minority Economic Impact in the U.S. Department of Energy for special components of the survey. See Appendix A for a description of the information collected for the ACF.

As part of EIA's mission to provide meaningful data, the consumption surveys have ongoing user needs efforts to ascertain the requirements of its users. If you have any suggestions to make the data in this report more useful to your needs, please contact Dr. Wendel Thompson, RECS Manager, at 202-586-1119 or at the address below.

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Executive Summary

This report, *Household Energy Consumption and Expenditures 1990*, is based upon data from the 1990 Residential Energy Consumption Survey (RECS). Focusing on energy end-use consumption and expenditures of households, the 1990 RECS is the eighth in a series conducted since 1978 by the Energy Information Administration (EIA). Over 5,000 households were surveyed, providing information on their housing units, housing characteristics, energy consumption and expenditures, stock of energy-consuming appliances, and energy-related behavior. The information provided represents the characteristics and energy consumption of 94 million households nationwide.

Key Findings

- **New Homes.** Analysis of the data on homes built in 1988-1990 indicate that these newer homes consume significantly more energy per household than homes built in 1985-1987. Although the newer homes are slightly larger than the older homes, the main reason their energy consumption is higher is the increased penetration of natural gas. Homes heated with natural gas consume more energy per square foot than those heated with electricity.

- **Demand-Side Management (DSM).** The 1990 RECS is the first RECS survey to include household participation in utility-sponsored DSM programs (such as rebates for efficient appliances, load-control devices for appliances, and energy audits). Since only 7 percent of eligible households participated in 1990, the potential exists for more significant energy savings with a broader base of participants. The survey identified 26 million additional households for which existing DSM programs could provide substantial energy savings.

- **New Appliances.** Federal standards have increased the efficiency of new appliances, but the slow turnover of the appliance stock limits the overall average energy savings. If everyone could be persuaded to replace appliances 10 years and older with new 1990 appliances, nearly 700 trillion British thermal units (Btu) per year could be saved. This represents 7.3 percent of total residential end-use consumption per year, nearly half of it in the form of natural gas.

Household Energy Consumption and Expenditures

How much energy did households use, and what did it cost in 1990?

- U.S. households consumed 9.2 quadrillion Btu of the major energy sources: natural gas, electricity, fuel oil, liquefied petroleum gas (LPG), and kerosene.

- Of the major energy sources, natural gas accounted for 53 percent of the consumption; electricity, 33 percent; fuel oil, 11 percent; LPG, 3 percent; and kerosene, 1 percent.

- The average household[1] use of natural gas was 84.2 million Btu; electricity, 32.3 million Btu; and fuel oil, 83.4 million Btu.

- Expenditures for the major energy sources amounted to $110.2 billion, or $1,172 per household.

[1]Averages of energy use or expenditure are always averages of those who used that energy source, rather than simple averages of all households. This excludes those households who do not use the source.

- Of the expenditures for major energy sources, 65 percent were for electricity; 25 percent for natural gas; and 10 percent for fuel oil, LPG, and kerosene combined.

- Expenditures for electricity averaged $761; natural gas, $472; fuel oil, $652; LPG, $381; and kerosene, $116. Households paid an average of $12.00 per million Btu for these energy sources.

- If wood consumption were included, the estimates of total household energy consumption would be 6 percent higher.

- Warmer-than-normal weather in 1990 caused households to use an estimated 0.75 quadrillion Btu less than they otherwise would. Nationwide, the winter of 1990 was 14 percent warmer than normal, and the summer 11 percent hotter. Thus, households saved about $46 each in 1990, due to weather patterns in a year where a major concern was the Desert Storm crisis.

How has energy consumption changed?

- Energy consumption in the residential sector is affected by the increasing number of households, their improving economic circumstances, improving construction techniques, the use and efficiency of new appliances, and the price of energy.

- In 1990, there were more households and higher disposable personal incomes than in 1987, when the last survey was conducted; but nominal energy prices were higher.[2]

- Both energy consumption and expenditures per household declined slightly since 1987.[3]

- Wood consumption declined by 32 percent since 1987, based upon RECS personal interviews. This is attributed to improved efficiency of wood-burning stoves and tighter local emission regulations, particularly in colder rural areas where wood is most popular.

Where does the energy go?

- Space heating uses 52 percent of total household energy consumption; air conditioning, 5 percent; water heating, 18 percent; refrigerators, 5 percent; and all other appliances, 19 percent.

- Space heating accounts for 31 percent of household energy expenditures; air conditioning, 10 percent; water heating, 14 percent; refrigerators, 11 percent; and appliances, 34 percent.

- Electricity-intensive uses dominate household energy expenditures.

- The patterns of use for electricity and natural gas households are different, reflecting both the versatility of the source and the regional and climatic characteristics of the household.

[2]Since the last survey, which was conducted in 1987, the number of households has risen from 90.5 million to 94.0 million; disposable personal income (in current dollars) has risen from $13,500 per capita to $16,200, a nominal increase of 20 percent compared with an inflation rate of 11.5 percent; and energy prices have risen by 12 percent, about the rate of inflation.

[3]In 1987, energy consumption per household was 100.8 million Btu and energy expenditures per household (excluding gasoline) were $1,210 in comparable 1990 dollars.

Household Energy Use

Is household energy usage changing?

- For average households, energy consumption per square foot of heated floorspace is 62.5 thousand Btu per square foot, 18 percent lower than in 1980. This energy-intensity measure continued to show a decline even after correcting for the milder winter weather that occurred in every survey year since 1980.

- Although household energy efficiency is difficult to define or measure, it appears to have improved based on indicators of the intensity of energy usage in the average household.

- For natural gas-heated households, the decline in the average weather-corrected intensity of consumption was much more significant.

- The efficiency improvements inferred from the above findings are offset by increased penetration of natural gas in new homes (with slightly higher heating intensities), slightly larger new homes, and increased penetration of air conditioning.

- On average, the intensity of use for natural gas is significantly higher than for electricity--almost three times more for both space heating and water heating. This is due to differences in efficiency of the housing units, conversion losses, region, climate, and energy costs.

Does the age of appliances matter?

- Major household equipment is steadily improving in efficiency due to progressively improving federal standards; however, the average stock efficiency of residential appliances is still very low relative to the efficiencies of new appliances.

- Compared with their efficiency in 1972, new 1990 freezers improved by 95 percent; central air conditioners and heat pumps, 40-45 percent; and conventional gas furnaces, 21 percent.

- The average stock of freezers in 1990, compared with the 1972 new models, improved by only 15 percent; central air conditioners and heat pumps, only 15-21 percent; and conventional gas furnaces, only 6 percent.

- The potential energy savings from replacing the oldest appliance stock by new units are significant, from 7 trillion Btu for heat pumps to 208 trillion Btu for refrigerators and as much as 281 trillion Btu per year for natural gas furnaces. The largest potential efficiency gain would be 59 percent for freezers and 50 percent for refrigerators.

- The estimated savings are at best illustrative, as underlying assumptions affect the outcome. The results presented above assume that older appliances are used in much the same way as new ones; that older appliances work as efficiently as when they were new; that the average size of each appliance has not changed since 1972; and that replaced units are scrapped.

Demand-Side Management

Who participates?

- Only 7 percent of eligible households participated in at least one DSM program (4.6 million households). Rebate programs were used by 1.2 million households; load-control devices, 1.6 million; audits, 1.1 million; and other conservation programs, 1.3 million.[4]

- Participation in DSM programs is voluntary, and this substantially affects the energy savings.

- 872 of the 3,250 electric utilities responding to EIA's electric utility survey (Form EIA-861) ran DSM programs in 1990, including 363 of the 1,194 largest utilities. The savings attributed to DSM by the largest utilities include a 4.9-percent reduction in peak demand and a 0.6-percent reduction in delivered electricity to all sectors--mostly residential.

- DSM participants tend to be efficiency conscious, older than nonparticipants, relatively more affluent, better educated, and homeowners living in a newer home. They tend to take active conservation measures and live in a relatively energy-efficient house. Households with these characteristics usually consume less electricity than average, in addition to the enhanced efficiency due to the DSM program.

- Heavy electricity users receive larger electricity bills and would be more prone to respond to DSM advertising, and those who volunteer would be more likely to be efficiency conscious.

Do participants use less energy?

- For the average of all electricity users, DSM participants use less electricity than nonparticipants, but the savings are relatively small. This occurs because the average includes households that do not use electricity intensively.

- The DSM advantage increases with level of use. For intensive household users, such as those using electricity for their main space heating or central air conditioning, DSM participants used significantly less than nonparticipants.

- DSM could save even more electricity by focusing more on nonparticipants who are less efficient and not natural conservers. In areas served by DSM programs, there are at least 26 million nonparticipant households in single-family homes using electricity for main space heat, main water heat, and/or central air conditioning. These nonparticipants on average used significantly more electricity than their DSM counterparts in 1990.

The Average Energy-Consuming Household

What is a typical household?

- It is an urban, single-family detached home in a temperate region of the country, with two household members who own the house and earn a combined income of $34,268.

- The household consumes 98.1 million Btu of energy for which it spends nearly $1,200. It uses most of its electricity for appliances and most of its natural gas for space heat.

[4]Table 41, "Conservation by Census Region and Urban Status, Million U.S. Households, 1990" in the *Housing Characteristics 1990*, DOE/EIA-0314(90).

- The home has 1,569 square feet of heated space and was built in 1979 or earlier. A household in a newer home would spend less per square foot.

- Consumption for any particular household depends more on climate and heating source than on the household size or number of occupants.

Introduction

The purpose of this report is to provide information on the use of energy in residential housing units in the United States. This includes household energy consumption, expenditures, and prices for natural gas, electricity, fuel oil, liquefied petroleum gas (LPG), and kerosene, as well as, household wood consumption.

The Energy Information Administration (EIA) is mandated by Congress to be the agency that collects, analyzes, and disseminates impartial, comprehensive data about energy--how much is produced, who uses it, and the purposes for which it is used. To comply with that Congressional mandate, the EIA collects energy data from a variety of sources covering a range of topics.[5]

Background

The data reported here were collected on the 1990 Residential Energy Consumption Survey (RECS) Forms EIA-457A through G. EIA conducts this national sample survey of residential housing units and their energy suppliers on a triennial basis. The RECS is the only comprehensive source of national-level data on energy-related information for the residential sector. The 1990 RECS is the eighth residential energy consumption survey conducted by EIA. Previous RECS were conducted annually from 1978 to 1982 and in 1984 and 1987.

The RECS is a national multistage probability sample survey. Housing unit and household characteristics data are collected via a personal interview with the householder. Householders are asked to sign authorization forms allowing their suppliers of energy to release billing information about their household. A mail survey is used to collect household energy consumption and expenditure information from the energy suppliers.

This report, and the *Household Energy Consumption and Expenditures 1990 Supplement: Regional,* are based on data from both the household interviews from the 1990 RECS, conducted in the fall of 1990 and on the billing records collected during the survey for the 12-month period of January through December 1990. Information on the physical characteristics of the housing units, the appliances utilized, the occupants, the types of fuels being used, and other characteristics that relate to energy use were published in an earlier report, *Housing Characteristics 1990*.

Data in this report are presented in the form of aggregate totals and household averages. Also included are estimates of consumption and expenditures for the five end uses of residential energy: space heating, air conditioning, water heating, appliances, and refrigerators. The values presented for the end-use estimates are based on the 1990 RECS and are disaggregations of actual bills using a nonlinear regression technique. (See Appendix D, "End-Use Estimation Methodology," for details on the procedures used to calculate the end-use estimates.) Measures of energy use are also presented in the form of heating and air-conditioning intensities. (See the box on page 12 for a description of the intensities.)

[5]The EIA conducts numerous energy-related surveys. In general, the surveys can be divided into two broad groups. One group of surveys is directed to the suppliers and marketers of specific energy sources. These surveys--called supply surveys--measure the quantities of specific fuels produced and/or supplied to the market. The results of the supply surveys are combined and published in the *Monthly Energy Review* and other EIA publications. The second group--the consumption surveys--gathers information on the types of energy used by the end users along with the characteristics of those end users that can be associated with energy use. The RECS belongs to the consumption survey group because it collects information directly from the end-user—the household. There are important differences between the supply and consumption surveys that need to be taken into account in any analysis that uses both data sources. For a summary of the differences in the residential sector, see Appendix C or Energy Information Administration, *Energy Consumption by End-Use Sector, A Comparison of Measures by Consumption and Supply Surveys*, DOE/EIA-0533 (Washington, DC, April 6, 1990).

The data are published to provide objective, accurate energy information for a wide audience including Congress, Federal and State agencies, industry, and the general public. The data were collected and published by the EIA to fulfill its responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended.

The EIA gratefully acknowledges the cooperation of the respondents in supplying the information used to produce the estimates presented here.

Organization of the Report

The text of the report provides a discussion of the energy consumption, expenditures, and energy-related characteristics of U.S. residential households. Many data referenced in the text are from the "Detailed Tables" section of the report, where extensive cross tabulations of energy sources and end uses are presented. However, some tabulations of special interest appear in the main text of the report.

The appendices provide the supporting information on the survey. Appendix A, "How the Survey Was Conducted," provides information on the survey design and how the data were collected and processed. Appendix B, "Quality of the Data," discusses procedures for calculating the relative standard error of the data, data imputation procedures, and other quality-related topics. Differences in the coverage of this survey and EIA supply surveys are discussed in Appendix C, "RECS Coverage Related to EIA Supply Surveys." Appendix D, "End-Use Estimation Methodology," presents the nonlinear equations used to estimate end-use consumption.

The data for the RECS are collected on Forms EIA-457 A through G. Copies of the forms can be found in Appendix E, "Survey Forms." Climate zones and Census regions and divisions maps are located in Appendix F, "U.S. Climate Zones and Census Regions and Divisions Maps." A list of related EIA publications are located in Appendix G, "Related EIA Publications on Energy Consumption." Definition of the terms used in this report are located in the "Glossary."

The energy consumption and expenditure data in this report are presented at the national level. Regional data are presented in *Household Energy Consumption and Expenditures 1990 Supplement: Regional*, the companion volume to this publication. The 1990 RECS data are also available on public use diskettes; order information can be found in Appendix G. The "Detailed Tables" section provides more information about the organization of the tables, including a Quick-Reference Guide to major table topics, and how to use the RSE Row and Column Factors presented in the data tables.

Statistics Reported

New Data for the 1990 RECS

Several new data questions were added to the 1990 RECS. New data collected were on lighting, participation in demand-side management programs, shade trees and other methods of helping to cool a house other than air conditioning, and also collected were air-conditioning nameplate data so as to obtain more information on their energy efficiencies. More information was collected on refrigerators and their usage, enabling refrigerators to be estimated as a separate end use (previously refrigerators were included in the appliance end use).

Housing Units

The RECS is a sample of all housing units in the United States. For RECS, a housing unit is a house, an apartment, a mobile home, a group of rooms or a single room, occupied as separate living quarters by a family, an individual, or a group of one to nine unrelated persons. The housing unit must be the primary residence that is occupied for most of the year; seasonal units are not included. Group quarters for ten or more persons, such as a prison or nursing home, are not included in the RECS. Hotel and motel rooms are considered housing units if occupied as the usual or permanent place of residence.

Type of Housing Unit

As stated above, the RECS publishes information on housing units in several types of structures: single-family houses (both detached and attached), mobile homes, and small (two to four units) and large (five or more units) multifamily or apartment buildings.

Energy Consumption and Conditional Energy Intensities

Consumption is reported on a net basis in terms of energy delivered on site; no adjustment was made for the primary fuels consumed to produce electricity. Energy intensities reported are in terms of conditional intensities. Refer to the box on page 12 for information on how the intensities are calculated.

End-Use Estimates

There are two types of data reported in the "Detailed Tables" section of this report. The first is the energy consumption and expenditure data that were obtained from the energy suppliers to the households. The second is the nonlinear regression estimates of household energy consumption and expenditures by five end uses--space heating, air conditioning, water heating, appliances, and refrigerators. Appendix D, "End-Use Estimation Methodology" provides details on the regression equations used to estimate the end uses.

Survey Estimates

The statistics published in this report are based on a random sample selected from the population of occupied housing units in the United States as of November 1990. As a result, all the numbers are estimates rather than exact measures for the population. The 1990 RECS represents 94.0 million households in the 50 States and the District of Columbia. As described in Appendix B, "Quality of the Data," the accuracy of each estimate is indicated by the RSE. No estimates were published that were based on data from fewer that 10 sampled households or that had an RSE greater than 50 percent. All of the estimates, except those for the energy end-use estimates, include corresponding RSE's that can be calculated using row/column RSE factors.

Floorspace

Three different definitions of floorspace are used. One is *total floorspace*, which includes the floor area of the housing unit that is enclosed from the weather. A second is *heated floorspace*, which includes the portion of the floorspace that is heated during most of the winter season. A third is *cooled floorspace*, which is the portion of the floorspace that is cooled by air conditioning during the cooling season. Cooled floorspace is estimated using the number of rooms usually cooled, the number of rooms, and total floorspace.

Electronic Data Sets

The national-level tables and the regional-level tables from the "Detailed Tables" sections of both this and the companion report, *Household Energy Consumption and Expenditures 1990 Supplement: Regional*, are available on diskette. In addition, the public use data from the 1990 Residential Energy Consumption Survey will be available on diskette. See the "Detailed Tables" section, Appendix G, "Related EIA Publications on Energy Consumption," and the inside back cover of this report for ordering information.

Overview of Household Energy Consumption and Expenditures in 1990

This section presents a 1990 portrait of the total and average consumption and expenditures for the major sources of energy used in the U.S. residential sector: natural gas, electricity, fuel oil, liquefied petroleum gas (LPG), and kerosene. The first part discusses the role each energy source played in the overall energy usage of U.S. households in 1990. It also addresses wood consumption, which exceeds the use of kerosene and LPG combined.

The second part describes in detail the usage of the two most significant household energy sources, electricity and natural gas. It includes tables showing average and total end-use consumption for both of these energy sources, as well as disaggregations of each energy source by end-use consumption. Key differences between end-use consumption for electricity and natural gas are also presented. For example, almost 47 percent of the electricity used by households is for appliances, while almost 69 percent of the natural gas is for space heating.

The section concludes with two analyses dealing with decreases in energy consumption. The first deals with the effect of weather, which is a major determinant of energy usage. Because 1990 was warmer than usual (14 percent warmer than the 30-year average), households used less energy for space heating and more for air conditioning. The analysis estimates how much more energy would have been used in 1990 if the weather had been normal. The second analysis deals with the drastic decline of wood consumption since 1987 (32 percent). Unlike the decline for other energy sources, the decline in wood consumption was not due to weather, but to changes in the number of households using wood and in how much wood each household used. The analysis presents some details about these changes.

Total Consumption and Expenditures by Type of Energy Source

In 1990, householders in the United States paid $110 billion for the energy to heat and cool their homes, to refrigerate and cook their food, and for numerous other end uses that distinguish their high consumption from many other countries in the world. This was $12 billion more than in 1987, the year of the previous Residential Energy Consumption Survey (RECS). In real terms (1990 dollars), the total expenditures are comparable between 1987 and 1990.

Consumption

Direct energy consumption by U.S. households totalled 9.2 quadrillion Btu in 1990. This equates to 98.1 million Btu per household,[2] or 38 million Btu per person. The major sources of energy for residential use are natural gas and electricity, followed by fuel oil, liquefied petroleum gas (LPG), and kerosene (Table 1 and Figure 1).

[2]The fact that average national household consumption is higher than that for any fuel is an artifact of the number of users. For each fuel, there are usually more total users than there are intensive users, and many households use more than one fuel. Thus the average usage for any one fuel is always lower than that for all fuels.

Table 1. Summary of Energy Consumption and Expenditures in U.S. Households, 1990

Energy Consumption and Expenditure Characteristics	All Major Energy Sources[a]	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas
Housing Characteristics						
Total Households (million)	94.0	94.0	57.7	11.7	5.3	8.2
Average Floorspace per Household[b] (square feet)	1800	1801	1842	2169	1753	1684
Energy Consumption						
Total (quadrillion Btu)	9.2	3.0	4.9	1.0	0.1	0.3
Average per Household[c] (million Btu)	98.1	32.3	84.2	83.4	12.3	34.1
Average per Square Foot[b] (thousand Btu)	54.5	17.9	45.7	38.5	7.0	20.2
Energy Expenditures						
Total (billion dollars)	110.18	71.54	27.26	7.63	0.62	3.14
Average per Household[c] (dollars)	1172	761	472	652	116	381
Average per Energy Source (dollars per million Btu)	12.0	23.6	5.6	7.8	8.9	11.2

[a]Major energy sources include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas.
[b]Based on total square feet per housing unit (heated and unheated).
[c]Averages are calculated with only those households using the energy source.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey. Tables 18-25, 27 and RECS Public Use Data Files.

The number of household users and the variety of household purposes for each energy source affect both the total and average consumption of each. These considerations produce significant differences in residential energy consumption patterns for the major household energy sources, as measured by household bills for energy usage.

- **Natural gas** is by far the dominant energy source for residential use, accounting for 53 percent of total household energy consumption in 1990. In that year, U.S. households consumed 4.9 quadrillion Btu of natural gas (4.7 trillion cubic feet). Approximately 58 million households (61 percent of all households) used natural gas, predominantly for space heating and water heating. Natural gas consumption averaged 84.2 million Btu per household.[3]

[3]Averages of energy use or expenditures are always averages of those who used that energy source, rather than simple averages of all households. This excludes those households who do not use the source.

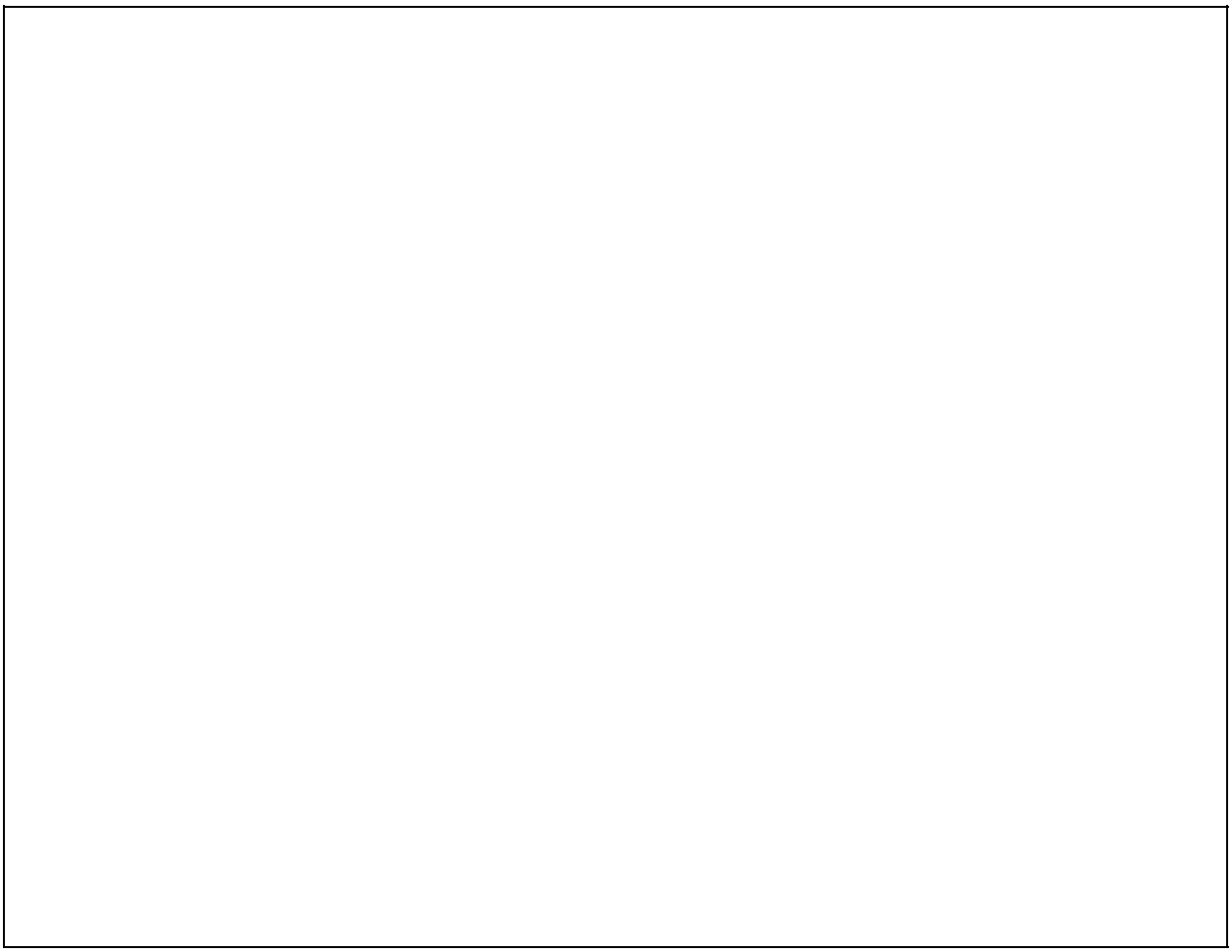


Figure 1

- **Electricity** is used by nearly all of the 94 million households in the United States and its use accounts for the second largest share of residential energy consumption, 33 percent. In 1990, U.S. households consumed 3.0 quadrillion Btu of electricity (888.4 billion kilowatthours, kWh). Because of the large number of residential users and the diversity of applications for electricity in U.S. households, the average household use is relatively low in comparison to natural gas--only 32.3 million Btu.

- **Fuel oil** consumption of 1.0 quadrillion Btu (7.1 billion gallons) accounted for only 11 percent of the total household energy used in 1990. However, only about 12 percent of all households (12 million) used fuel oil, and they used it for predominantly one purpose--home heating. Fuel oil consumption averaged 83.4 million Btu (606 gallons) per household in 1990.

- **LPG and kerosene** are significant household energy sources in rural areas, but they play a relatively minor role overall at the national level. Residential consumption of these two energy sources totalled 350 trillion Btu in 1990, with LPG consumption of 280 trillion Btu (3.1 billion gallons) representing about 3 percent of total residential energy consumption and kerosene consumption of 70 trillion Btu (490 million gallons) representing less than 1 percent. Consumption averaged 34.1 million Btu per household for LPG and 12.3 million Btu for kerosene.

While these statistical averages depict the overall characteristics of household energy consumption in the United States, considerable variation from these averages is evident--in particular, the differences in consumption based on climate. For example, although energy consumption per household averaged 98.1 million Btu for the United States as a whole, households in the hottest zones of the Nation used about 23 percent less energy (an average of only 75.2 million Btu) while those in the colder zones used about 26 percent more energy (123.3 million Btu). Households in the coldest zones actually used even more energy, but the data presented so far do not include wood.

Unlike the five major energy sources discussed above, **wood** is not billed to consumers by a utility, making it more difficult to estimate consumption and expenditures. From RECS respondents, it is estimated that 22.9 million households each burned an average of 1.3 cords of wood in 1990, amounting to total consumption of 580 trillion Btu--more than kerosene and LPG combined. Since this is *in addition to the estimates from utility bills for the five major energy sources cited above*, total household energy consumption is consequently 580 trillion Btu higher. This means that total residential energy consumption was actually about 9.8 quadrillion Btu in 1990, about 6 percent more than the 9.2 quadrillion Btu reported above.

Expenditures

In 1990, the 94 million U.S. households spent $110.2 billion on energy in their homes. These expenditures averaged $1,172 per household.

- **Electricity** expenditures of $71.5 billion accounted for the largest share of household energy bills (65 percent). The average expenditure per household ($761) was more than for any of the other major energy sources. Electricity is the most expensive energy source, but it is also the most flexible. With the cost of electricity averaging $23.56 per million Btu (8.1 cents per kilowatthour) nationwide, it costs more than four times as much as the cheapest energy source (natural gas).

- **Natural gas** expenditures of $27.3 billion accounted for only 25 percent of total household energy expenditures. Despite the fact that it has the highest per household consumption, the average expenditure per household was only $472. This is because of the relatively low cost of natural gas, which averaged $5.61 per million Btu (5.8 dollars per thousand cubic feet) nationwide--the lowest of all the major energy sources.

- **Fuel oil, LPG, and kerosene** expenditures of $11.4 billion accounted for only 10 percent of the total. Average household expenditures were $652 for fuel oil, $381 for LPG, and $116 for kerosene.

Because **wood** is not billed by utilities, precise data on household expenditures for this energy source are unavailable.

There is surprisingly little variation in household energy expenditures from the coldest to the warmest zones in the country (only about $243). Excluding expenditures for wood, the highest average household bill in the colder zones was $1,251, while households in the warmest zones paid an average of $1,197 and households in the temperate zones had the lowest bill of $1,008. The source of this uniformity is the role of electricity in space heating and cooling. Households in the warmest zones have lower heating bills, but significantly higher cooling bills. Electricity is an efficient provider of cooling (via a heat pump or central air conditioning), but it is also more expensive on a Btu basis than other energy sources used for heating in colder zones. Higher electricity costs relative to other energy sources, therefore, tend to carry greater weight in raising the average expenditures in warmer zones.

Household Consumption by End Use

Energy provides a wide range of household uses such as heating, cooling, hot water, refrigeration, and the services of many appliances--from lights to hot tubs. For some years, the RECS has estimated the importance of each of these types of usage in total energy consumption. Tables 2 and 3 present estimates of the amount of electricity and natural gas consumed for the most important household uses, along with a more detailed breakout of energy used for selected household appliances. The other commonly used household energy sources (fuel oil, LPG, and kerosene) are used mostly for space heating, water heating, and cooking.

The consumption estimates presented here are aggregates for all households that use electricity (Table 2) or natural gas (Table 3) for particular end uses. Therefore, the percentage shares and relative ranking of the major end uses at the top of each table simply represent the average usage calculated from survey data, and not any specific household.

In fact, it is possible that no particular household uses energy exactly as shown in these tables, and the "average" household may be purely mythical. As a simple example, households in the northern United States use significantly more energy for space heating than households in the South; conversely, southern households use significantly more energy for air conditioning than their northern counterparts. Climate differences are only part of what distinguishes energy usage among U.S. households, as many other factors affect individual household energy consumption. The principal variables are the size of the heated or cooled area of the home, the number of occupants, and, less intuitively, which of the major energy sources are used for space heating.

The estimates of energy consumption for particular appliances are based upon a combination of metered information and the RECS, which counts the number of appliances in each surveyed household. However, the RECS does not have metered information on the actual amount of energy consumed by each appliance--only the total utility bill. *(The consumption estimates by appliance were obtained by applying published industry estimates of consumption per appliance to the RECS counts of number of appliances to obtain estimates of appliance consumption whose sum (over all appliances) was prorated to equal the appliance total.)*

The most important use of electricity in the average U.S. household is for appliances, which consume over 46 percent of all electricity used in the residential sector (Table 2). Cooling (air conditioning and refrigeration) consumes another 32 percent, and the remaining 21 percent is at most, evenly divided between water heating and space heating. Natural gas is used predominantly for space and water heating, with space heating accounting for about 69 percent of all household consumption of natural gas and water heating about 24 percent (Table 3).

Table 2. U.S. Residential End-Use Consumption of Electricity, 1990

Appliance/End Use	Million Units	Annual kWh Consumption per Unit	Electricity Consumption		
			Billion kWh	Trillion Btu	Percent
Total Households	94.0	9,447	888.0	3,030	100.0
Air Conditioning	60.3	2,333	140.7	480	15.8
Water Heating	36.1	2,742	99.0	340	11.2
Space Heating	37.2	2,392	89.0	300	9.9
Refrigerator[a]	112.6	1,301	146.5	497	16.4
Appliances	94.0	4,395	413.1	1,410	46.5
			[f]Consumption estimates in the shaded areas are prorated		
Lighting	94.0	[b]844	88.3	301	9.9
TV[a]	192.8	[b]360	77.6	265	8.7
Clothes Dryer	49.5	[b]909	50.1	171	5.7
Freezer	32.4	1,299	47.0	160	5.3
Range/Oven	54.3	[b]700	42.3	144	4.8
Furnace Fan[a,c]	57.2	[d]404	25.7	88	2.9
Waterbed Heater[a]	16.9	[b]960	18.0	61	2.0
Microwave Oven	74.1	[b]191	15.8	54	1.8
Dishwasher	42.7	[b]330	15.7	54	1.8
Swimming Pool Pump	5.0	[e]2,022	11.2	38	1.3
Clothes Washer	71.7	[b]99	7.9	27	0.9
Dehumidifier	11.3	[b]370	4.7	16	0.5
Well Pump	14.3	[b]228	3.7	13	0.4
Personal Computer	14.8	[b]77	1.2	4	0.1
Hot Tub/Spa Heater	1.7	[e]482	0.9	3	0.1
Residual	--	--	3.0	10	0.3

-- = Data not applicable.

[a]Count of individual units within the household.

[b]National survey of electric utilities conducted by the American Electric Power Service Corporation, Columbus, Ohio.

[c]Includes furnace fans for heat pumps (6.8 million) as well as central furnaces with ducts (50.4 million).

[d]Sierra Pacific Power Company (1986).

[e]Average of two estimates from Southern California Edison.

[f]Consumption estimates by appliances in the shaded area were obtained by applying published industry estimates of consumption per appliance to the RECS counts of number of appliances to obtain estimates of appliance consumption whose sum (over all appliances) was prorated to equal the appliance total.

Note: "Residual" includes appliances not listed such as small cooking appliances and electric tools.

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Residential Energy Consumption Survey (RECS), RECS Public Use Data Files; American Electric Power Service Corporation, Sierra Pacific Power Company, and Southern California Edison.

Table 3. U.S. Residential End-Use Consumption of Natural Gas, 1990

Appliance/End Use	Million Units	Annual Therms Consumed per Unit[a]	Natural Gas Consumption	
			Trillion Btu	Percent
Total Households	57.7	842.3	4,860	100
Space Heating	52.7	639.5	3,370	69.3
Water Heating	50.3	230.6	1,160	23.9
Air Conditioning	0.4	280.0	10	0.2
Appliances	40.0	82.5	328	6.8
		[c]Consumption estimates in the shaded area are prorated		
Range/Oven	33.0	[b]79.0	234	4.8
Clothes Dryer	14.5	[b]60.0	78	1.6
Outdoor Light	1.0	[b]184.0	17	0.3
Residual	--	--	1	[d/]

-- = Data not applicable.

[a]A therm is 100,000 Btu. Estimates are taken from the Residential Energy Consumption Survey unless otherwise indicated.

[b]Data from the American Gas Association, 1982.

[c]Consumption estimates by appliances in the shaded area were obtained by applying published industry estimates of consumption per appliance to the RECS counts of number of appliances to obtain estimates of appliance consumption whose sum (over all appliances) was prorated to equal the appliance total.

[d]Less than 0.1 percent.

Note: "Residual" includes appliances not listed such as hot tubs and natural gas fireplaces.

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and F of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files and data from the American Gas Association, 1982.

Comparison of Electricity and Natural Gas

Comparing the estimates of end-use consumption for electricity and natural gas reveals surprising, but not altogether meaningful, results. This is because the table entries represent averages for all household usage of electricity or natural gas, regardless of whether a particular household used the energy source for space heating, air conditioning, water heaters, refrigerators, or appliances intensively or at a minimal level. Even though almost every household uses many of the appliances included in the RECS, not all use them intensively, giving the misleading impression that electricity usage is low on average and, thus, is highly efficient. Other considerations limit the validity of comparisons between electricity and natural gas. For example, the electric space-heating category includes households that have gas-fired central heating systems with electric heaters as secondary units. The category of households with air conditioning includes households with one room-size air conditioner.

Although natural gas applications appear to be more dedicated to specific uses and used more intensively than electricity, the average estimates shown in the tables include both small and large users in all climate zones. Using space heating as an example, a major reason that natural gas is used more intensively than electricity is that the average gas-heated household is in the northern (colder) half of the Nation, while the average electrically heated household is in the southern (warmer) half. A careful examination of other details presented in the tables suggests a range of other comparisons, and possible explanations.

Energy Consumption and Expenditure Intensities

Conditional Energy Intensity

A **Conditional Energy Intensity** is a measure of intensity that adjusts either the amount of energy consumed or expenditures spent for the effects of certain characteristics such as weather, size of unit, and number of household members for households that **use a particular energy source**.

Consumption: **Conditional Energy Intensity** =

$$\frac{\text{Btu}}{\text{Energy Source-Specific Square Feet.}}$$

Where:

Btu = total consumption of a specific type of energy in all housing units within a specific category.
Energy Source-Specific Square Feet = total floorspace of housing units within that category, which **use that specific energy source.**

Expenditures: **Conditional Energy Intensity** =

$$\frac{\text{Dollars}}{\text{Energy Source-Specific Square Feet.}}$$

Where:

Dollars = total expenditures for a specific type of energy in all housing units within a specific category.

Conditional End-Use Intensity

A **Conditional End-Use Intensity** is a measure of intensity that adjusts either the end-use consumption or expenditures for the effects of certain characteristics such as: floorspace, degree-days, or household members for households that **use an energy source for a particular end use**. In the case of space-heating intensity, only the heated floorspace and heating degree-days are used. The air-conditioning intensity uses only the cooled floorspace and cooling degree-days. The water-heating intensity adjusts consumption and expenditures for the effects of the number of household members on water-heating consumption.

Conditional End-Use Intensity (for space heating and air conditioning) =

$$\frac{\text{End-Use Btu}}{\text{Energy Source-Specific Square Feet*Degree-Days.}}$$

Where:

End Use Btu = total consumption of a specific type of energy in all housing units for an end use within a specific category.
Degree-Days = heating degree-days (HDD) or cooling degree-days (CDD).

Conditional End-Use Intensity (for water heating) =

$$\frac{\text{End-Use Btu}}{\text{Number of Household Members.}}$$

Table 4 illustrates some of the key differences between electricity and natural gas and shows the range of end-use intensities for either gas or electricity users across U.S. climate zones (See box on page 12 for definitions of end-use intensity). This encompasses a wide variation in housing types (an important factor in space heating) and ground water temperatures (an important factor in water heating). For both space and water heat, the range of average end-use intensities indicates that electricity is in general more efficient than natural gas for these applications.

Table 4. Electricity Versus Gas Intensities in U.S. Households, 1990

Ranges	Electricity	Natural Gas
Space-Heat Intensity (Btu/sq. ft./HDD)	2.5-4.8	6.9-14.6
Space-Heat Expenditure Intensity (cents/HDD/1000 sq. ft.)	4.4-10.5	3.4-8.6
Water-Heat Intensity (million Btu/per household member)	2.8-4.3	7.0-10.6
Water-Heat Expenditure Intensity (dollars/per household member)	63-91	42-55
Price (dollars/million Btu)	23.59	5.61

HDD = Heating Degree-Days.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, E, and F of the 1990 Residential Energy Consumption Survey (RECS). Tables 33 and 41 and RECS Public Use Data Files.

The basic RECS data on end-use consumption of both electricity and natural gas come from household utility bills. Differences in intensity of use for electricity and natural gas reflect physical differences associated with the actual efficiency of the heating device, the efficiency of service delivery, and the ventilation requirements of natural gas (which reduce its efficiency). Perhaps even more important is the significant price difference between natural gas and electricity, which is readily seen from the ranges of expenditures for the two energy sources. On a Btu basis, electricity is more than four times as expensive as natural gas. In reaction to these relatively higher prices, electric homes tend to be better insulated and have lower usage of hot water.

Electricity, measured as end-use energy, nearly has a 3:1 advantage over natural gas for space heat and water heat intensities (Table 4). Typically, 3 Btu of primary energy (coal, oil or gas[4]) are required to generate 1 Btu of end-use electricity. However, RECS directly records electricity and natural gas consumption as billed to the consumer. The relative efficiencies of electricity and natural gas expressed in primary terms are surprisingly similar. From a national perspective of primary energy, gas or electric households are equally efficient.

1990 Was Warmer than Normal: Implications for the Energy Used

Weather is a major determinant of the variations in household energy consumption and, therefore, expenditures for energy. The 1990 and 1987 RECS were both conducted in years that were significantly warmer than the 30-year average. In fact, 1987 was 8 percent warmer than the 30-year average[5] and 1990 was 14 percent warmer. If the 1990 heating season had been normal, there would have been, on average, 4,529

[4]Strictly speaking, coal, petroleum, natural gas, nuclear, hydropower and other electrical utility inputs are referred to as primary inputs.

[5]Energy Information Administration, Office of Energy Markets and End Use, *Household Energy Consumption and Expenditures 1987, Part 1: National Data* DOE/EIA-0321/1(87), page 10.

heating degree-days (HDD).[6] However, the average number of HDD in 1990 was only 3,887.[7] The 1990 cooling season was also warmer than normal, with 11 percent more cooling degree-days (CDD) than normal. Figure 2 shows the diversity in weather over the last 20 years.[8]

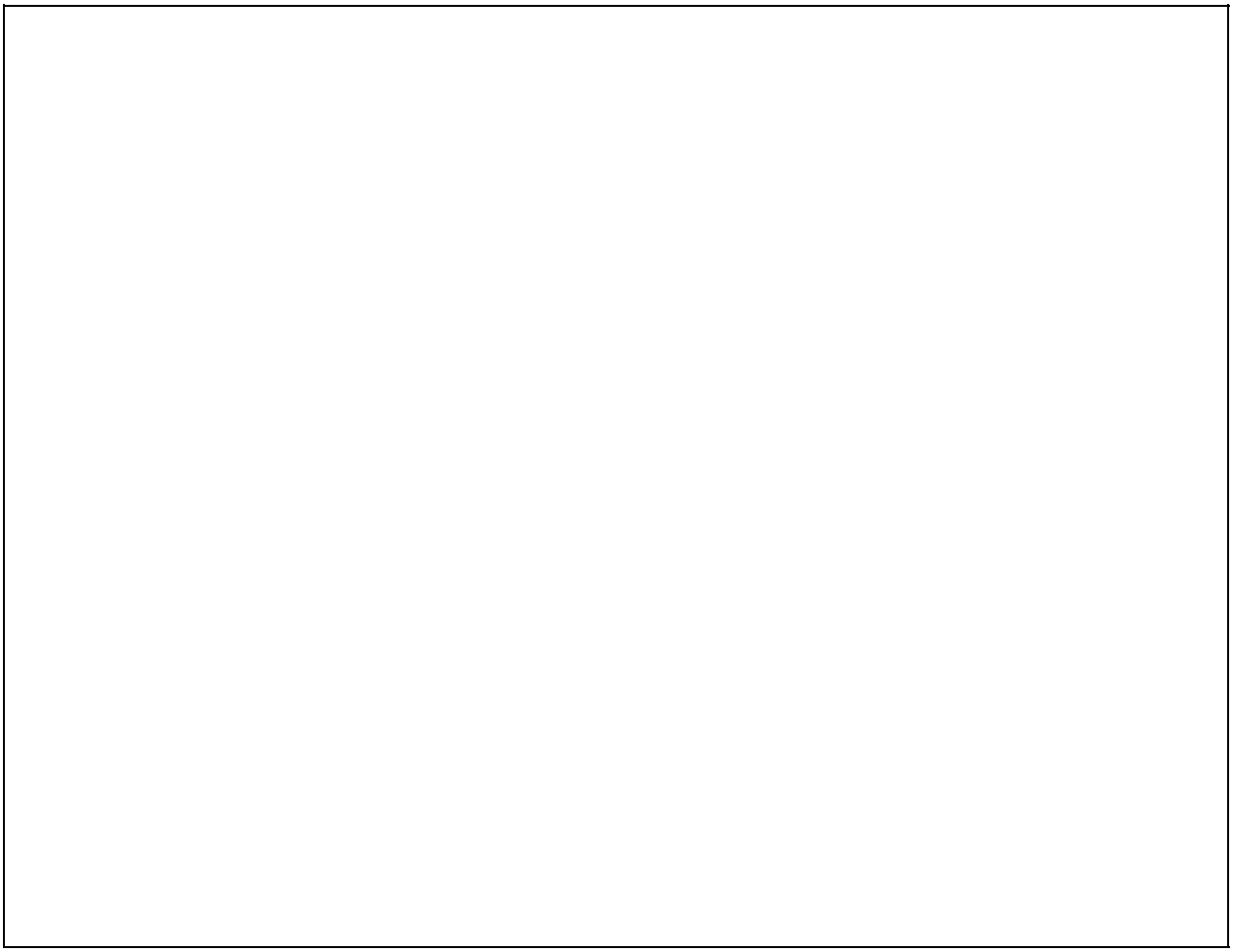


Figure 2

Since the winter of 1990 was not as cold as normal, households needed less energy to keep warm. On the other hand, households needed more electricity to keep cool in the summer, since it was also warmer than normal. Overall, however, the net effect was to reduce the need for household energy by 750 trillion Btu

[6]HDD is a measure of how cold a location was over a period of time, relative to the base temperature of 65 degrees Fahrenheit. See the Glossary for more detailed definitions of heating and cooling degree-days.

[7]Energy Information Administration, Office of Energy Markets and End Use, *Housing Characteristics 1990* DOE/EIA-314(90) Table 55.

[8]Although the calculations of energy consumption and expenditures are based upon RECS weather data, data from the National Oceanic and Atmospheric Administration were used for Figure 2 since in 1987, EIA changed degree-day assignments. See "Weather" in Appendix B for details. NOAA's 1990 average CDD is 5.1 percent from normal and NOAA's 1990 HDD average is 13 percent from normal. One of the differences between NOAA and RECS degree-days is the differences in the population weights. Another is that different years were used in the calculations of the 30-year average. The 1990 NOAA 30-year average is based on the years 1961 to 1990. The 1990 RECS 30-year average is based on the years 1951 to 1980.

below what would have been consumed if the weather had been normal.[9] In 1990, this meant a savings of $4.3 billion for U.S. households, about $46 per household.

The warmer weather in 1990 was particularly beneficial for the country in light of the Persian Gulf crisis that began in August and created concern over oil supplies and prices for the remainder of the year. The warmer-than-normal weather reduced the need for fuel oil to heat homes by 200 trillion Btu from what it would have been in a normal heating season, equivalent to approximately 34 million barrels of crude oil.[10] The weather produced even greater savings in terms of the need for natural gas for space heating, reducing consumption by more than 600 trillion Btu compared with normal winter weather (Table 5).

Table 5. Warmer Winter Effects on the Main Space-Heating Consumption of Major Energy Sources in the United States, 1990

Energy Source	Total House-holds (million)	Average Heating Degree-Days[1]		Total Consumption (quadrillion Btu)		Total Expenditures (billion dollars)	
		1990	30-Year Average	1990	30-Year Average	1990	30-Year Average
Electricity	21.5	2,955	3,562	0.3	0.3	5.2	6.3
Natural Gas	51.7	4,028	4,661	3.3	3.9	18.4	21.3
LPG	4.4	3,867	4,470	.2	.2	1.9	2.2
Fuel Oil	10.4	4,950	5,777	.8	1.0	6.5	7.6

[1]In 1990, the average heating degree-days (HDD) are averages for those households using the energy source for space heating. The 30-year average HDD are averages for those regions where the households using the energy source for space heating are located.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A to G of the 1990 Residential Energy Consumption Survey (RECS). Tables 33-36 and RECS Public Use Data Files.

In total, 800 trillion Btu more of electricity, natural gas, LPG, and fuel oil would have been needed in 1990 for main space heating if the weather had been normal.[11] Correspondingly, if the summer had not been hotter than normal, 50 trillion Btu less electricity would have been needed for air conditioning (Table 6).

The energy savings for space heating seem to be spread almost equally across the country, with the exception of the West Census Region (Figure 3). This occurred probably because the weather in the West was closer to normal than in the other regions.[12] The West was only 7 percent warmer than normal, whereas the South

[9]The amount of energy that would have been used or not used (as is the case for air conditioning) in 1990 if the weather had been normal was calculated for electricity, natural gas, LPG and fuel oil for main space heating and only electricity for air conditioning using the following:

Adjustment Ratio = 30-Year Average Degree-Day/1990 Degree-Day (1)
Normal Total Consumption (Expenditures) = Adjustment Ratio x 1990 Total Consumption (Expenditures) (2)
Difference in Consumption (Expenditures) = Normal Total Consumption (Expenditures) - 1990 Total Consumption (Expenditures) (3)

[10]Calculations are, based on 1 quadrillion Btu of energy equaling approximately 170 million barrels of crude oil, *Energy Facts 1989*, DOE/EIA-0469(89), page 105.

[11]Kerosene savings were not calculated since only 1.1 million households used kerosene as a main space-heating energy source.

[12]Data for the regional analysis are from the tables in *Household Energy Consumption and Expenditures 1990 Supplement: Regional.*

Table 6. Cooler Summer Effects on Electricity Used for Air Conditioning in the United States, 1990

Air-Conditioning Equipment	Total Households (million)	Average Cooling Degree-Days[1]		Total Consumption (trillion Btu)		Total Expenditures (billion dollars)	
		1990	30-Year Average	1990	30-Year Average	1990	30-Year Average
Central	35.1	1,797	1,615	390	350	9.0	8.1
Room Unit	25.1	1,318	1,201	90	80	2.2	2.0

[1]In 1990, the average cooling degree-days (CDD) are averages for those households using the energy source for air conditioning. The 30-year average CDD are averages for those regions where the households using the energy source for air conditioning are located.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A,B,C, and E of the 1990 Residential Energy Consumption Survey (RECS). Tables 37 and 38 and RECS Public Use Data Files.

was 22 percent warmer than normal in the winter. For the South, these weather patterns led to an overall change in energy consumption of 231 trillion Btu less of the energy sources for heating in the winter, and 34 trillion Btu more electricity for air conditioning in the summer. If the weather in 1990 had been normal, there would have been a net increase of 197 trillion Btu in the South.

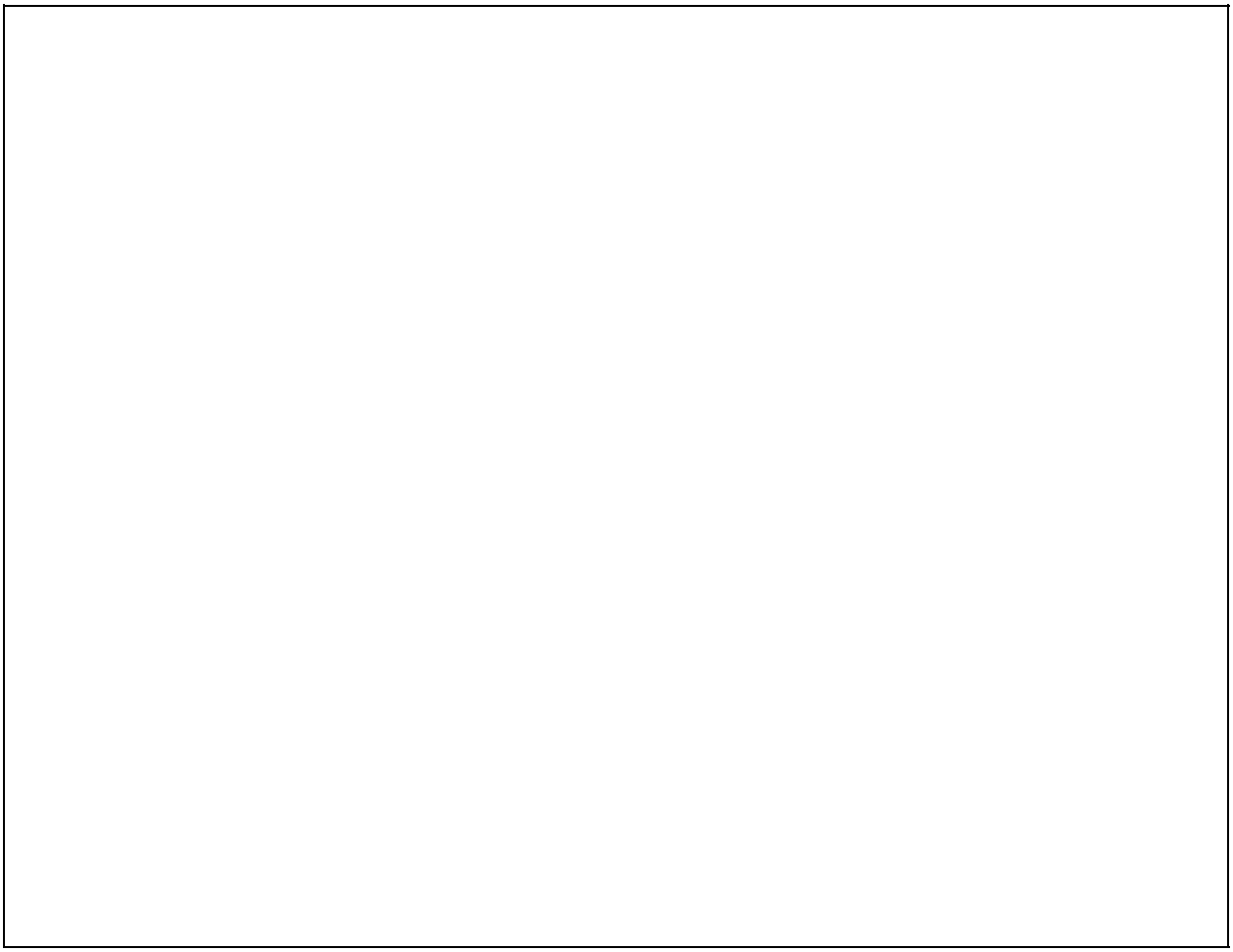


Figure 3

After subtracting the additional $1.1 billion households spent for air conditioning due to a warmer summer, U.S. households spent $4.3 billion less than what they would have spent if the weather had been normal (Tables 5 and 6). The greatest dollar savings were for households in the Northeast, where most of the energy expenditures are for space heating. If the weather had been normal in the Northeast, households would have spent almost $2 billion more for energy in 1990, after subtracting the $110 million they would have saved in electricity costs due to less need for air conditioning (Figure 4).

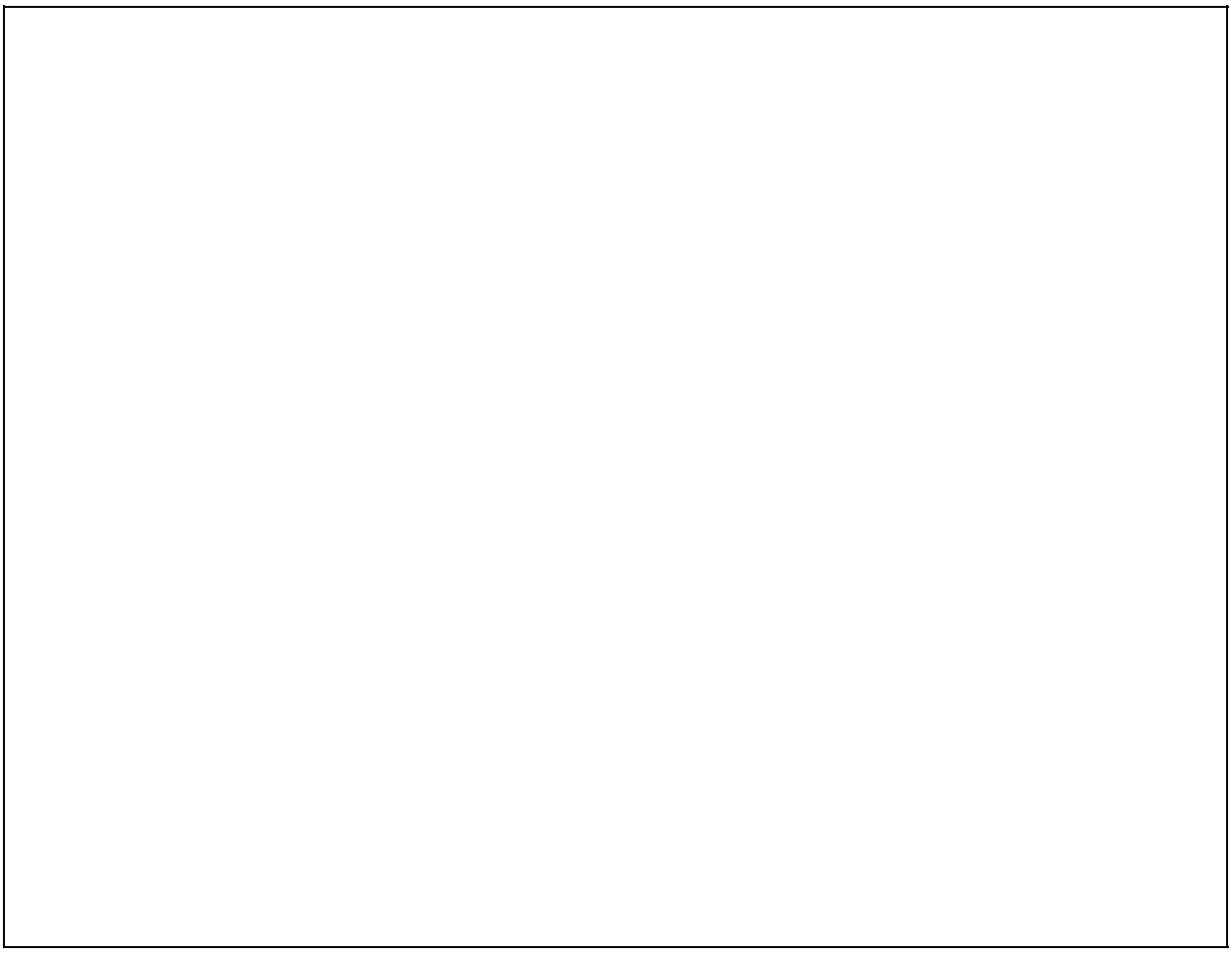


Figure 4

Has the American Fascination with Wood as an Energy Source Begun to Fade?

In 1990, the use of wood as an energy source reached its lowest level since the RECS began collecting data on wood in 1980. The drop in wood consumption from 1987 to 1990 was the most dramatic decline of the decade. In 1987, households reported burning 42.6 million cords of wood, but by 1990 wood consumption had plummeted 32 percent, to only 29.1 million cords (Figure 5).

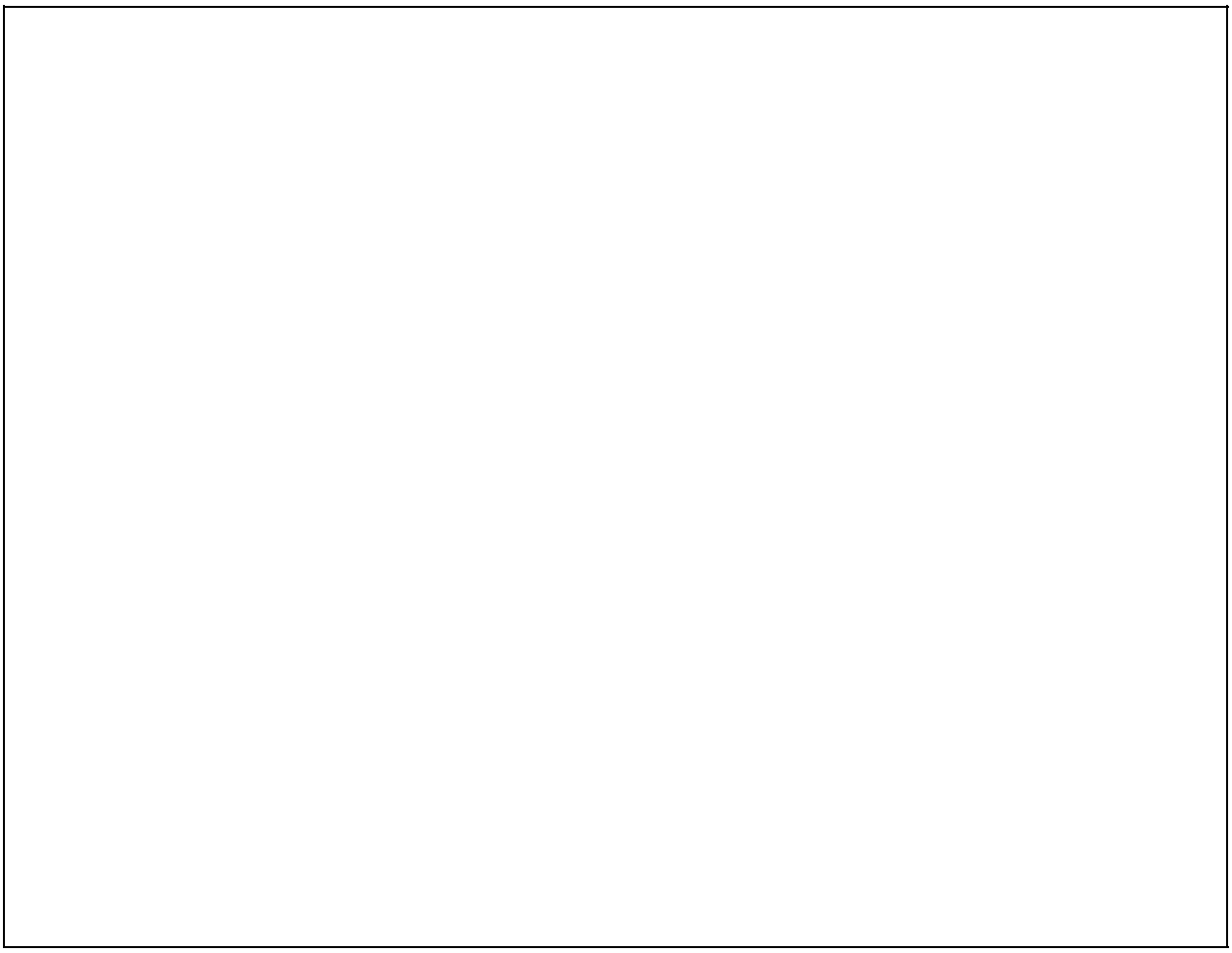


Figure 5

This trend can be partially explained by the changes in the use of wood as the main space-heating energy source. In 1987, 5.0 million households consumed wood as their main space-heating energy source. In 1990, that number fell to 3.9 million. This shrinkage of 1.1 million homes accounted for a decline of 4.3 million cords, 32 percent of the total decline.

The decline in wood consumption can also be explained by reduced intensity of wood use for space heating. Households using wood for main space heating consumed an average of 4.7 cords per year in 1987 and only 3.9 cords per year in 1990, even though the need for heat in those households using wood as indicated by HDD remained the same. The decline in wood space-heating intensity reduced wood consumption by 3.1 million cords, 23 percent of the total decline.

The remainder of the decline in wood consumption can be attributed to changes in the use of wood for secondary heating.[13] Between 1987 and 1990, the number of homes using wood as a secondary energy source increased by 1.6 million. This increased wood consumption. However, the increase was offset by a decrease in usage intensity. The average number of cords burned for secondary heating per household per year fell from 1.1 in 1987 to 0.7 in 1990. Together, these changes in the use of wood as a secondary heating source accounted for a 6.1-million-cord decline in wood consumption, 45 percent of the total decline (Figure 6).

[13]Secondary heating includes burning wood in a fireplace, which may produce negligible benefits in space heating.

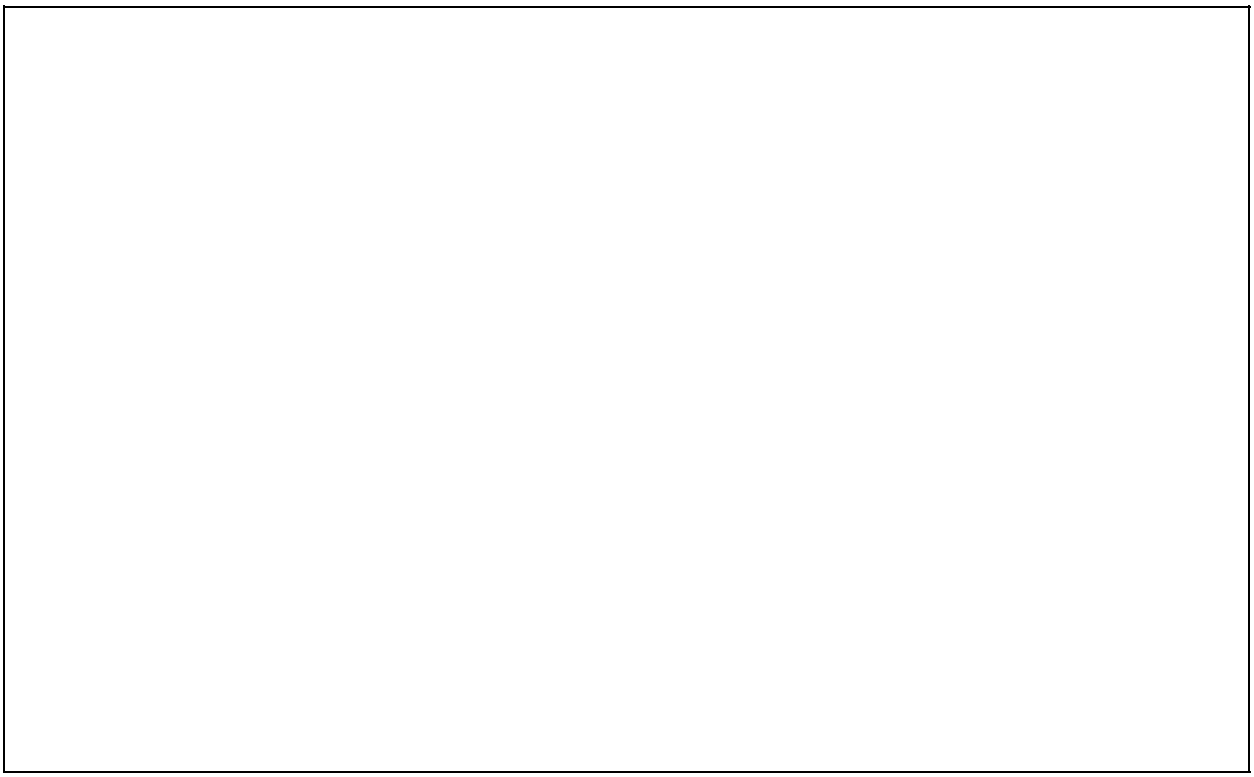


Figure 6

In summary, a decline of 1.1 million in the number of homes heating mainly with wood resulted in a 32-percent decline in the use of wood. Reduced wood space-heating intensity for main heating caused wood consumption to fall 23 percent. Finally, changes in the use of wood as a secondary heating energy source accounted for 45 percent of the decline in wood consumption.

Why did wood space-heating intensity drop and households burn less wood? A detailed comparison of the characteristics of wood-burning homes in 1990 and 1987 found that wood-burning homes in 1990 were similar to those in 1987 in terms of average square footage, household income, age of the house, climate, region, and cost of the energy source.[14]

One factor that does help explain the reduced use of wood is increased wood-stove efficiency. Wood stoves purchased since late 1987 are more efficient than older models, because the U.S. Environmental Protection Agency (EPA) required that wood stoves manufactured after July 1, 1988, meet efficiency standards. Data from the 1990 RECS suggest that, on average, the new stoves were 15 percent more efficient than older stoves.[15] The 15-percent increase in the efficiency of the approximately 2.2 million new wood stoves purchased since 1987 resulted in a 1 million cord decline in wood consumption.

Increased wood-stove efficiency explains only 7 percent of the total decline in wood consumption. Explaining the remainder of the drop must be left to hypothesis. One possible explanation is that the decline in wood use is simply a behavioral change. Heating with wood was popular in the early 1980's, and the novelty of heating with wood may have worn off, as users grew tired of hauling wood and maintaining a fire. This theory is supported by the fact that the overwhelming majority of those homes that heated with wood had a convenient alternative heating source available. In 1987, 82 percent of those who heated mainly with wood had secondary heating sources, and 35 percent

[14]1987 and 1990 Residential Energy Consumption Surveys.

[15]See "Increased Efficiency of New Wood Stoves" in Appendix B for information on how this estimate of 15-percent improved efficiency was determined.

of those who used wood as their main space-heating source had central furnaces. This indicates that those who heated with wood could have switched to their secondary heating system easily.

Another possible explanation is that increased environmental regulation has reduced the use of wood. State and local regulations designed to limit particulate emission by restricting the burning of wood may have caused a reduction in wood use. Some cities for example, Missoula, Montana, have passed laws banning the use of fireplaces and wood-burning stoves when air pollution levels are high. Similarly, the state of Washington has enacted legislation regulating the burning of wood and the efficiency of wood stoves. These and similar local regulations may have contributed to the decline in the use of wood.

The reduction in the number of homes using wood for their main space heat and the lower per-household usage in these homes compared with 1987 were important factors in the 32-percent fall in wood consumption in 1990. Regulations which restricted emissions, increased the efficiency of new wood stoves, and limited the usage of stoves in high pollutant areas added to this decrease in wood consumption.

This trend may very well continue, as new Federal and local regulations discouraging wood usage are enacted. The EPA regulations were tightened in 1992, and some recently passed local laws are more stringent. As of January 1, 1993, Denver will not allow any new or remodeled homes to have conventional fireplaces or uncertified wood stoves. Additionally, the EPA and many individual cities such as Crested Butte, Colorado are fining householders who do not trade in their old wood stoves and buy the new EPA-certified clean-burning stoves. Other cities, including Denver, are offering low-interest loans and rebates for the purchase of new stoves.[16]

[16]For a more detailed discussion see "Wood Stoves Clean Up their Act" in *The Christian Science Monitor*, September 23, 1992, p. 12, and "Incentives Offered to Convert Fireplaces, Woodburning Stoves" in *The Denver Post*, September 3, 1992, p. 4B.

Overview of Energy Efficiency in U.S. Households in 1990

A major concern articulated during the public hearings for a National Energy Strategy was the need to increase energy efficiency. This was seen as a way to reduce pollution, cost of energy, and the country's dependence on foreign supplies.

Because the concept of energy efficiency is difficult to quantify, other measures such as energy intensity are usually used. Measuring energy efficiency in terms of energy intensity, however, is problematical. A measurement of intensity is often misinterpreted to mean only energy efficiency, but it encompasses more than just efficiency. Because efficiency is the main component of energy intensity, changes in energy efficiency largely determine changes in energy intensity. Lower intensities usually mean higher efficiencies. However, structural and behavioral changes also come into play. For example, a change in the mix of heating equipment or energy sources affects changes in energy intensity, as do the level and quality of equipment maintenance.

This section examines several components of energy intensity, including average intensity and trends in efficiency levels of new homes and appliances. The first part discusses the changes in the energy intensities for household usage of electricity and natural gas. Much of the increase in electricity intensity may be due to the increase in the number of uses for electricity, from space heat to waterbeds and computers, as saturation levels of appliances have risen rapidly in the last 10 years. This is not the case for natural gas, whose intensity levels have declined. Since there are not as many uses for natural gas, increased efficiency may be the dominant factor.

The second part looks at trends in new homes. Energy intensity was found to be no different for new homes built from 1988 to 1990 than for those built from 1985 to 1987. One would have expected more efficient appliances and housing shells to lower energy intensities for new homes. However, the RECS data indicate that new homes consumed more total energy because they are larger and use a different mix of electricity and natural gas than older homes.

The final part of this section examines the efficiency of household appliances. After estimating the average efficiency of the appliance stock in 1990, it estimates how much energy would have been consumed if existing appliances in every household in the country had been replaced with new 1990 appliances. It also estimates the potential energy savings from replacing only those appliances that were at least 10 years old in 1990. The analysis in this section uses RECS and manufacturers' shipment weighted energy data to estimate the potential efficiency gains and energy savings.

Changes in the Intensity of Average Residential Energy Consumption, 1980 to 1990

The efficiency of household energy use is assessed by looking at the average usage of energy per heated square foot of residential floorspace, a measure of average energy intensity.[16] The assessment of the efficiency of household energy use has to be approached cautiously because of fundamental differences between the two major energy sources, electricity and natural gas. As reported in the previous section (Tables 2 and 3), electricity has many more residential end uses than natural gas, which is dominated by space heating and water heating. Between 1980 and 1990, the intensity of residential usage of all energy sources declined steadily, by about 18 percent over the 10-year period (Table 7). In households that used natural gas for main space heating, natural gas intensity declined 27

[16]Intensity of energy consumption is defined here as energy consumed per square foot of heated area. The square footage value that is used is that for households that use the fuel in question, rather than the square footage for all households.

percent from 1980 to 1990. The corresponding decline for electricity intensity in households that used electricity for main space heating was only 8 percent. A very real confounding factor is the effect of weather during the years of the RECS. As noted in the previous section, the years 1987 and 1990 were warmer than normal. In fact, there was a continuous decline in the number of heating degree-days (HDD) from 1980 to 1990 for the years in which RECS was conducted (Figure 2). This weather-related decline would be responsible for some of the observed decline in energy consumption intensity for natural gas and electricity (Table 7).

Table 7. Average Energy Consumption Intensity in the U.S. Residential Sector, 1980 to 1990

Energy Source	Average Energy Consumption Intensity (thousand Btu per heated square foot)					
	1980	1982	1984	1987	1990	Percent Change, 1980 to 1990
All Energy Sources	76.2	71.0	72.7	67.6	62.5	-18.0
Not adjusted to 30-year average heating degree-days						
Natural Gas (all natural gas for households with natural gas as main space heating)	69.8	64.1	67.0	59.7	51.2	-26.6
Electricity (all electricity for households with electricity as main space heating)	40.3	42.5	40.9	38.2	36.9	-8.4
Adjusted to 30-year average heating degree- days						
Natural Gas (all natural gas for households with natural gas as main space heating)	67.8	64.5	65.0	63.6	57.5	-15.2
Electricity (all electricity for households with electricity as main space heating)	39.1	41.8	40.9	39.5	39.0	0

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1980, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys (RECS). RECS Public Use Data Files.

To determine the impact of the decline in HDD for 1980 to 1990, we calculated what natural gas and electricity consumption for space heating would have been if the survey years had normal winters corresponding to the 30-year HDD average. It was assumed that the percentage departure from the 30-year average translated to an equivalent percentage change in consumption. The weather-adjusted space-heating consumption was added or subtracted from each of the natural gas and electricity intensities in Table 7. The adjustments show that the decline in natural gas intensity still remains, but is reduced to 15 percent. Total natural gas consumption for space heating for the five survey years was 17.0 quadrillion Btu. If the winters had been normal, the consumption would have been 17.6 quadrillion Btu, or 590 trillion Btu more than was actually consumed. Similarly, if the winters for the survey years had been colder by the same amount (i.e., HDD greater by an equal amount than the 30-year average), then 18.2 quadrillion Btu would have been consumed, 1.2 quadrillion Btu more than was actually consumed.

The decline in electricity intensity disappears when the weather adjustment is made. This analysis demonstrates that there has been a decline in residential natural gas consumption intensity over the period 1980 to 1990. Just as importantly, it shows how significant the changes in weather are in the analysis of conservation effects.

Changes in Intensity of Electricity and Natural Gas Consumption

The different trends for natural gas and electricity are at least partially explained by changes in the percentage of households equipped with some of the most common electrical appliances and other major end uses (Table 8). This is the "saturation level" for each of these appliances and end uses. Based on data for the 1980 to 1990 period, it appears that the intensity of electricity usage should have increased due to increased saturation levels for three major electrical end uses--space heating, water heating, and central air conditioning. However, this is not observed in the electricity consumption intensity data (Table 7). This suggests that the combined effect of these changes in saturation alone had little measurable impact on total electricity consumption. However, it should be pointed out that the energy efficiency of the entire appliance stock improved during the period, as less efficient older units were replaced by new, more efficient ones. This overall efficiency improvement would have served to decrease consumption per household, contributing to the observed decrease in consumption intensity.

The relatively small changes in saturation levels of natural gas appliances and end uses (Table 9) do not explain the reduction in natural gas consumption intensity. One explanation is the improved energy efficiency of the primary household energy users of natural gas--space heating and water heating. This includes improvements in the energy efficiency of natural gas equipment (furnaces and water heaters), enhancements to building shells where this equipment is installed, and conservation efforts by the people who live in these households.

Table 8. Saturation of Selected U.S. Household Electrical Appliances and End Uses, 1980 to 1990

Appliance/ End Use	Saturation (percent of all households)					Percent Change in Saturation, 1980 to 1990
	1980	1982	1984	1987	1990	
Refrigerator (one)	86	86	88	86	84	-2
Refrigerator (two or more)	14	13	12	14	15	1
Central Air Conditioning	27	28	30	36	39	12
Room Air Conditioning	30	30	30	30	29	-1
Water Heating	32	32	34	35	37	5
Main Space Heating	18	16	17	19	23	5
Color Television	82	85	88	93	96	14
Black and White Television	51	47	43	36	31	-20
Clothes Dryer	47	45	46	51	53	6
Freezer	38	37	37	34	35	-3
Range	54	53	54	57	58	4
Oven	51	53	49	57	59	4
Microwave Oven	14	21	34	61	79	65
Dishwasher	37	36	38	43	45	8
Clothes Washer	75	72	74	76	76	1
Dehumidifier	9	9	9	10	12	3
Waterbed Heater	NA	NA	10	14	15	--
Hot Tub/Spa Heater	NA	NA	<1	1	2	--
Personal Computer	NA	NA	NA	NA	16	--

NA = Data not available.
-- = Data not applicable.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1980, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys (RECS). RECS Public Use Data Files.

Table 9. Saturation of Selected U.S. Household Natural Gas Appliances and End Uses, 1980 to 1990

Appliance/ End Use	Saturation (percent of all households)					Percent Change in Saturation, 1980 to 1990
	1980	1982	1984	1987	1990	
Main Space Heating	55	57	55	55	55	0
Water Heating	54	56	54	54	53	-1
Range	46	47	45	43	34	-10
Oven	40	40	42	41	35	-5
Clothes Dryer	14	15	16	15	16	2

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1980, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys.

Trends in the Efficiency of New Homes: Are They Using More Energy?

New home construction represents one of the most significant sources of change in average household energy efficiency. This section examines trends in new homes built from 1988 to 1990 and compares them to homes built during the 3-year period from 1985 to 1987. These homes (built in 1988, 1989, and 1990) represented only 3 percent of the total housing stock in 1990. The small number of new homes creates more random variation in the data, making it more difficult to interpret the increase in consumption trends for RECS new homes.[17] In general, the end-use intensity of these homes is about the same as that of the homes built in 1985, 1986, and 1987. However, the new homes built in 1988 to 1990 use a different energy source for their space heating and water heating, are larger, and consequently consume more energy than homes built in 1985 to 1987, although they have no decline in intensity on a square foot basis. Additional details on these findings follow.

No Change in Intensity of Energy Consumption in New Homes

For a given location and household size, energy consumption in any home is a function of the characteristics of the structure's shell[18] and of the household equipment used to generate energy services such as heat, air conditioning, hot water, and refrigeration. These characteristics explain why an end use such as space heating may be more energy intensive in a particular home relative to the average in the same weather zone.

Because the RECS is not an engineering study, it is not capable of analyzing the quality of residential building shells. Instead, the focus is on the *energy intensities* of the various household energy services such as space conditioning (i.e., heating and cooling) and water heating. Energy intensity is determined, in part, by the efficiency of the equipment used to provide particular household services that consume energy and also how the equipment is used.

[17]The relatively small number of 1990 RECS observations that correspond to new homes and the clustering of new construction implies that the standard RECS estimates of the average energy consumption for new homes will have relatively large variances. Poststratification techniques can be used to reduce the variances. Additionally, if the estimation of the amount of energy consumed in new homes is an important result of RECS, then the RECS design should include an oversample of new homes where the design of the oversample takes into account the high amount of clustering in new residential construction.

[18]Such as size, insulation, permeability to air leakage, orientation to the sun, and the quality of the windows.

Because accurate data on equipment efficiencies[19] are difficult to collect and do not distinguish the specific usage characteristics of the household, it is necessary to impute energy intensities for the major end uses. The intensity estimates reported in RECS incorporate the effects of the equipment efficiency and other factors such as how the equipment is installed, maintained, and used.

For new homes in the 1990 RECS, energy intensities for space heating, air conditioning, and water heating are essentially the same as for the preceding cohort of homes built from 1985 to 1987 (Table 10). For the same heating degree-days and floorspace, electrically-heated homes built from 1988 to 1990 used 0.70 kWh per heating degree-day per thousand square feet of heated space, statistically the same amount of electricity as homes built from 1985 to 1987 (0.69 kWh). Although the intensities for both electricity and natural gas used for water heating in new homes exceed the intensities for homes built in 1985 to 1987 by a larger margin, the differences are not statistically significant.

Table 10. End-Use Consumption Intensities for Recently Built U.S. Homes, 1990

End-Use Intensity	New Homes (built 1988 to 1990)	Homes Built 1985 to 1987
Number of Homes (million)	2.8	5.1
Main Space Heating		
Electricity (kWh/HDD*1000 square feet)	0.70	0.69
Natural Gas (cubic feet/HDD*1000 square feet)	5.8	6.6
LPG (gallons/HDD*1000 square feet)	0.056	0.060
Electric Air Conditioning		
Central (kWh/CDD*1000 square feet)	0.75	0.82
Room (kWh/CDD*1000 square feet)	0.94	1.04
Main Water Heating		
Electricity (kWh per household member)	1,042	963
Natural Gas (1,000 cubic feet per household member)	9.6	8.2
LPG (gallons per household member)	58	58

Note: See "Glossary" for definition of terms used in this table.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-F of the 1990 Residential Energy Consumption Survey. Tables 18, 33, 34, 36, 37, 38, 41, and 42.

New Homes Consume More Total Energy

Even though energy intensities in the newest homes did not change from the earlier cohort, the total amount of energy consumed in new homes built in 1988 to 1990 was higher than in homes built in the previous 3-year period. The small number of new homes relative to the total number of homes in the RECS sample (3 percent of total homes), however, presents difficulties in interpreting these data.

The 1990 RECS results indicate a reversal of a 10-year trend of declining energy consumption per household in new construction (Figure 7). In 1990, the newest homes consumed 53 percent more total energy than homes built from 1985 to 1987 (an average of 103.1 million Btu of energy compared with an average of 67.6 million Btu for the next newest homes).

[19]RECS made a special effort in 1990 to collect data on the design efficiency of central air-conditioning equipment. See "Potential Efficiency Gains and Energy Savings from Replacing 1990 Stock with 1990 New Appliance Units" later in this section for information on the SEER.

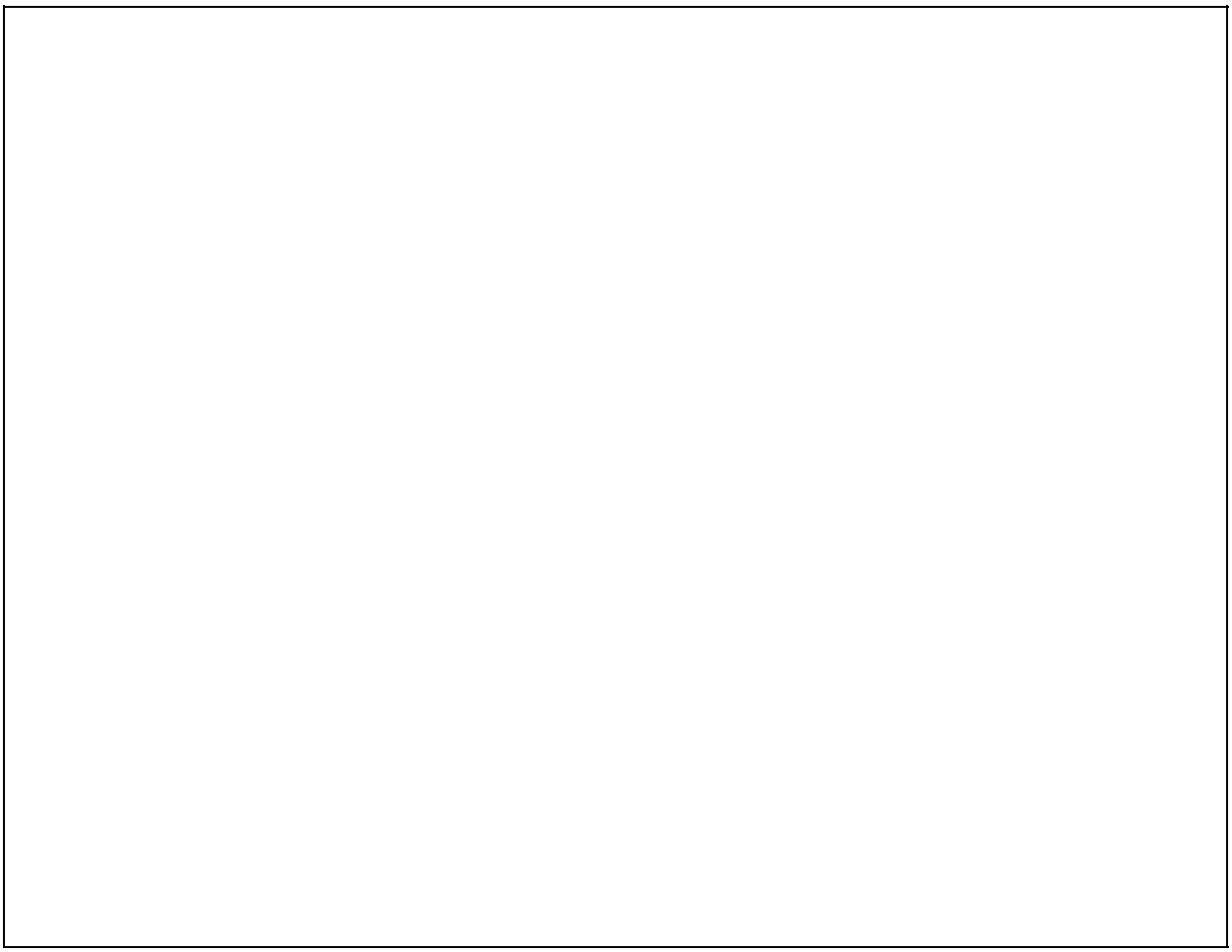


Figure 7

The higher energy consumption in the new homes stems from a combination of actual changes in the housing stock and random variation in the sample. In an attempt to isolate the real effect from the random effects, the RECS sample of new homes was ratio adjusted using other information about new housing.[20] This ratio adjustment was designed to assist the analysis to determine why consumption was higher in new homes. It was used only for adjusting data reported in Tables 11 and 12 of this section. The ratio adjustment removes some of the random effects of a small sample, leaving a clearer picture of the real change (Table 11). The real change is a 28 percent increase in energy consumption for the newest homes--about 20 million Btu per household. Homes built from 1985 to 1987 consumed 70.6 million Btu per household compared to 90.3 million Btu for homes built from 1988 to 1990.[21]

[20]See "Ratio Adjustment Procedures for RECS New Homes Data," in the Section "Data Analyses Background," in Appendix B for details concerning this adjustment.

[21]Poststratification estimation techniques were also used to estimate the mean energy consumption for housing units built from 1985 through 1987, and those from 1988 through 1990. (See Appendix B, "Quality of the Data," for details.) The poststratification technique yielded estimates of 74.5 million Btu for homes built from 1985 through 1990 and 89.7 million Btu for homes built from 1988 through 1990. These results are similar to those obtained from the ratio-adjustment process.

Table 11. Adjustments to Sample of U.S. Homes Built from 1985 to 1990

Statistic	Homes Built 1988-1990		Homes Built 1985-1987	
	RECS	RECS Ratio Adjusted	RECS	RECS Ratio Adjusted
RECS Count of Total New Homes (million)	2.8	2.8	5.1	5.1
Total Consumption (quadrillion Btu)	0.29	0.25	0.34	0.36
Total Consumption per Household (million Btu)	103.1	90.3	67.6	70.6
1990 Annual Heating Degree-Days	4,047	3,655	3,177	3,319
Heated Floorspace (square feet)	2,143	1,849	1,581	1,591
Main Space Heating (million Btu per household)				
Electricity	10.3	9.8	7.9	8.2
Natural Gas	77.8	63.5	59.7	59.1
LPG	39.2	37.5	28.5	29.0
Household End-Use Intensities				
Main Space Heating				
Electricity (kWh/HDD*1000 sq. ft.)	0.70	0.78	0.69	0.68
Natural Gas (cubic feet/HDD*1000 sq. ft.)	5.8	6.4	6.6	6.7
LPG (gallons/HDD*1000 sq. ft.)	0.056	0.076	0.060	0.056
Electric Air Conditioning				
Central (kWh/CDD*1000 sq. ft.)	0.75	0.83	0.82	0.80
Room (kWh/CDD*1000 sq. ft.)	0.94	0.89	1.04	0.99

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, D, E, and F of the 1990 Residential Energy Consumption Survey (RECS). Tables 18, 19, 33, 34, 36, 37, and 38 and RECS Public Use Data Files.

Why Did New Homes Consume More Energy?

The higher energy consumption in new homes built in 1988-1990, compared with homes built in 1985-1987, can be traced to the increased use of natural gas and to larger homes, and the increased level of services in new homes (Table 12).

Proportionately, more new homes built in 1988 to 1990 made use of natural gas for space heating than those in the 1985 to 1987 cohort. A house heated by gas consumes more energy per square foot than one with electric heat (Expenditures per square foot are more similar. See "Comparison of Electricity and Natural Gas" in the previous section). For example, for the same heating degree-days and floorspace, a house with electric heat would use 2.4 Btu per square foot per degree-day while a house with natural gas heat would use 6.0 Btu, a difference of 3.6 Btu (Tables 33 and 34). The net effect of this shift in space heating (and water heating) energy source is to add an additional requirement of 14 million Btu per household, since gas-heated households are more energy intensive than electrically-heated households.

Table 12. Causes of Increased Energy Consumption per U.S. Household, 1990

Causes	Million Btu per Household
1985-1987 Cohort of Household Consumption (RECS ratio adjusted)	70.6
Incremental Effects of	
More Natural Gas	[a]14
Larger Homes	[a]4
More Heating, Less Cooling and More Appliances	[a]2
1988-1990 Cohort of New Household Consumption (RECS ratio adjusted)	[a]90.3

[a]Approximate size of the effects using a method of ratio adjustment for new homes according to Census information. Other methods of using available information would probably produce different estimates of the effect.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey using information on new housing from the U.S. Bureau of the Census.

The larger size of new homes means an increased demand for energy-consuming services such as space heating and cooling. Even at equal rates of efficiency, a larger home always needs more energy to heat or cool. New homes as a group contained more floorspace than older homes, and the subset of new homes that had central air conditioning cooled more space than older homes with central air conditioning.[22] The cumulative effect of the larger conditioned space leads to an incremental requirement of 4 million Btu per household in 1990 over the homes built from 1985 to 1987.

The remaining increment of 2 million Btu per household is attributable to changes in demand for heating and cooling and changes in usage levels of refrigerators and appliances. Factors that distinguish homes built in 1988 to 1990 from the older cohort follows.

- More electricity is used in newest homes for refrigerators simply because these homes have more refrigerators--1.3 refrigerators per household versus 1.1 for homes built in 1985 to 1987 (Table 44). Homeowners may bring a refrigerator they already own to their new house, or the new home may already be equipped with more than one refrigerator.

- More natural gas is used in new homes for appliances because the saturation of natural gas stoves and clothes dryers is greater than in the older cohort of homes (Table 45). In addition, energy intensity tends to be higher for gas appliances than for electrical appliances, even though the efficiencies may be comparable, other factors such as price and location cause gas to be used more intensely.

- The reason for the increase in consumption of electricity for appliances in new homes is less clear (Table 44). Households use appliances that consume electricity for many purposes including cooking, entertainment, fans, waterbed heaters, well pumps, swimming pools, and spas. New homes, however, use less electricity than the older cohort of homes for the common end uses: cooking, clothes washing, and clothes drying since the appliances are new and more energy efficient. More often though, new homes have more of the other end uses, for example, dishwashers, personal computers, waterbed heaters, hot tubs or spas, and well pumps that increase energy usage (See Table 40 in *Housing Characteristics 1990*).

[22]See Table 11 for the increase in floorspace and Table 37 for the increase in cooled floorspace. See "Ratio Adjustment Procedures for RECS New Homes Data" in Appendix B for a discussion of the RECS overestimate for the increase in floorspace. This overestimate probably means that RECS overestimated the increase in cooled floorspace also.

In conclusion, the 10-year decline in energy consumption per household reversed itself with new homes built from 1988 to 1990. The largest factor in the increase in per-household consumption for these new homes is the greater use of gas (natural gas and LPG) and diminished use of electricity for space heating and water heating. Gas is more energy intensive than electricity when measured at the point of use. The increased size of homes was a factor requiring more energy for heating and cooling. Other factors included more appliances and their location in colder climates requiring more heating.

Potential Efficiency Gains and Energy Savings from Replacing 1990 Stock with 1990 New Appliance Units

The energy efficiency of new appliances has improved significantly over the past several years, but these efficiency improvements are not as apparent in the RECS due to the larger number of older appliances still in use. An interesting question is how much energy would be saved if appliances presently being used by consumers were replaced by new, more energy-efficient units. Two hypothetical possibilities were considered: replacing the entire 1990 stock with new (1990) appliances and replacing only those appliances that were at least 10 years old in 1990. The first example is purely hypothetical, since the immediate replacement of the 1990 stock by new units is unlikely. However, this example does provide an upper limit for potential energy savings through replacement of the existing appliance stock. The second example is more plausible, since replacement of the oldest appliances in the 1990 stock can be expected over the next few years.

The National Appliance Energy Conservation Act (NAECA) of 1987 mandated minimum energy efficiency standards for several types of household appliances and equipment.[23] This followed the earlier voluntary appliance efficiency targets of the Energy Policy and Conservation Act (EPCA) of 1975 and various state appliance efficiency standards. In response to these various standards, manufacturers have significantly improved the energy efficiency of household appliances over the past 20 years.

Using the 1990 RECS data, it is possible to estimate the magnitude of efficiency improvements and savings that would have been obtained if the 1990 appliance stock[24] had been replaced by new units. The analysis shows there would have been significant efficiency gains for each appliance type and a significant savings in the total consumption of energy (Table 13 and Figures 8 and 9). If the entire 1990 stock were replaced by new units, as much as 835.7 trillion Btu per year would be saved.

The estimated 1990 average stock efficiency of each appliance is given in the first column of Table 13. For example, the 1990 stock average residential freezer efficiency is estimated to be 114.5 (relative to 1972=100). This means it is 14.5 percent more efficient than a new freezer bought in 1972. Comparing this with the new freezer efficiency of 194.7 for 1990 means that it is 94.7 percent more efficient than one sold in 1972.

[23]Covered products under NAECA: refrigerator-freezers, freezers, room air conditioners, heat pumps, electric and natural gas water heaters, furnaces, dishwashers, clothes washers, clothes dryers, direct heating equipment, kitchen ranges and ovens, pool heaters, television sets, and fluorescent lamp ballasts.

[24]The mix of different ages of units that comprise the units in use in the given year.

Table 13. Potential Efficiency Gains and Energy Savings of Replacing Existing 1990 Stock with 1990 New Appliance Units in the United States, 1990

Appliance/ Equipment	Existing 1990 Stock Efficiency (1972=100)	1990 Consumption (Trillion Btu)	Entire Existing 1990 Stock Replaced with 1990 New Appliance Units			Existing Stock 10 Years and Older Replaced with 1990 New Appliance Units		
			Efficiency (1972=100)	Efficiency Gain	Energy Savings (Trillion Btu)	Efficiency (1972=100)	Efficiency Gain	Energy Savings (Trillion Btu)
Freezer	114.5	160.0	194.7	70.0%	112.0	182.3	59.2%	94.7
Refrigerator (most-used)	127.6	414.1	212.2	66.3%	274.5	191.8	50.3%	208.3
Room Air Conditioner	117.2	90.4	146.0	24.6%	22.2	135.2	15.4%	13.9
Central Air Conditioner	115.0	386.1	139.8	21.6%	83.4	134.8	17.2%	66.4
Heat Pump	121.2	65.3	145.1	19.7%	12.9	134.4	10.9%	7.1
Natural Gas Furnace	106.1	2,345.3	121.1	14.1%	330.7	118.8	12.0%	281.4
Total Potential Energy Savings					**835.7**			**671.8**

Sources: Energy Information Administration, Office of Energy Markets and End Use, *Housing Characteristics 1990*, DOE/EIA-0314(90), Table 7; Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey. Tables 19, 33, 34, 37, and 44; J. McMahon, Lawrence Berkeley Laboratory, unpublished data.

In an analysis that assumed appliances that were at least 10 years old in 1990 were replaced by new appliances:

- The largest potential efficiency gains were for freezers (59.2 percent) and refrigerators (50.3 percent).
- The potential efficiency gains for other appliances ranged from 10.9 percent to 15.4 percent.
- The potential energy savings for each appliance were significant, from 7.1 trillion Btu per year for heat pumps to as much as 281.4 trillion Btu per year for natural gas furnaces.
- Energy savings for the six appliances considered could have totaled as much as 671.8 trillion Btu per year, an amount equal to 7.3 percent of the total energy consumed by all residential end uses in 1990.

Based on an examination of the average stock in 1990, most appliances have improved about 15 to 20 percent, with the refrigerator standing out as the most improved and the conventional gas furnace as the least improved.

One considerable caveat is that these calculations implicitly assume the usage characteristics of older appliances are comparable to those for newer appliances. Although such an assumption would obviously not be true for some energy uses such as automobiles, it is probably a reasonable assumption for residential appliances. Another more significant assumption in these calculations is that the average size of appliances does not change with vintage. This is not true for refrigerators and freezers, whose sizes have both increased considerably since 1972. A third assumption is that older appliances work as well as they were intended. For many appliances this is not true. A fourth, and very important, assumption is that all replaced units were scrapped and not used again.

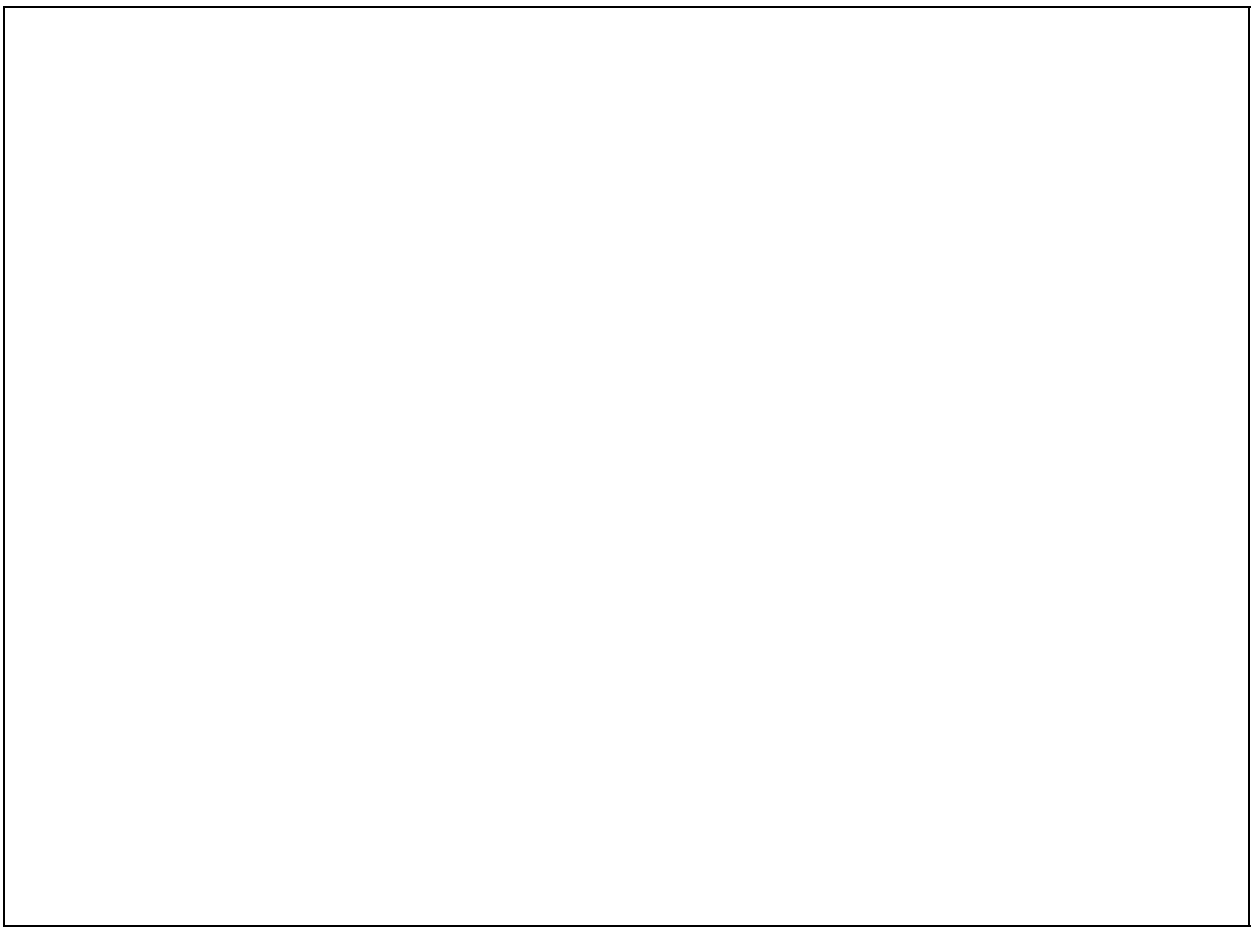


Figure 8

Analysis of RECS Age Data and Appliance Efficiency Data

The potential impacts of efficiency improvements on the 1990 stock considered two factors: the energy efficiency of new 1990 appliances and the efficiency of the existing stock in 1990. The analysis used available energy efficiency data from manufacturers for refrigerators, freezers, room air conditioners, central air conditioners, natural gas furnaces, and heat pumps. These data were fairly complete because manufacturers of appliances covered by NAECA and EPCA have been required to test their appliances for energy efficiency under DOE-specified testing procedures since 1978. For each model year, the manufacturers calculate the average efficiency, or shipment weighted energy factor.[25]

Details of the calculation of the 1990 stock efficiencies appear in Appendix B, "Quality of the Data." New model appliance efficiency data are available for the period 1972 to 1990, and Table 7 in the *Housing Characteristics 1990* provides information on the age distribution of the existing stock of appliances in 1990. The age distribution of the stock is given in the form of age ranges (e.g., less than 2 years, 2 to 4 years, etc.), rather than by individual year. The 1990 stock efficiency for each appliance was found by weighting the average new model efficiency of each age range by the proportion of units in that age range. The average efficiency is best estimated by computing the energy consumption by each age grouping of the appliances and dividing the result by the number of appliances.

[25]The shipment weighted energy factor is the average efficiency of appliances shipped during the model year, weighted according to the number of units shipped in each efficiency class.

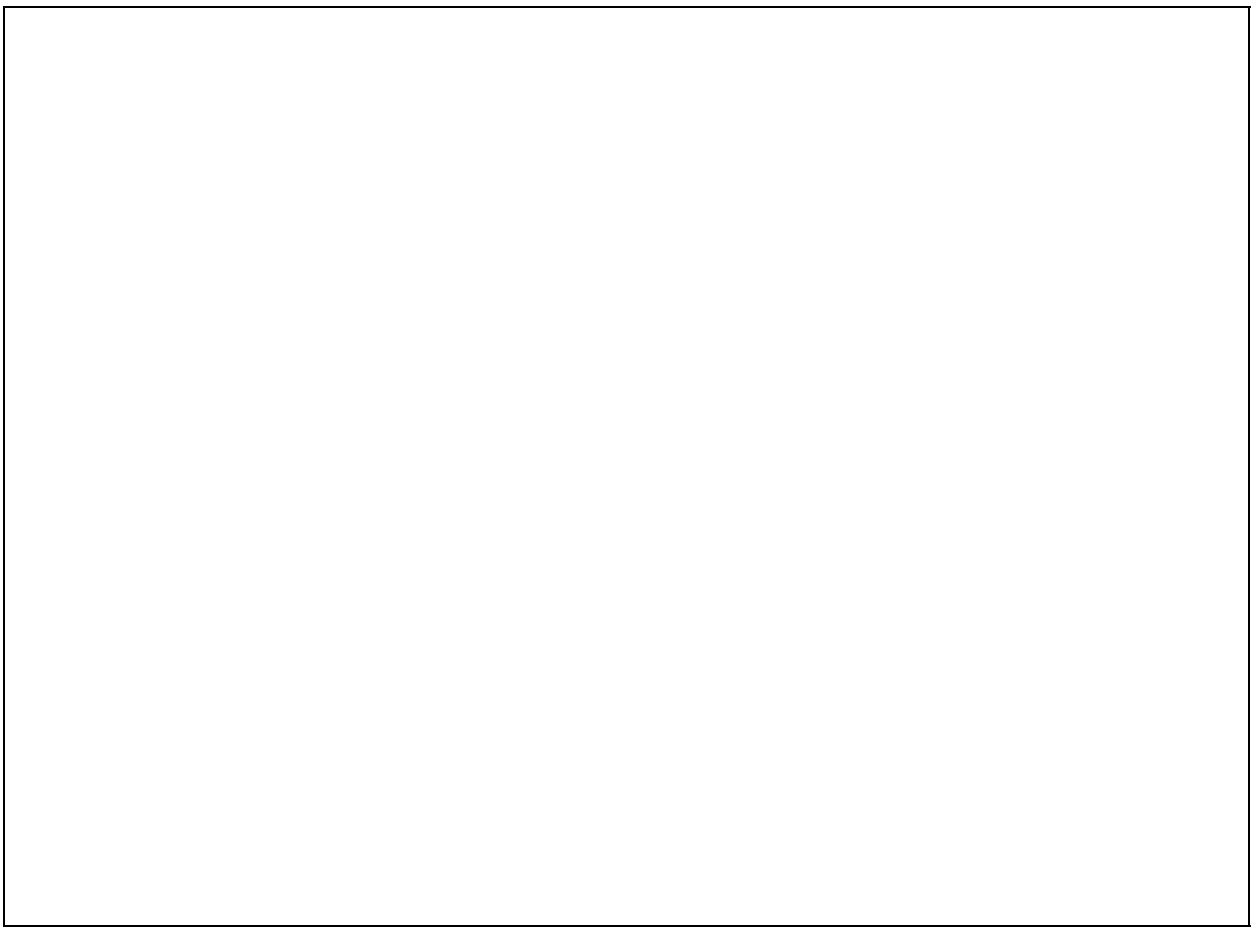


Figure 9

This approach has the effect of correctly aggregating the efficiencies and also emphasizing the assumption that usage characteristics of each age grouping of appliances do not change with age.

An interesting property of this calculation is that it is the least efficient, older units that dominate the usage and thus depress the average efficiency, rather than the larger number of newer and more efficient units. Computed this way, the average efficiency is always lower than the (incorrect) simple weighting of the efficiencies. Table 13 summarizes the potential efficiency gains and energy savings that would have resulted in 1990 if the existing stock of these appliances had been replaced with new units available at that time. The efficiency of the stock composed of a mix of existing 1990 stock and new units was found by substituting new unit efficiencies in the calculation for units that were at least 10 years old in 1990.

The potential efficiency gain and the potential energy savings are derived as follows:

$$\text{potential efficiency gain} = \frac{\text{Replaced stock efficiency - existing 1990 stock efficiency}}{\text{existing 1990 stock efficiency}}$$

$$\text{potential energy savings} = \text{1990 consumption} \times \text{potential efficiency gain}$$

The calculated 1990 stock efficiency overestimates the average efficiency of the stock because it does not take into consideration the decline in efficiency of units as they age, due to the aging of the appliances, lack of proper maintenance by the owner, or both.

For all six appliances, the potential efficiency gains from replacing older, less efficient units with new, more efficient ones are significant, whether the entire stock was replaced or whether only the older part of the stock was replaced. Assuming the efficiency gains could be translated directly to a reduction in energy used, the potential savings per appliance becomes a function of potential efficiency gain and the amount of energy consumed during 1990. On this basis, the combined sum of the energy savings for the six appliances, by replacement of units at least 10 years old, is 671.8 trillion Btu, an impressive 7.3 percent of the total amount of energy consumed by all residential end uses in 1990. Another way of looking at the energy savings is in terms of consumption of electricity and natural gas. The appliances that consume electricity, combined, would save 390.4 trillion Btu, or 114.4 billion kWh. Natural gas furnaces would save 281.4 trillion Btu, equivalent to 274.0 million cubic feet of natural gas. If the entire stock were replaced, the energy savings would total 835.7 trillion Btu, 9.1 percent of total consumption. The appliances that use electricity would save 505.0 trillion Btu, or 148.0 billion kWh. Natural gas furnaces would save 330.7 trillion Btu, or 322.0 million cubic feet of natural gas. Clearly, the replacement of older, less efficient household appliance stock can make a major contribution to the overall reduction of energy consumption in the United States.

Comparison of 1990 RECS Appliance Nameplate Data and Manufacturers' Shipment Weighted Energy Factor Data

The preceding analysis used RECS data on the age of appliances along with manufacturers' new model efficiency data to calculate stock efficiencies of appliances. An alternative approach is possible for central air- conditioning units. As part of the 1990 RECS, energy efficiency data were collected from the manufacturers' nameplates on central air-conditioning units of 331 of the 1,820 survey respondents who had such units. (See Appendix B, "Air-Conditioner Nameplate Data Collection.") These data provide direct information on the efficiency of air-conditioning units in the 1990 stock. The efficiency rating for the air-conditioning units is given as a seasonal energy efficiency ratio, or SEER,[26] which is an industry standard. These data were matched with the ages of the units to give the age distributions of the efficiencies. The data were then compared with manufacturers' shipment weighted energy factor data, which were grouped into the same age categories.

The efficiencies are very comparable for the three most recent age categories, but not as close for the oldest category (Table 14). This discrepancy may be due to the fact that the two samples are not identical. The nameplate data are a small portion of the RECS sample, whereas the manufacturers' shipment weighted data are based on all appliance shipments, both residential and nonresidential. Nevertheless, there is an overall consistency between the two sets of data. The collection of nameplate data in future RECS would provide a way to directly acquire efficiency data about the existing stock of residential appliances. However, the reasonably close correlation between the nameplate efficiency data and the more easily collected age data suggests that it is not worth the additional effort and cost.

[26]The Seasonal Energy Efficiency Ratio is the cooling output divided by the power input for an average U.S. climate.

Table 14. Comparison of Seasonal Energy Efficiency Ratios from 1990 RECS Appliance Nameplate Data and Manufacturers' Shipment Weighted Energy Factor Data in the United States

SEER Data Source	Age Category			
	Fewer Than 2 Years	2 to 4 Years	5 to 9 Years	10 Years or More
RECS Nameplate Sample	9.51	9.09	8.31	7.60
Manufacturers' Shipment Weighted Energy Factor	9.28	8.98	8.38	5.90

Sources: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 A of the 1990 Residential Energy Consumption Survey (RECS), RECS Public Use Data Files; U.S. Department of Energy, Office of Policy, Planning and Analysis and Office of Conservation and Renewable Energy, *Energy Conservation Trends,* DOE/PE-0092; J. McMahon, Lawrence Berkeley Laboratory, unpublished data.

Demand-Side Management: Do Participants Consume Less Electricity?

Demand-Side Management (DSM)[27] programs run by electric utility companies offer consumers incentives to reduce peak-demand growth or to reduce electrical energy consumption.[28] The RECS has traditionally included questions about household participation in a broad range of programs sponsored by utilities, but the 1990 RECS was the first to specifically address DSM programs.

The 1990 RECS asked respondents if they had participated in any DSM program sponsored by their utility in the past year. The responses to this question provide the first overview of household participation in DSM and the potential future impacts of DSM participation.

Most (if not all) DSM participants volunteer for the program and, therefore, tend to be inherently more cost- or energy-conscious than the general population. This fact implies that any difference between the average energy consumption of DSM participants and nonparticipants cannot be solely attributed to the effect of the DSM program. Some of the difference is an effect of the inherent cost of energy or the energy consciousness of the volunteers. In order to study the effect of DSM programs, it would be more appropriate to compare the energy consumption of the DSM participants before and after they entered the DSM program. This is not yet possible with this RECS survey, because similar questions were not asked in past surveys. This section discusses the differences between participants and nonparticipants. The differences in the characteristics of the households are discussed as well as the differences in the energy consumption. In order to clarify the discussion, the comparisons of DSM participants and nonparticipants presented below are restricted to households whose utility offered a DSM program. Of the 64.4 million single-family households nationally, 45.8 million households were served by electric utilities that had DSM programs (Table 15).

Summary of Results

Intensive household users[29] of electricity that participated in DSM programs used significantly less electricity for main space heating and cooling than households that did not participate.[30] Participation in DSM programs, however, does not appear to be the main reason for this finding. Other household attributes tend to account for the differences in consumption patterns between participants and nonparticipants.

DSM participants tend to be older, relatively more affluent, and better educated than nonparticipants, and are more likely to be homeowners and live in a newer home. They also tend to conserve energy by taking active conservation measures. Households with these characteristics would usually be expected to consume less electricity, even before taking into account the effects of any efficiency enhancements from the DSM program.

[27]DSM programs encompass more than just conservation-related activity. They also include peak-demand shaving, load shifting, and judicious choice of load growth. The intent is to make more efficient use of utility investments and to balance these against corresponding investments in consumer conservation. For an overview of DSM, see "EIA Statistics on Electric Utility Demand-Side Management" in the September 1992 issue of *Monthly Energy Review*, DOE/EIA-0035(92/09) and "Electric Utility Demand-Side Management," *Electric Power Annual 1991*, DOE/EIA-0348 (due to be published February 1993).

[28]Although DSM programs are offered by gas and electric utility companies, this analysis is restricted to only electric utilities companies.

[29]An intensive user uses electricity for main space heat, main water heat, and/or central air conditioning.

[30]Nonparticipant households in this analysis were only those households whose utilities had reported a DSM program on Schedule V of their 1990 filing of Form EIA-861, "Annual Electric Utility Report." DSM-participant households were those households in the RECS who reported that they had participated.

Table 15. U.S. Single-Family Potential and Actual Participation in Demand-Side Management Programs, 1990

Characteristics	Total Households (million)	DSM Potential Households (million)	DSM Actual Participants (million)	DSM Actual Participants with Intensive[a] Use of Electricity (million)	DSM Nonparticipants with Intensive[a] Use of Electricity (million)
Households	64.4	45.8	3.9	3.0	25.9
Census Region					
Northeast	11.9	10.1	.8	.4	3.9
Midwest	16.0	10.7	.8	.5	6.3
South	23.7	15.4	1.5	1.4	11.1
West	12.7	9.7	.8	.6	4.5

[a]An intensive user uses electricity for main space heat, main water heat, and/or central air conditioning.

Notes: Potential households could participate in DSM since their electric utilities offered a DSM program. Actual participants have participated in a DSM program. Nonparticipants could have participated but did not participate.

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1990 Residential Energy Consumption Survey (RECS), RECS Public Use Data Files; Office of Coal, Nuclear, Electric and Alternate Fuels, Form EIA-861, "1990 Annual Electric Utility Report."

Although DSM programs do save energy, they reach only a relatively small percentage of U.S. households (roughly 5 to 10 percent). RECS data indicate there are more than 26 million single-family households that are intensive users of electricity but do not yet participate in existing DSM programs for which they are eligible. The effectiveness of DSM programs could therefore be improved significantly with increases in participation rates for households with access to utility-sponsored DSM programs.

Electric Utility and Household Perspectives on DSM Participation

In addition to the RECS, which collects data from household energy users, EIA also collects data from electric utilities on their DSM activities. Schedule V of Form EIA-861, "Annual Electric Utility Report,"[31] asks utilities if they have a DSM program. By cross-referencing RECS utility information against data from the Form EIA-861, it was possible to identify which RECS households were served by a utility that had offered a DSM program. With this information, it was possible to assess actual participation relative to the total potential participation in DSM programs, excluding RECS households that did not participate simply because no DSM program was offered by their electric utility company.

Participation in DSM programs is voluntary. Most participants find out about the program from either an insert in the household utility bill or utility advertisements. The 1990 RECS identified the following types of DSM programs:

- **A rebate to buy a more energy-efficient appliance such as a heat pump or air conditioner.** More efficient appliances are more expensive than those that meet the minimum federal efficiency standards. Consumers, however, tend to buy the cheapest (and, consequently, least efficient) model available, according to industry sales statistics. Rebate programs are designed to change this behavior by reducing the net cost differential between the more efficient and less efficient model.

- **A load-control device on a household appliance such as a water heater or air conditioner.** Devices

[31]Although the two surveys serve different purposes and cover different populations, they overlap on one aspect -- the provision of (on Form EIA-861) and the receipt of (on Form EIA-457 A) DSM program services.

installed on the appliance by the utility switch the unit off during peak periods, delaying electricity demand to an off-peak period. This process may result in a small reduction in electricity consumption.

- **A utility-sponsored energy audit of the housing unit.** Energy audits determine the most economical means of reducing energy consumption in a particular household.

- **Other utility-sponsored conservation programs such as window caulking or insulation in walls or attics.** These programs are designed to reduce electricity and energy consumption.

Based on responses to the RECS from all types of households, approximately 4.6 million households participated in at least one DSM program in 1990. Of the 4.6 million participating households, 1.2 million obtained rebates, 1.6 million had accepted load-control devices, 1.1 million had energy audits of their homes, and 1.3 million were involved in some other type of utility-sponsored conservation activity.[32] Some households participated in more than one type of program.

Although these programs will save energy and consumer energy expenses, studies indicate the savings will probably be less than projected from engineering data.[33] What will make the biggest difference in the long run is the cumulative effect of DSM programs over time, as conservation investments made in earlier years continue to reduce consumption in the current year (and in each succeeding year). Even though only 7 percent of the eligible households participated in 1990, the cumulative effect of the increasing number of participants over time suggests that annual electricity savings will become progressively larger.

Based on utility responses to survey Form EIA-861,[34] more than one-fourth of the utilities (872 of 3,250) ran a DSM program in 1990. The largest utilities were somewhat more likely to run DSM programs, with 30 percent (363 of 1,194) offering such a program in 1990. The very largest almost always offered DSM programs.[35] These largest utilities estimated that their DSM programs have reduced peak demand by 4.9 percent and reduced delivered electricity by 0.6 percent.

Comparisons of these utility-reported energy savings with RECS data are not possible because the small sample size does not allow RECS results to realistically distinguish an energy saving in electricity as small as 0.6 percent. Residential savings may be even smaller, since the 0.6-percent savings reported by the electric utilities also include DSM savings by commercial and industrial customers.

The following analysis focuses on single-family housing units, which represent about 85 percent of all DSM participants. Excluded are households living in multifamily structures or mobile homes, as well as renters (who typically do not know whether their landlord participated in DSM). According to the RECS, 3.9 million single-family households participated in a DSM program in 1990. These households represent 9 percent of the 45.8 million potential single-family households in the RECS sample (Table 15). Potential participation and actual participation varied among the Census regions. The potential participation varied from 85 percent in the Northeast to 65 percent in the South. Actual participation varied from 7 percent of the potential households in the Midwest to 10 percent of the potential households in the South (Figure 10).

[32]Table 41, Conservation by Census Region and Urban Status, Million U.S. Households, 1990 in the *Housing Characteristics 1990*, DOE/EIA-0314(90).

[33]See "Comparing Engineering Estimates to Measured Savings: One Utility's Experience" in *ACEEE 1992 Summer Study on Energy Efficiency in Buildings*, Vol. 7, pp. 109-120.

[34]See, for example, "Electric Utility DSM Programs Through the Year 2000," Eric Hirst, *Public Utility Fortnightly*, August 1992, p. 13. Estimates of savings are engineering-based and vary by utility. Also, Energy Information Administration, *"Electric Utility Demand-Side Management," Electric Power Monthly*, DOE/EIA-0226 (92/04) (Washington, DC, April 1992) p. 19.

[35]69 percent of all single-family households were served by utilities that had DSM programs.

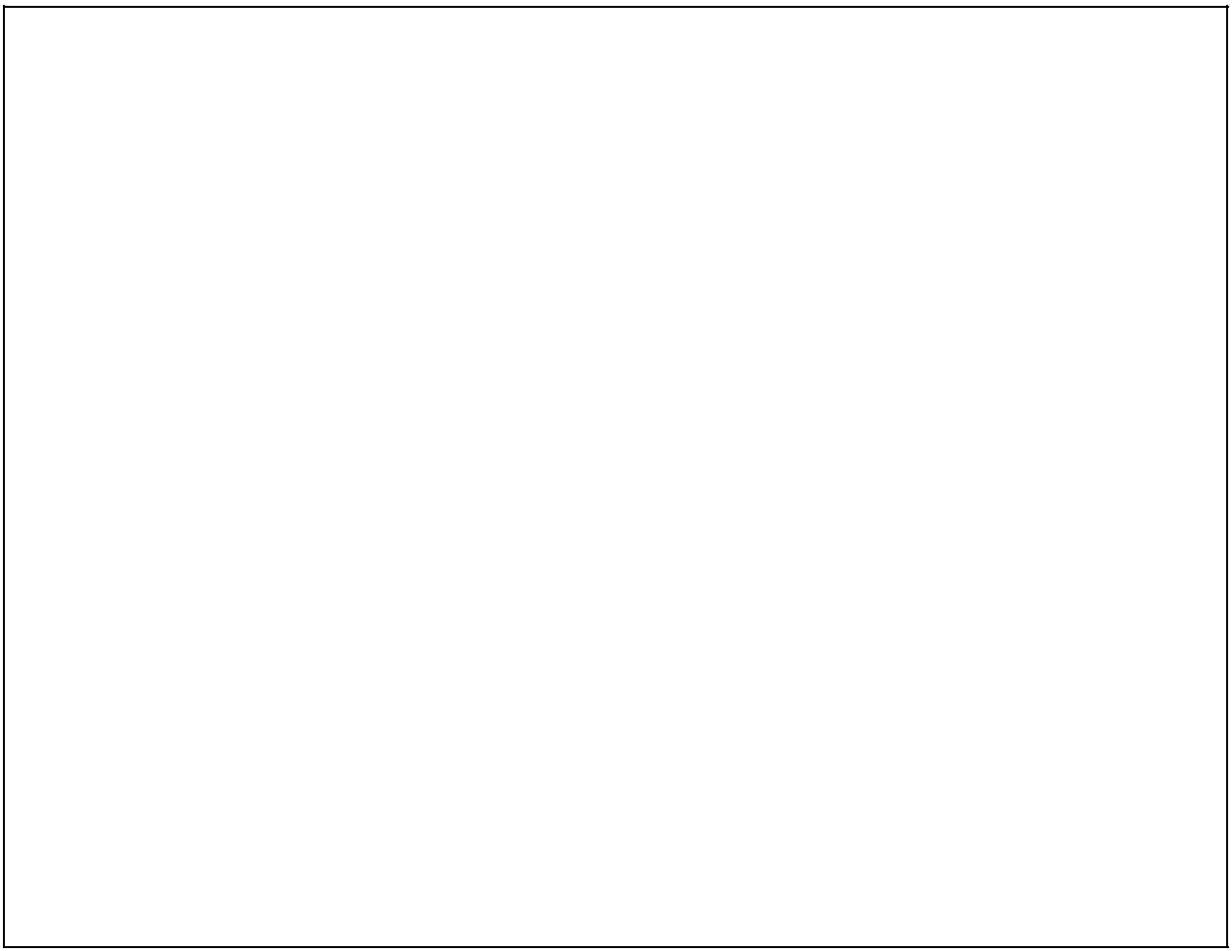


Figure 10.

Of the 3.9 million participating households in single-family homes, 0.9 million obtained rebates, 1.5 million participated in some type of load control, 1.0 million obtained energy audits, and 1.1 million undertook some other type of conservation measure (Figure 11). Some participated in more than one type of program.

Comparing Consumption by DSM Participants and Nonparticipants

Do DSM participants[36] use less electricity than nonparticipants? If one ignores the fact that participants are more likely to use electricity for space heating and water heating, then participants do not use less electricity than nonparticipants. But if one just looks at the consumption of electricity for space heating among households that use electricity for the main space-heating fuel, then participants do use less electricity for space heating than nonparticipants. Similarly, if one just looks at the consumption of electricity for air conditioning among households that use central air-conditioning systems, then participants do use less. Finally, an examination of conditional end-use intensities indicates that, for most end uses, participants also use energy less intensively than nonparticipants. If the DSM programs are effective, the answer clearly ought to be a definitive yes. The following analysis confirms that DSM participants do use less, but with strong qualifications as to whether this is due to participation.

[36]In each case, restricting the population to single-family households who could participate because their utility offered a DSM program.

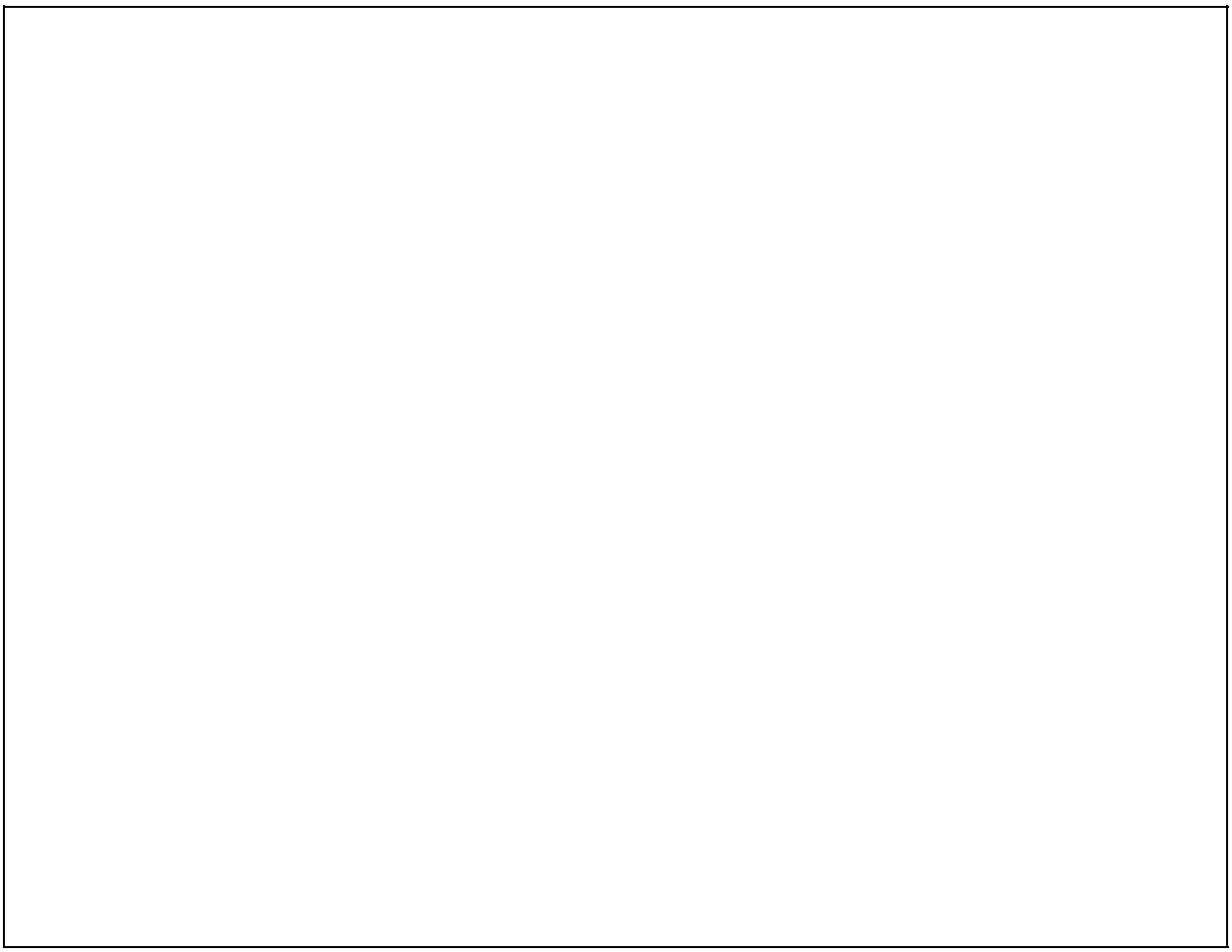


Figure 12.
An examination of average energy consumption and expenditures for intensive electricity users reveals that DSM participants do, on average, use less electricity than nonparticipants. Similarly, an examination of conditional end-use intensities indicate that, for most end uses, participants also use energy less intensively than nonparticipants. (See box on page 12 for a definition of conditional end-use intensity.)

Figure 12 provides four different averages of electricity consumption. These averages represent groupings of electricity consumption for households selected according to whether they use electricity for any purpose,[37] main space heating, for central cooling, or for water heating. These groupings overlap since households typically use electricity for more than one end use. For each end-use grouping, the consumption presented is for that end-use only and not for other electricity that is used in the household[38].

- DSM participants used significantly less electricity than nonparticipants in households that used electricity for main space heating and also in households that used electricity for central air conditioning.

[37]This group would include households that used electricity only for lighting.

[38]Average for the electricity used for "Main Space Heating" is calculated over just those households that use electricity as a main space-heating energy source. This pertains also to the calculations of the averages for the electricity used for "Central Air Conditioning" and "Main Water Heating."

- DSM participants in households that used electricity at least for water heating also used less electricity than nonparticipants in this group, but the results are not statistically significant.

- In the broadest category (households that used electricity for any purpose), there is no statistical difference in electricity consumption between DSM participants and nonparticipants.

The final grouping includes a much larger population of users than the other two. In households that use electricity for any use, average consumption is also lower because this grouping includes many households with only a few uses for electricity. The increasing advantage of DSM participation as the level of electricity use increases is not surprising. Because heavy users of electricity receive larger electricity bills, they probably are more responsive to advertising for DSM programs that could save them money.

Another traditional and perhaps more useful method of examining energy consumption for space heat and air conditioning is the **conditional end-use intensity** (CEUI) referred to earlier. This is the average per-household electricity consumption for an end use based only on households that actually use energy for that particular purpose. The measure is conditional in that it includes households only on the condition that they have and use a particular appliance or equipment. The intensity is calculated on a per degree-day basis, either per

square foot or per household member in the case of water heating. This minimizes any distorting effects of differences in house size or weather. Generally, the lower the intensity of electricity per household, the more energy efficient is the household.

The results of comparisons of DSM participants and nonparticipants on the basis of CEUI measures for electric main space heat and air conditioning are as follows:

- **The electric space-heating intensity for DSM participants was significantly less than that for nonparticipants.** The average electric space-heating intensity for households participating in DSM programs was 0.72 kWh per heating degree-day per thousand square feet, compared to 0.94 kWh for nonparticipants.

- **The electric central air-conditioning intensity was significantly lower for DSM participants than for nonparticipants.** The central air conditioning CEUI was 0.77 kWh per cooling degree-day per thousand square feet for participants, compared to 1.04 kWh for nonparticipants.

- **The electric water-heating intensity was also significantly lower for DSM participants than that for nonparticipants.** Consumption of hot water increases logarithmically with the number of household members, and the CEUI for water heating corrects for the average size of households. Electricity consumption for water heating was 1,074 kWh per household member in DSM-participating households, compared to 1,108 kWh per household member in nonparticipating households.

In summary, after correcting for the physical characteristics of the household that affects consumption (size of house, climate, and number of household members), DSM users tend to use less electricity than non-DSM users for the most intensive uses.

What Are the Household Savings Due to DSM Programs?

At the present time it is difficult, using RECS data, to separate the actual effects of DSM programs from the effects resulting from the fact that households select themselves for DSM programs. Quantifying the actual savings and the savings attributed to self-selection bias is even more difficult, if not impossible. Traditional methods of evaluating DSM savings at the national level are permeated with obstacles. Obstacles include the cost and impracticality of metering the electricity used by a household before and after DSM participation or obtaining individual engineering estimates. RECS does not have pre- and post-DSM consumption data, nor are there any established control groups against which the DSM households can be compared. At the present time, it can only be assumed intuitively that some of the savings are due to the DSM programs for the simple reason that if a household obtains a rebate for a new air conditioner, that household should be using less electricity due to the higher efficiency of the new unit. It is possible, however, to detail the differences in the characteristics of DSM participants and nonparticipants, which provide the rationale for some of the consumption differences.

Comparing the Characteristics of DSM Participants and Nonparticipants

On the basis of the CEUI findings (reported earlier), the energy savings for households participating in DSM programs appear significant. Yet from the perspective of electric utilities, DSM programs seem to do more to reduce peak loads than to reduce the total consumption of electricity.[39] The likely explanation for this different conclusion about the effectiveness of DSM programs is the difference in the characteristics of DSM participants and nonparticipants. DSM programs appeal more to households that are already efficient users of energy than to those that use energy inefficiently. Therefore, any comparison of DSM participants with nonparticipants needs to point out that while some DSM actions do produce reductions in energy usage and expenditures, DSM participants tend

[39]Savings in the aggregate would appear small when only 7 percent participate, but may appear large if only DSM households are considered.

to be more efficient anyway.

An analysis of end-use demand using a conditional demand analysis (CDA) methodology (See Appendix D, "End-Use Estimation Methodology") found that participation in a DSM program was not significant in explaining electricity consumption for most specific services such as air conditioning or water heating. A preliminary analysis did find DSM significant in explaining electricity consumption for electric space heat. In this analysis, DSM participation may have acted as a surrogate for efficiency in the same manner the age of heating equipment acts as a surrogate for efficiency. In general, households with similar characteristics display similar consumption patterns, independently of whether they participate in a DSM program.

Comparisons of the characteristics of DSM participants and nonparticipants highlight the effects resulting from the fact that households select themselves for DSM programs. The first volume of the 1990 RECS results, *Housing Characteristics 1990*, compared DSM participants with nonparticipants living in single-family or mobile homes. DSM houses were more likely[40] to be newer and consequently larger than non-DSM houses, and also more likely to be owned than rented. Householders who participated in DSM programs were more likely to be middle aged and better educated, have a higher income, and consequently buy a newer house.

By restricting the analysis to electric-intensive households (those that use electricity for their principal source of space conditioning or water heating), it is possible to illustrate the effects of these differences in characteristics between DSM participants and nonparticipants (Figure 13). Of these intensive users of electricity, a larger number of DSM participants than nonparticipants lived in newer homes (1980 or later) and also owned their homes. In addition, 65 percent of DSM householders have at least 1 year of college. There is also a larger number of DSM participants than nonparticipants in the higher income groups.

Energy intensity data for all households in the general population using electricity for main space heat (Table 33) and for central air conditioning (Table 37) may be used to analyze the characteristics that are common in the DSM households described above.

For all households in the RECS:

- Higher income households have lower electricity space-heating and central air-conditioning intensities than households in the lower income groups.
- More highly educated householders have lower electricity space-heating and air-conditioning intensities than those with less education.
- Newer homes have lower electricity space-heating and central air-conditioning intensities than older homes.
- Homeowners have lower electricity space-heating and central air-conditioning intensities than renters.

A problem for each of these comparisons is the correlation of income and education with newer or better construction, higher consumption levels, and lower consumption intensities (which tend to decrease with consumption levels). Thus income and education correlate with higher efficiency.

Figure 13.

[40]The emphasis should be on *more likely to be*, because the DSM programs do enjoy broad coverage.

There is also a correlation between DSM households and households that actively participate in conservation programs (Figures 14 and 15). DSM participants are likely to reduce their thermostat temperature at night or before they leave their homes, tune up their heating equipment, and have weather stripping and caulking in their homes. Many more have water-heater blankets, storm doors, and storm windows. Because the survey did not ask whether or not these actions were a result of the DSM program, it is not possible to determine whether the conservation behavior of DSM participants is due to the DSM programs or to the fact that these households are energy conservers by nature. DSM participants and nonparticipants do not seem to differ in the percentage of households having insulation characteristics, such as wall or attic insulation, that could have been present upon home purchase and is more difficult to add to or replace (Figure 15).

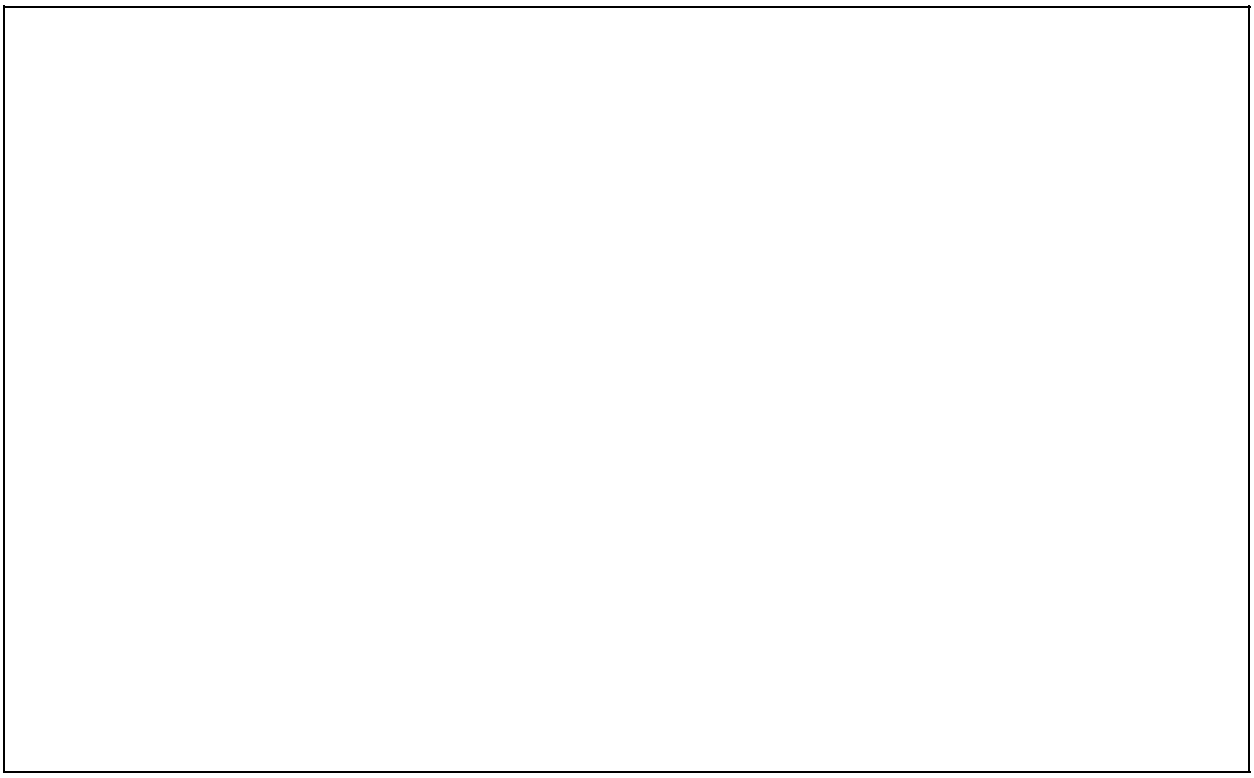


Figure 14.

DSM Reduces Peak Loads--Could DSM Save More Energy?

The assessment of the utility industry is that DSM can reduce peak loads significantly more than it can generate a reduction of the total consumption of electricity (The first electric utility-wide study indicates 4.9 percent peak-load reduction versus 0.6 percent savings for all sectors as noted earlier in this analysis). This seems to follow from the fact that most DSM participants are more efficient. However, RECS data also suggest a significant opportunity to extend DSM programs to a broader base of residential consumers. In areas already served by a utility-sponsored DSM program, large numbers of households do not yet participate. For single-family households using electricity for main space heat, main water heat, and/or central air conditioning, the number of eligible households that do not yet participate in a DSM program is estimated to total at least 26 million. These 26 million nonparticipants all used significantly more electricity than their DSM counterparts.

The current population of DSM participants apparently were self-selected from already more energy-efficient households. The 26 million nonparticipants, however, are likely to be less energy efficient and, therefore, likely to realize more significant energy savings if they were to enter a DSM program. As reported above, these include households with lower education and/or income levels and those living in older homes--all of

whom seem to be underrepresented in the current population of DSM participants. These nonparticipants include intensive users of electricity whose households are not very energy efficient.

Industry perspectives on DSM programs may not fully recognize the magnitude of these potential savings due to lack of data at an appropriate level of detail. The average electric utility does not have the type of data on household characteristics and efficiency that would permit an in-depth examination such as that provided by the RECS at the national level.

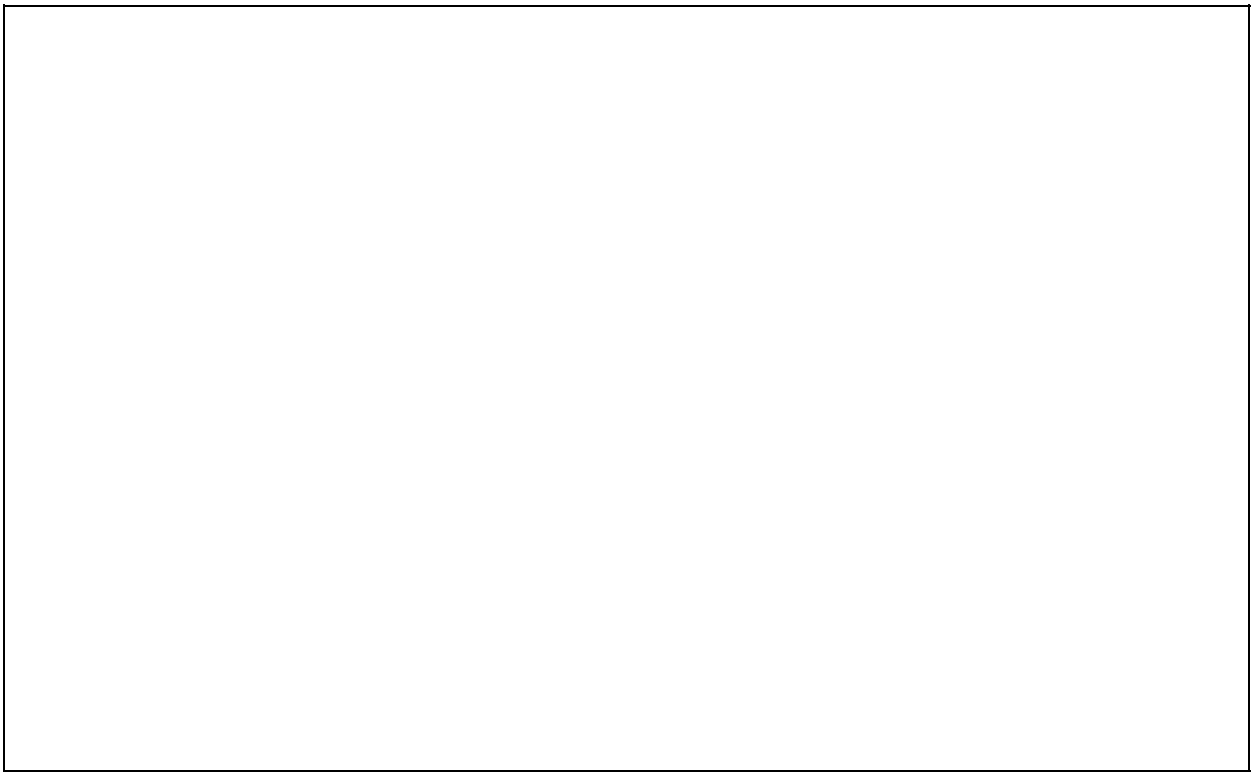


Figure 15

The Average Energy-Consuming Household

The RECS, covering over 5,000 sampled households and representing 94 million households, generates a snapshot of energy consumption for families of all sizes, all ethnic backgrounds, all incomes, living in climates and locations as varied as Florida to Alaska. In general, the typical household is an urban, single-family detached home.

Basic Household Information

There are More Two-Person Households than Any Other Size

Of 94 million households, there are 23.4 million one-person, 30.6 million two-person and 15.8 million three-person households (Figure 16). While the average household is typically headed by a white male whose average age is 47 years, there are 26.6 million households whose head is 60 years or older and 5.8 million households whose head is younger than 25. RECS found 80 percent of the householders to be white, 11 percent black, 3 percent other. Hispanics made up 6 percent.

Hot water, washing, and drying all depend upon household size. In particular, hot water consumption requires an average of 17.8 million Btu per household, but 10.5 million Btu for a one-person household and 28.6 million Btu for households with at least 6 persons.

Average Family Household Income in the U.S. is $34,268

There are 15.9 million households with incomes less than $10,000 and 17.3 million with incomes over $50,000. Families with incomes of $50,000 or more use 131.6 million Btu of energy versus 79.9 million Btu for those households with income of $10,000 or less (Figure 17).

Householders with larger incomes live in larger homes and have more appliances. Their homes, however, tend to be newer and as a result more efficient.

Most of Housing Stock Was Built in 1979 or Earlier

Almost 83 percent of all homes in the country were built in 1979 or earlier. New homes, however, are much more energy efficient. New homes built in 1988 or later use 42 thousand Btu per square foot, compared to 63 thousand for homes built in 1939 or earlier (Figure 18). New homes tend to be larger, better insulated, and have newer appliances. Although larger homes use more energy, they are efficient. Older homes were built in a period of cheaper energy, which resulted in less attention to energy design and construction.

Housing Unit Characteristics

The Typical American Household Owns a Single-Family Home

The 1990 RECS describes 94 million year round occupied homes, of which 66 percent were owner-occupied and 34 percent rented. Of these homes, 46 percent were in the suburbs, 32 percent were in the central cities, and 22 percent were in rural areas (Figure 19). Nearly 69 percent of the RECS homes were conventional single-family homes, 26 percent were multifamily and 6 percent were mobile homes (Figure 20).

The average single-family home used more than twice as much energy as a typical unit in a large multifamily building, 111 million Btu per household versus 51 million Btu per unit in the large multifamily building. On a square footage basis, large multifamily units are generally larger users, 62 thousand Btu per square foot versus 51 thousand Btu per square foot for the single-family home.

Energy consumption per square foot is much less for owned versus rented homes, 51 versus 70 thousand Btu per square foot. However, rented homes tend to be smaller and thus require less heating and cooling. On a per household basis, rented homes use 74 million Btu versus 111 million Btu for owned homes.

The Average Home Has 1,569 Square Feet of Heated Space.

The average heated floorspace for a single-family home is 1,865 square feet. The multifamily unit is, on average, 928 square feet, followed by the mobile home of 921 square feet.

Most Americans Live in Temperate Regions of the Country

Nearly 67 million households live in the temperate climate zones of 7,000 heating degree-days (HDD) or fewer and under 2,000 cooling degree-days (CDD) (Table 16). The remaining 27 million households live in regions that are extremely hot or cold. Regions like Florida typically exceed 2,000 CDD.

Table 16. U.S. Household Distribution by Climate Zone, 1990

Climate Zone	Households (millions)
Under 2,000 CDD and	
Over 7,000 HDD	10.1
5,500 to 7,000 HDD	26.7
4,000 to 5,499 HDD	20.9
Under 4000 HDD	19.3
2,000 CDD or More	
Under 4,000 HDD	17.0

Source: Energy Information Administration, Office Of Energy Markets and End Use, Forms EIA-457 A-C of the 1990 Residential Energy Consumption Survey (RECS). Table 18 and RECS Public Use Data Files.

Total Energy Consumption & Expenditures

Average Energy Consumption is 98.1 Million Btu per Household

Excluding energy used for transportation, over 50 percent of household energy goes to heating. An average household will use significantly more total energy in the coldest zone than in the hottest zone because the heating load in winter exceeds the cooling load in summer (Figure 21).

These data in Figure 21 do not include about 2½ cords of wood per household for the coldest climate zone, dropping to about ¾ cord for the warmest. Most wood users are in the 4,000 to 7,000 HDD climate zone.

Average Household Annual Energy Expenditures are Nearly $1,200.

Households in the colder zones spend more on energy, but as the climate gets hotter electricity consumption also increases, boosting expenditures for the air-conditioned hottest zones.

Wood is assumed to be free in Figure 22, but paying for this energy would boost the expenditures for the coldest zone by about $200-$300 for those households heating with wood.

The average household spends about 4 percent of its gross income on energy.

Expenditure per Square Foot Decreases for New Homes

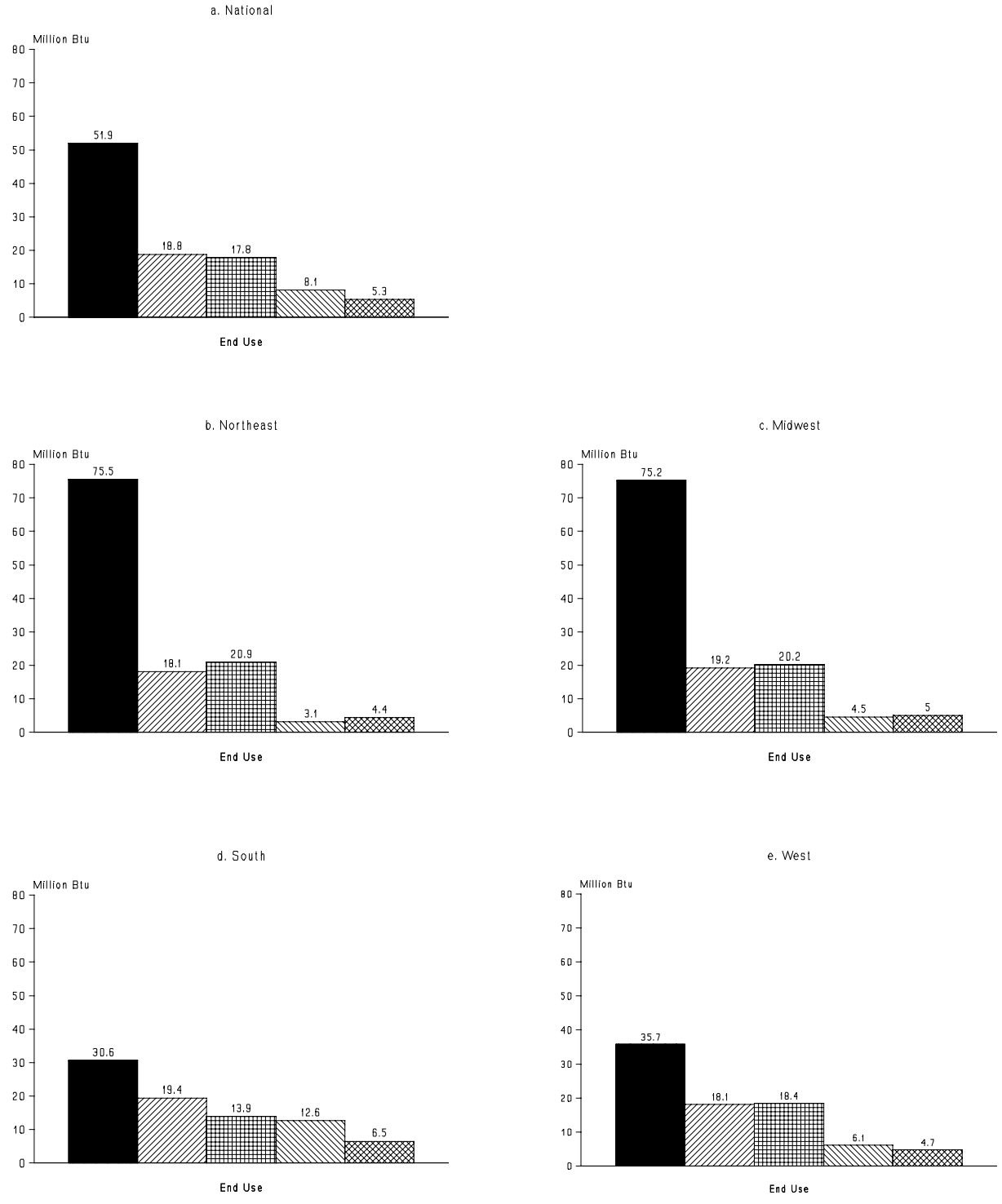
Expenditures per household generally decrease, the newer the house. In the early years of home building, homes increased steadily in size and tended to heat with cheap natural gas, resulting in lower attention to insulation. Later homes, though larger, used electric heat, whose expense led to improved building shell insulation (Figure 23).

Energy End Uses

Consumption per household depends upon the household size, number of occupants, and above all, on climate and heating source. Figure 24 shows the different ways in which households use energy in each region.

As expected, households in the northern regions--Northeast and Midwest--use significantly more energy on space heat, while households in the South use significantly less than the national average (Table 17). Average air-conditioning demands, surprisingly, do not compensate for lack of heating. For the South as a whole, average air-conditioning usage is higher than for the other regions, as is refrigerator use. Appliance use is fairly uniform across the regions.

Figure 24. End-Use Energy Consumption per U.S. Household, by Census Region, 1990



Source: Energy Information Administration, Office of Energy Markets and End Use, *Household Energy Consumption and Expenditures 1990 Supplement: Regional*, Tables 12, 39, 67, and 93.

Table 17. Consumption per U.S. Household by Census Region, 1990
(Million Btu)

Census Region	Total	Space Heat	Appliances	Water Heat	Air Conditioners	Refrigerators
U.S.	98.1	51.9	18.8	17.8	8.1	5.3
Northeast	119.6	75.5	18.1	20.9	3.1	4.4
Midwest	121.7	75.2	19.2	20.2	4.5	5.0
South	80.6	30.6	19.4	13.9	12.6	6.5
West	77.8	35.7	18.1	18.4	6.1	4.7

Source: Energy Information Administration, Office of Energy Markets and End Use, *Household Energy Consumption and Expenditures 1990 Supplement: Regional*, Tables 12, 39, 67, and 93.

Most Electricity is Used for Appliances

For the residential national average electricity bill, 47 percent of the electricity is used for appliances of all kinds, including lights, washers, dryers, and cooking appliances. Air conditioning and refrigerators consume over 30 percent and space heating and water heating consume the remaining 21 percent (Figure 25).

Most Natural Gas is Used for Space Heat

For the national average natural gas bill, nearly 70 percent is used for space heating and 24 percent is used for hot water, with the remaining 7 percent for appliances, such as stoves, clothes dryers, barbecue grills, pool heaters, etc. (Figure 26).

Detailed Tables

The following tables present detailed energy consumption and expenditures of households in the residential sector at the national level. The data are from the 1990 RECS. Similar data at the four Census regions and nine Census divisions level are available in *Household Energy Consumption and Expenditures 1990 Supplement: Regional*. See the "Glossary" in this report for definitions of terms used in the tables.

Table Organization

Overall Organization

The tables are grouped by topics to facilitate finding related information. The Quick-Reference Guide (Figure 27) indicates the broad topic and relevant table number.

Row Stubs

There is a standard set of row categories (stubs) which appears in all tables. Depending on the specific table topic, the standard stub may be augmented with selected variables pertinent to that topic. The standard stub items always appear in the same order, with any additional stub items interspersed adjacent to the related standard stub items.

Consumption and Expenditures Tables

The first 10 tables (Tables 18 through 27) provide household energy consumption and expenditure data that were obtained from the energy suppliers to the households. Data are presented for a total of all energy sources, followed by tables specifically by energy source. Statistics are provided both by all households and per household averages.

End-Use Tables

The last 18 tables (Tables 28 through 45) contain nonlinear regression estimates of energy consumption and expenditures by five end uses--space heating, air conditioning, water heating, appliances, and refrigerators. Details concerning the methodology used for the end-use estimates are in Appendix D, "End-Use Estimation Methodology." Data are presented for a total of all energy sources, followed by tables specifically by energy source. Statistics are provided both by all households and per household averages.

Electronic Data Sets

The national-level tables (18-45) in this report, as well as the regional-level tables (1-106) presented in the *Household Energy Consumption and Expenditures 1990 Supplement: Regional*, are also available on diskette. The electronic files on the diskette are flat ASCII files. There is one file for each of these tables. The diskette containing the files also contains a READ.ME DOS text file with a Table of Contents. See the inside back cover for details on obtaining the diskettes.

Figure 27. Quick-Reference Guide to the Detailed Tables

Topic	Table Numbers
Energy Consumption and Expenditures	
Average of All Major Sources	18
Consumption by Each Major Source	19
Expenditures by Each Major Source	20
Electricity, per Household	21
Natural Gas, per Household	22
Fuel Oil, per Household	23
Kerosene, per Household	24
Liquefied Petroleum Gas (LPG), per Household	25
Wood Consumption	26
Average Expenditures by Each Major Energy Sources	27
Energy End Use	
Consumption and Expenditures by End Uses	28
Per Household Consumption by End Uses	29
Per Household Expenditures by End Uses	30
Space-Heating Consumption and Expenditures	
Electricity and Natural Gas	31
Fuel Oil, Kerosene, and LPG	32
Per Household Electricity	33
Per Household Natural Gas	34
Per Household Fuel Oil	35
Per Household LPG	36
Air-Conditioning (A/C) Consumption and Expenditures	
Electricity for All A/C and Central A/C	37
Electricity for Room A/C	38
Water-Heating Consumption and Expenditures	
Electricity and Natural Gas	39
Fuel Oil and Natural Gas	40
Per Household Electricity and Natural Gas	41
Per Household Fuel Oil and Natural Gas	42
Appliances Consumption and Expenditures	
Electricity, Natural Gas, and LPG	43
Per Household Electricity (both	44
Appliances and Refrigerators)	45
Per Household Natural Gas and LPG	

Source: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey.

Row and Column Factors

The tables in this report present estimates for occupied residential housing units and their related consumption and expenditures in the United States. Since the estimates are based on the sample surveyed, they are subject to sampling error. To help the reader compute an approximate Relative Standard Error (RSE) for each of the estimates in the tables, row and column factors are displayed on the top row and in the far right column of each table, except for the end-use estimation tables.

To calculate the RSE for a specific estimate, multiply the row factor by the column factor. The use of the row and column RSE factors is illustrated in Figure 28, which includes a table from this report. Using the second column of the table labeled "Electricity" and the second row labeled "Urban" under the category labeled "Urban Status" gives an estimate of 24.6 Dollars per Million Btu for the average electricity expenditure for households where the Urban Status is urban. The RSE row factor is 1.7. The RSE column factor is 0.8. The approximate RSE for the estimate is, therefore,

$$RSE_{\text{Average Electricity Expenditure in the Urban area}} = (1.7)\ (0.8) = 1.36 \text{ percent.}$$

The standard error derived from the row and column factors can be used to construct confidence intervals, as in Figure 28, to perform hypothesis tests by standard statistical methods. However, because the generalized variance procedure gives only approximate RSE's, such confidence intervals and statistical tests must also be regarded as only approximate.

For more details about the derivation of the row and column RSE factors, see Appendix B, "Quality of the Data."

Figure 28. Use of RSE Row and Column Factors

Row Factor (Urban) = 1.7
Column Factor (Electricity) = 0.8

Approximate RSE (Average Electricity Expenditure in the Urban Area) = (1.7) * (0.8)
= 1.36 percent

Approximate Standard Error (Average Electricity Expenditure in the Urban Area) = (.0136) * (24.6)
= 0.33 Dollars per Million Btu

Approximate 2 Standard Errors (95 percent confidence interval) = (1.96) * (0.33)
= 0.6 Dollars per Million Btu

Therefore, with 95 percent confidence, the average electricity expenditure in the Urban area is between 24.0 and 25.2 Dollars per Million Btu (24.6 $\pm$ 0.6)

Source: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey.

Table 18. Consumption and Expenditures in U.S. Households, 1990

Characteristics	Total Households (million)	Residential Buildings: Total Number (million)	Residential Buildings: Total Floorspace (billion square feet)	Average of Major Energy Sources1/: Consumption: per Building (million Btu)	Consumption: per Square Foot (thousand Btu)	Consumption: per Household (million Btu)	Consumption: per Household Member (million Btu)	Expenditures (dollars): per Building	Expenditures (dollars): per Square Foot	Expenditures (dollars): per Household	Expenditures (dollars): per Household Member	RSE Row Factors
RSE Column Factors:	1.4	1.6	1.6	1.0	0.8	0.9	0.9	0.9	0.8	0.7	0.7	
Total U.S. Households.....	94.0	74.2	169.2	124	54	98.1	38	1,485	0.65	1,172	450	1.4
Urban Status												
Urban.....	72.9	54.6	131.8	132	55	99.2	38	1,575	.65	1,180	455	1.6
Central City.....	29.8	19.3	46.4	151	63	97.7	39	1,694	.70	1,095	436	2.3
Suburban.....	43.0	35.3	85.5	122	50	100.2	38	1,509	.62	1,239	467	2.0
Rural.....	21.1	19.6	37.4	102	53	94.2	35	1,237	.65	1,146	431	3.1
Climate Zone2/												
Under 2,000 CDD and												
Over 7,000 HDD.....	10.1	8.3	21.0	136	53	110.6	45	1,389	.55	1,132	465	6.1
5,500 to 7,000 HDD....	26.7	21.2	54.5	155	60	123.3	47	1,578	.61	1,251	481	3.1
4,000 to 5,499 HDD....	20.9	16.3	39.3	131	54	101.6	39	1,573	.65	1,222	469	4.8
Under 4,000 HDD.....	19.3	14.8	28.6	95	49	72.9	28	1,311	.68	1,008	386	4.3
2,000 CDD or More and												
Under 4,000 HDD.....	17.0	13.7	25.7	93	50	75.2	28	1,486	.79	1,197	440	4.1
Type of Housing Unit												
Single-Family.....	64.4	64.4	140.9	111	51	110.9	39	1,321	.60	1,321	469	1.6
Detached.....	58.4	58.4	130.9	113	51	113.3	40	1,340	.60	1,340	470	1.6
Attached.....	6.0	6.0	10.0	87	52	87.3	36	1,129	.68	1,129	462	5.7
Mobile Home.....	5.2	5.2	4.9	78	83	78.0	29	1,011	1.08	1,011	375	5.7
Multifamily.....	24.4	4.6	23.5	364	71	68.5	34	4,325	.85	815	399	3.1
2 to 4 Units.....	10.0	3.6	11.8	262	80	94.5	42	2,811	.86	1,015	452	4.3
5 or More Units.....	14.4	1.0	11.7	734	62	50.5	27	9,827	.84	677	355	4.5
Heated Floorspace (square feet)												
Fewer than 1,000.....	30.6	16.1	24.4	121	80	63.6	30	1,523	1.01	802	373	2.5
1,000 to 1,999	39.1	34.9	66.4	111	58	98.5	36	1,338	.70	1,192	436	1.7
2,000 to 2,999	16.9	15.9	45.9	133	46	125.2	42	1,590	.55	1,500	507	2.3
3,000 or More	7.4	7.3	32.5	180	40	176.4	59	1,878	.42	1,845	613	4.5
Number of Rooms												
1 to 3.....	11.7	3.7	8.2	159	71	49.9	31	2,110	.94	662	408	5.0
4 to 6.....	58.0	46.6	90.9	114	58	91.5	35	1,376	.71	1,106	426	1.6
7 or More.....	24.3	23.9	70.2	139	47	136.9	44	1,603	.55	1,576	507	2.5
Ownership of Unit												
Owned.....	62.3	58.9	135.8	117	51	110.5	41	1,397	.61	1,322	488	1.6
Rented.....	31.7	15.2	33.4	153	70	73.7	31	1,827	.83	878	365	2.4
Public Housing.....	2.5	.6	2.1	254	66	57.4	24	2,857	.75	646	275	12.0
Not Public Housing....	29.2	14.7	31.3	150	70	75.1	31	1,788	.84	898	373	2.6
Rent Subsidy.....	1.7	.7	1.6	176	75	69.7	25	2,179	.93	863	311	11.9
No Rent Subsidy....	27.5	14.0	29.7	148	70	75.4	32	1,769	.83	900	377	2.6
Year of Construction												
1939 or Before.....	21.5	16.7	40.8	153	63	119.7	47	1,559	.64	1,216	474	2.5
1940 to 1949.....	7.0	6.1	11.6	122	64	105.2	41	1,309	.68	1,130	435	3.8
1950 to 1959.....	13.4	11.9	24.7	123	59	109.5	43	1,412	.68	1,254	490	3.2
1960 to 1969.....	14.8	11.4	26.2	124	54	95.4	39	1,507	.65	1,155	467	3.4
1970 to 1979.....	21.4	15.3	36.3	119	50	85.1	32	1,599	.68	1,143	431	3.1
1980 to 1984.....	8.0	6.2	13.6	93	42	71.9	26	1,452	.66	1,120	399	4.8
1985 to 1987.....	5.1	4.1	9.2	83	37	67.6	26	1,294	.58	1,051	403	7.9
1988 to 19903/.....	2.8	2.5	6.9	114	42	103.1	35	1,371	.50	1,237	417	8.7

See footnotes at end of table.

Table 18. Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Total Households (million)	Residential Buildings: Total Number (million)	Residential Buildings: Total Floorspace (billion square feet)	Average of Major Energy Sources1/: Consumption: per Building (million Btu)	Consumption: per Square Foot (thousand Btu)	Consumption: per Household (million Btu)	Consumption: per Household Member (million Btu)	Expenditures (dollars): per Building	Expenditures (dollars): per Square Foot	Expenditures (dollars): per Household	Expenditures (dollars): per Household Member	RSE Row Factors
RSE Column Factors:	1.4	1.6	1.6	1.0	0.8	0.9	0.9	0.9	0.8	0.7	0.7	
All Utilities Paid by Household												
Yes	79.3	70.2	154.9	115	52	101.9	38	1,394	0.63	1,234	456	1.5
No	14.7	3.9	14.3	288	79	77.3	37	3,124	.86	838	406	4.5
1990 Family Income												
Less than $10,000	15.9	10.8	19.7	118	65	79.9	38	1,310	.72	888	423	3.8
$10,000 to $19,999	19.8	14.7	28.2	113	59	83.7	36	1,318	.69	978	421	2.7
$20,000 to $34,999	24.3	19.1	41.4	119	55	93.4	35	1,420	.65	1,115	416	2.3
$35,000 to $49,999	16.7	14.2	33.1	123	53	104.5	37	1,529	.65	1,296	456	2.7
$50,000 or More	17.3	15.5	46.7	147	49	131.6	43	1,807	.60	1,618	526	3.0
Below Poverty Line												
100 Percent	13.2	9.1	16.1	116	65	80.1	28	1,347	.76	928	323	3.7
125 Percent	18.2	12.9	23.2	115	64	81.3	29	1,342	.75	951	343	3.2
Eligible for Federal Assistance4/	27.9	20.4	37.9	117	63	85.4	32	1,357	.73	994	367	2.6
Age of Householder												
Under 35 Years	27.5	18.4	38.8	130	62	86.9	30	1,562	.74	1,044	355	2.5
35 to 44 Years	20.2	17.0	40.3	126	53	106.5	33	1,534	.65	1,297	400	2.3
45 to 59 Years	19.7	17.0	41.2	125	51	107.6	42	1,555	.64	1,343	520	2.7
60 Years and Over	26.6	21.7	49.0	118	52	96.2	53	1,328	.59	1,084	602	2.1
Education of Householder												
12 Years or Fewer	52.6	42.0	84.3	118	59	93.9	36	1,396	.69	1,114	425	1.8
13 to 16 Years	31.7	24.5	62.0	129	51	100.1	38	1,559	.62	1,205	462	2.2
17 Years or More	9.7	7.7	23.0	143	48	114.0	45	1,737	.59	1,381	544	4.3
Race of Householder												
White	80.9	65.3	150.9	122	53	98.2	38	1,464	.63	1,181	463	1.4
Black	10.6	7.1	14.9	154	74	103.6	36	1,730	.82	1,162	405	4.1
Other	2.5	1.8	3.4	98	52	71.5	21	1,296	.69	944	282	7.8
Householder of Hispanic Descent												
Yes	6.3	4.5	8.8	118	61	83.7	25	1,459	.75	1,034	313	6.1
No	87.6	69.7	160.5	125	54	99.1	39	1,487	.65	1,182	462	1.4
Household Size												
1 Person	23.4	15.1	31.1	110	53	71.1	71	1,251	.61	807	807	2.7
2 Persons	30.6	24.0	57.0	124	52	97.6	49	1,463	.62	1,148	574	2.1
3 to 5 Persons	36.4	31.9	74.0	130	56	113.6	30	1,595	.69	1,396	372	1.7
6 or More Persons	3.6	3.2	7.2	134	60	119.7	18	1,664	.75	1,488	225	4.8

1/ Major Energy Sources include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas.
2/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
3/ Does not include all new construction for 1990.
4/ Below 150 percent of poverty line or 60 percent of median State income.

Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 19. Total Consumption in U.S. Households, 1990

Characteristics	Major Energy Sources1 (quadrillion Btu)	Electricity (quadrillion Btu)	Electricity (billion kWh)	Natural Gas (quadrillion Btu)	Natural Gas (billion cubic feet)	Fuel Oil (quadrillion Btu)	Fuel Oil (billion gallons)	Kerosene (quadrillion Btu)	Kerosene (billion gallons)	Liquefied Petroleum Gas (quadrillion Btu)	Liquefied Petroleum Gas (billion gallons)	RSE Row Factors
RSE Column Factors:	0.4	0.5	0.5	0.6	0.6	1.1	1.1	2.8	2.8	1.9	1.9	
Total U.S. Households.....	9.22	3.03	888	4.86	4,737	0.98	7.10	0.07	0.49	0.28	3.07	5.3
Urban Status												
Urban.....	7.23	2.25	660	4.08	3,970	.75	5.46	.03	.23	.11	1.24	6.2
Central City.....	2.92	.83	243	1.85	1,808	.21	1.54	.01	.10	.01	.11	9.9
Suburban.....	4.31	1.42	417	2.23	2,163	.54	3.92	.02	.13	.10	1.12	6.9
Rural.....	1.99	.78	228	.78	767	.22	1.63	.03	.26	.17	1.84	10.4
Climate Zone2/												
Under 2,000 CDD and												
Over 7,000 HDD.....	1.12	.29	86	.53	525	.21	1.51	Q	Q	.07	.78	24.4
5,500 to 7,000 HDD....	3.29	.75	219	2.04	1,992	.42	3.07	.01	.10	.06	.67	13.7
4,000 to 5,499 HDD....	2.12	.67	195	1.06	1,030	.33	2.39	.01	.10	.06	.65	16.3
Under 4,000 HDD.....	1.41	.59	172	.72	703	.02	.12	.02	.14	.06	.62	16.5
2,000 CDD or More and												
Under 4,000 HDD.....	1.28	.74	216	.50	487	Q	Q	Q	Q	.03	.35	19.5
Type of Housing Unit												
Single-Family.....	7.14	2.39	699	3.73	3,634	.76	5.51	.04	.28	.22	2.45	6.4
Detached.....	6.61	2.20	644	3.45	3,365	.70	5.09	.04	.27	.22	2.45	6.7
Attached.....	.52	.19	55	.28	269	.06	.41	(*)	.01	Q	Q	19.4
Mobile Home.....	.41	.16	47	.15	149	.02	.13	.02	.18	.05	.54	22.5
Multifamily.....	1.67	.48	142	.98	953	.20	1.46	Q	Q	.01	.08	12.0
2 to 4 Units.....	.94	.20	59	.62	604	.11	.84	Q	Q	.01	.07	18.5
5 or More Units.....	.73	.28	83	.36	350	.08	.62	Q	Q	Q	Q	18.3
Heated Floorspace (square feet)												
Fewer than 1,000.....	1.94	.69	203	.98	950	.15	1.14	.04	.28	.08	.91	9.5
1,000 to 1,999	3.85	1.34	393	2.05	1,996	.32	2.29	.02	.17	.13	1.37	7.4
2,000 to 2,999	2.11	.68	199	1.10	1,069	.28	2.05	(*)	.03	.05	.53	9.8
3,000 or More	1.31	.32	94	.74	723	.22	1.62	(*)	(*)	.02	.27	16.9
Number of Rooms												
1 to 3.....	.58	.22	64	.27	268	.06	.41	.01	.04	.03	.32	16.9
4 to 6.....	5.31	1.78	521	2.82	2,743	.49	3.54	.05	.38	.18	1.93	6.5
7 or More.....	3.33	1.04	304	1.77	1,726	.44	3.15	.01	.07	.08	.83	10.6
Ownership of Unit												
Owned.....	6.88	2.27	666	3.54	3,451	.78	5.68	.04	.33	.24	2.60	6.6
Rented.....	2.34	.76	222	1.32	1,286	.19	1.42	.02	.15	.04	.48	9.5
Public Housing.....	.14	.05	14	.07	68	Q	Q	NC	NC	Q	Q	42.4
Not Public Housing....	2.19	.71	208	1.25	1,218	.17	1.25	.02	.15	.04	.47	10.2
Rent Subsidy.....	.12	.04	11	.07	66	.01	.07	Q	Q	(*)	.03	36.7
No Rent Subsidy....	2.07	.67	197	1.18	1,152	.16	1.18	.02	.13	.04	.43	10.3
Year of Construction												
1939 or Before.....	2.57	.51	150	1.57	1,525	.40	2.90	.02	.14	.07	.82	9.7
1940 to 1949.....	.74	.19	56	.45	434	.07	.53	(*)	.02	.03	.29	16.0
1950 to 1959.....	1.47	.41	120	.81	789	.21	1.51	.01	.04	.03	.34	12.7
1960 to 1969.....	1.41	.48	141	.77	752	.13	.96	(*)	.02	.02	.26	14.1
1970 to 1979.....	1.82	.82	241	.78	761	.14	1.00	.03	.20	.06	.62	12.4
1980 to 1984.....	.58	.32	94	.21	203	.01	.07	Q	Q	.04	.39	22.6
1985 to 1987.....	.34	.19	55	.13	130	Q	Q	Q	Q	.01	.14	28.3
1988 to 19903/.....	.29	.11	31	.15	143	Q	Q	Q	Q	.02	.23	32.1

See footnotes at end of table.

Table 19. Total Consumption in U.S. Households, 1990 (Continued)

Characteristics	Major Energy Sources1 (quadrillion Btu)	Electricity (quadrillion Btu)	Electricity (billion kWh)	Natural Gas (quadrillion Btu)	Natural Gas (billion cubic feet)	Fuel Oil (quadrillion Btu)	Fuel Oil (billion gallons)	Kerosene (quadrillion Btu)	Kerosene (billion gallons)	Liquefied Petroleum Gas (quadrillion Btu)	Liquefied Petroleum Gas (billion gallons)	RSE Row Factors
RSE Column Factors:	0.4	0.5	0.5	0.6	0.6	1.1	1.1	2.8	2.8	1.9	1.9	
All Utilities Paid by Household												
Yes	8.09	2.79	816	4.16	4,058	0.81	5.87	0.06	0.48	0.26	2.84	6.0
No	1.13	.25	72	.70	679	.17	1.22	Q	Q	.02	.24	14.6
1990 Family Income												
Less than $10,000	1.27	.36	105	.70	679	.14	1.00	.01	.09	.07	.72	12.9
$10,000 to $19,999	1.66	.53	156	.88	862	.15	1.10	.02	.16	.07	.76	9.2
$20,000 to $34,999	2.27	.77	227	1.17	1,139	.23	1.70	.02	.18	.07	.76	9.0
$35,000 to $49,999	1.75	.62	181	.90	875	.19	1.35	(*)	.03	.04	.45	11.1
$50,000 or More	2.27	.75	219	1.21	1,182	.27	1.95	(*)	.03	.04	.40	13.4
Below Poverty Line												
100 Percent	1.05	.32	94	.56	548	.10	.72	.01	.10	.06	.64	12.5
125 Percent	1.48	.46	136	.78	757	.14	1.00	.02	.13	.08	.93	11.1
Eligible for Federal Assistance4/	2.38	.72	212	1.26	1,222	.26	1.88	.03	.19	.12	1.31	8.9
Age of Householder												
Under 35 Years	2.39	.79	232	1.30	1,269	.21	1.53	.02	.14	.07	.76	9.2
35 to 44 Years	2.15	.74	217	1.12	1,090	.21	1.49	.02	.14	.07	.71	9.2
45 to 59 Years	2.12	.77	226	1.06	1,035	.22	1.58	.02	.12	.05	.54	10.2
60 Years and Over	2.56	.73	214	1.38	1,343	.34	2.50	.01	.08	.10	1.06	8.6
Education of Householder												
12 Years or Fewer	4.94	1.58	463	2.53	2,460	.57	4.16	.05	.40	.21	2.28	6.8
13 to 16 Years	3.17	1.10	321	1.72	1,678	.28	2.01	.01	.08	.06	.70	8.2
17 Years or More	1.11	.36	105	.62	599	.13	.92	(*)	.01	.01	.10	18.7
Race of Householder												
White	7.94	2.66	779	4.08	3,972	.91	6.57	.05	.37	.25	2.74	6.1
Black	1.10	.30	89	.69	671	.07	.49	.02	.11	.02	.24	16.8
Other	.18	.07	20	.10	94	Q	Q	Q	Q	Q	Q	29.5
Householder of Hispanic Descent												
Yes	.53	.17	50	.31	304	.05	.33	Q	Q	(*)	.04	19.6
No	8.69	2.86	839	4.55	4,433	.93	6.77	.06	.48	.28	3.04	5.6
Household Size												
1 Person	1.66	.49	144	.94	916	.18	1.29	.01	.06	.05	.49	9.0
2 Persons	2.98	.96	280	1.59	1,553	.33	2.37	.02	.14	.09	.98	7.6
3 to 5 Persons	4.14	1.44	421	2.11	2,058	.43	3.11	.03	.24	.13	1.40	7.4
6 or More Persons	.43	.15	43	.22	210	.04	.33	.01	.05	.02	.20	17.9

1/ Major Energy Sources include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas.
2/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
3/ Does not include all new construction for 1990.
4/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 20. Total Expenditures in U.S. Households, 1990
(Billion Dollars)

Characteristics	Major Energy Sources1/	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas	
RSE Column Factors:	0.4	0.5	0.6	1.2	3.1	2.0	RSE Row Factors
Total U.S. Households.....	110.18	71.54	27.26	7.63	0.62	3.14	4.4
Urban Status							
Urban.....	85.97	55.35	23.17	5.87	.29	1.29	5.2
Central City.....	32.68	20.13	10.72	1.55	.13	.15	8.0
Suburban.....	53.30	35.22	12.45	4.32	.16	1.15	5.9
Rural.....	24.21	16.19	4.09	1.76	.33	1.85	9.4
Climate Zone2/							
Under 2,000 CDD and Over 7,000 HDD.....	11.46	6.34	2.66	1.61	Q	.72	24.5
5,500 to 7,000 HDD.....	33.38	18.39	10.83	3.34	.13	.69	12.3
4,000 to 5,499 HDD.....	25.57	15.60	6.62	2.54	.14	.67	14.7
Under 4,000 HDD.....	19.42	14.27	4.18	.13	.17	.66	15.8
2,000 CDD or More and Under 4,000 HDD.....	20.35	16.93	2.96	Q	Q	.41	16.1
Type of Housing Unit							
Single-Family.....	85.01	55.65	20.47	6.06	.36	2.46	5.6
Detached.....	78.23	51.03	18.79	5.60	.34	2.46	5.9
Attached.....	6.78	4.61	1.68	.46	.02	Q	18.7
Mobile Home.....	5.27	3.50	.82	.15	.23	.58	21.2
Multifamily.....	19.91	12.39	5.97	1.42	Q	.10	11.0
2 to 4 Units.....	10.15	5.32	3.80	.93	Q	.09	18.5
5 or More Units.....	9.76	7.07	2.17	.50	Q	Q	17.0
Heated Floorspace (square feet)							
Fewer than 1,000.....	24.52	16.37	5.63	1.15	.36	1.01	8.6
1,000 to 1,999	46.66	31.04	11.51	2.51	.22	1.38	6.8
2,000 to 2,999	25.30	16.26	6.31	2.18	.04	.52	9.2
3,000 or More	13.70	7.87	3.81	1.79	(*)	.23	16.3
Number of Rooms							
1 to 3.....	7.72	5.28	1.64	.39	.06	.36	15.4
4 to 6.....	64.12	41.90	15.99	3.76	.47	2.00	5.8
7 or More.....	38.34	24.36	9.63	3.48	.09	.78	9.7
Ownership of Unit							
Owned.....	82.34	53.41	19.67	6.20	.41	2.64	5.7
Rented.....	27.84	18.13	7.59	1.43	.20	.50	8.6
Public Housing.....	1.59	1.01	.43	.14	NC	Q	38.9
Not Public Housing....	26.25	17.12	7.15	1.29	.20	.49	9.1
Rent Subsidy.....	1.48	.95	.39	.07	Q	.05	33.4
No Rent Subsidy....	24.76	16.17	6.76	1.22	.18	.44	9.2
Year of Construction							
1939 or Before.....	26.09	13.03	9.00	3.09	.18	.80	8.8
1940 to 1949.....	7.94	4.47	2.54	.58	.03	.32	14.8
1950 to 1959.....	16.78	10.15	4.56	1.66	.05	.36	12.0
1960 to 1969.....	17.10	11.37	4.39	1.02	Q	.29	12.5
1970 to 1979.....	24.51	18.34	4.20	1.07	.26	.64	11.3
1980 to 1984.....	8.99	7.36	1.16	.08	Q	.37	20.3
1985 to 1987.....	5.34	4.42	.71	Q	Q	.15	27.0
1988 to 19903/.....	3.42	2.41	.70	Q	Q	.21	28.8

See footnotes at end of table.

Table 20. Total Expenditures in U.S. Households, 1990 (Continued)
(Billion Dollars)

Characteristics	Major Energy Sources1/	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas	
RSE Column Factors:	0.4	0.5	0.6	1.2	3.1	2.0	RSE Row Factors
All Utilities Paid by Household							
Yes	97.91	64.84	23.10	6.47	0.61	2.90	5.1
No	12.27	6.70	4.17	1.16	Q	.24	13.2
1990 Family Income							
Less than $10,000	14.13	8.23	3.95	1.05	.12	.79	12.0
$10,000 to $19,999	19.38	12.25	5.00	1.16	.19	.78	8.6
$20,000 to $34,999	27.08	17.88	6.39	1.81	.24	.75	8.0
$35,000 to $49,999	21.68	14.60	5.12	1.46	.04	.46	10.2
$50,000 or More	27.92	18.57	6.80	2.15	.03	.36	11.7
Below Poverty Line							
100 Percent	12.21	7.41	3.24	.75	.13	.68	11.8
125 Percent	17.32	10.67	4.44	1.04	.17	1.00	10.4
Eligible for Federal Assistance4/	27.71	16.89	7.17	1.98	.24	1.42	8.3
Age of Householder							
Under 35 Years	28.74	18.87	7.28	1.63	.19	.78	8.3
35 to 44 Years	26.15	17.43	6.27	1.62	.17	.66	8.2
45 to 59 Years	26.45	18.09	5.90	1.71	.16	.60	9.4
60 Years and Over	28.84	17.15	7.81	2.67	.10	1.11	8.0
Education of Householder							
12 Years or Fewer	58.57	36.88	14.38	4.45	.51	2.35	6.1
13 to 16 Years	38.16	25.80	9.40	2.17	.10	.70	7.2
17 Years or More	13.46	8.86	3.48	1.01	.01	.09	16.9
Race of Householder							
White	95.53	62.63	22.57	7.08	.47	2.78	5.1
Black	12.31	7.24	4.14	.52	.15	.26	15.7
Other	2.35	1.67	.55	Q	Q	.10	23.7
Householder of Hispanic Descent							
Yes	6.56	4.40	1.77	.33	Q	.05	17.6
No	103.62	67.14	25.49	7.30	.60	3.09	4.8
Household Size							
1 Person	18.86	11.65	5.23	1.35	.08	.54	7.4
2 Persons	35.08	22.38	9.01	2.52	.17	1.00	6.9
3 to 5 Persons	50.84	33.96	11.78	3.41	.30	1.39	6.4
6 or More Persons	5.41	3.55	1.23	.35	.07	.21	16.8

1/ Major Energy Sources include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas.
2/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
3/ Does not include all new construction for 1990.
4/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 21. Electricity Consumption and Expenditures in U.S. Households, 1990

Characteristics	Households Using Electricity (million)	Average per Household					RSE Row Factors
		Consumption		Expenditures (dollars)	Floorspace (square feet)	Expenditures (cents per kWh)	
		(million Btu)	(kWh)				
RSE Column Factors:	1.5	1.1	1.1	0.9	0.9	0.7	
Total U.S. Households.....	94.0	32.3	9,456	761	1,801	8.1	1.6
Urban Status							
Urban.....	72.9	30.9	9,060	760	1,809	8.4	1.9
Central City.....	29.8	27.8	8,150	674	1,553	8.3	3.1
Suburban.....	43.0	33.1	9,691	819	1,987	8.4	1.9
Rural.....	21.1	36.9	10,824	768	1,772	7.1	3.4
Climate Zone1/							
Under 2,000 CDD and							
Over 7,000 HDD.....	10.1	29.0	8,489	626	2,075	7.4	6.4
5,500 to 7,000 HDD....	26.6	28.1	8,224	690	2,046	8.4	4.2
4,000 to 5,499 HDD....	20.9	31.8	9,318	746	1,880	8.0	3.9
Under 4,000 HDD.....	19.3	30.5	8,942	741	1,485	8.3	4.0
2,000 CDD or More and							
Under 4,000 HDD.....	17.0	43.4	12,713	996	1,514	7.8	3.8
Type of Housing Unit							
Single-Family.....	64.3	37.1	10,868	865	2,189	8.0	1.7
Detached.....	58.3	37.7	11,038	875	2,243	7.9	1.8
Attached.....	6.0	31.4	9,210	769	1,669	8.3	5.3
Mobile Home.....	5.2	31.0	9,087	671	939	7.4	5.3
Multifamily.....	24.4	19.8	5,814	508	961	8.7	3.0
2 to 4 Units.....	10.0	20.1	5,891	532	1,179	9.0	4.9
5 or More Units.....	14.4	19.7	5,761	490	810	8.5	4.1
Heated Floorspace (square feet)							
Fewer than 1,000.....	30.5	22.6	6,636	536	798	8.1	2.2
1,000 to 1,999	39.1	34.3	10,042	793	1,698	7.9	2.0
2,000 to 2,999	16.9	40.2	11,788	964	2,720	8.2	2.6
3,000 or More	7.4	43.2	12,659	1059	4,379	8.4	4.2
Number of Rooms							
1 to 3.....	11.6	18.6	5,457	453	702	8.3	4.0
4 to 6.....	58.0	30.7	8,985	723	1,567	8.0	1.6
7 or More.....	24.3	42.6	12,491	1001	2,883	8.0	2.5
Ownership of Unit							
Owned.....	62.2	36.5	10,704	858	2,181	8.0	1.7
Rented.....	31.7	23.9	7,005	572	1,055	8.2	2.4
Public Housing.....	2.5	19.5	5,728	409	864	7.1	9.7
Not Public Housing....	29.2	24.3	7,113	585	1,071	8.2	2.5
Rent Subsidy.....	1.7	21.3	6,253	552	927	8.8	8.1
No Rent Subsidy....	27.5	24.5	7,167	587	1,080	8.2	2.6
Year of Construction							
1939 or Before.....	21.5	23.8	6,987	607	1,900	8.7	2.7
1940 to 1949.....	7.0	27.3	7,993	635	1,649	7.9	4.0
1950 to 1959.....	13.4	30.7	8,986	758	1,846	8.4	3.1
1960 to 1969.....	14.8	32.4	9,499	768	1,768	8.1	3.2
1970 to 1979.....	21.4	38.4	11,250	856	1,692	7.6	3.0
1980 to 1984.....	8.0	40.1	11,748	921	1,699	7.8	3.9
1985 to 1987.....	5.1	37.2	10,914	870	1,817	8.0	5.0
1988 to 19902/.....	2.8	38.1	11,160	869	2,482	7.8	8.0

See footnotes at end of table.

Table 21. Electricity Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Households Using Electricity (million)	Average per Household					RSE Row Factors
		Consumption		Expenditures (dollars)	Floorspace (square feet)	Expenditures (cents per kWh)	
		(million Btu)	(kWh)				
RSE Column Factors:	1.5	1.1	1.1	0.9	0.9	0.7	
All Electricity Paid by Household							
Yes	87.9	33.1	9,699	781	1,862	8.1	1.7
No	6.0	20.1	5,897	468	906	7.9	6.3
1990 Family Income							
Less than $10,000	15.9	22.6	6,617	518	1,239	7.8	3.3
$10,000 to $19,999	19.8	26.9	7,888	618	1,426	7.8	2.2
$20,000 to $34,999	24.3	31.8	9,329	736	1,706	7.9	2.3
$35,000 to $49,999	16.7	37.0	10,847	873	1,982	8.0	2.1
$50,000 or More	17.3	43.3	12,699	1076	2,708	8.5	3.1
Below Poverty Line							
100 Percent	13.1	24.4	7,157	564	1,225	7.9	3.4
125 Percent	18.2	25.5	7,474	587	1,273	7.9	2.9
Eligible for Federal Assistance3/	27.8	26.0	7,617	607	1,361	8.0	2.4
Age of Householder							
Under 35 Years	27.5	28.7	8,413	685	1,409	8.1	2.4
35 to 44 Years	20.1	36.8	10,772	866	2,002	8.0	2.2
45 to 59 Years	19.7	39.2	11,490	919	2,091	8.0	2.5
60 Years and Over	26.6	27.4	8,033	644	1,840	8.0	2.0
Education of Householder							
12 Years or Fewer	52.6	30.0	8,797	701	1,603	8.0	1.8
13 to 16 Years	31.6	34.7	10,158	815	1,958	8.0	2.1
17 Years or More	9.7	36.6	10,732	909	2,356	8.5	3.9
Race of Householder							
White	80.9	32.9	9,633	774	1,866	8.0	1.4
Black	10.6	28.7	8,417	683	1,408	8.1	3.9
Other	2.5	27.7	8,127	669	1,369	8.2	6.7
Householder of Hispanic Descent							
Yes	6.3	26.7	7,818	693	1,379	8.9	4.5
No	87.6	32.7	9,575	766	1,831	8.0	1.7
Household Size							
1 Person	23.3	21.0	6,163	499	1,330	8.1	2.4
2 Persons	30.6	31.3	9,165	732	1,864	8.0	1.9
3 to 5 Persons	36.4	39.4	11,560	933	2,032	8.1	1.8
6 or More Persons	3.6	40.8	11,970	976	1,986	8.2	5.0

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.

Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 22. Natural Gas Consumption and Expenditures in U.S. Households, 1990

Characteristics	Households Using	Average per Household					RSE Row Factors
		Consumption				Expenditures	
	Natural Gas (million)	(million Btu)	(thousand cf)	Expenditures (dollars)	Floorspace (square feet)	(dollars per thousand cf)	
RSE Column Factors:	1.7	1.0	1.0	1.0	1.0	0.5	
Total U.S. Households.....	57.7	84.2	82.1	472	1,842	5.8	1.8
Urban Status							
Urban.....	48.6	83.9	81.7	477	1,856	5.8	1.9
Central City.....	22.3	83.1	81.1	481	1,620	5.9	2.5
Suburban.....	26.3	84.6	82.1	473	2,055	5.8	2.6
Rural.....	9.1	85.9	84.2	449	1,766	5.3	4.3
Climate Zone1/							
Under 2,000 CDD and							
Over 7,000 HDD.....	5.1	104.0	102.5	520	2,051	5.1	4.3
5,500 to 7,000 HDD....	18.5	110.7	107.9	587	2,048	5.4	2.7
4,000 to 5,499 HDD....	12.7	83.6	81.3	523	1,980	6.4	4.5
Under 4,000 HDD.....	12.5	57.8	56.0	334	1,526	6.0	3.1
2,000 CDD or More and							
Under 4,000 HDD.....	8.9	56.3	54.5	331	1,541	6.1	5.9
Type of Housing Unit							
Single-Family.....	39.5	94.4	92.0	518	2,226	5.6	2.1
Detached.....	36.2	95.4	92.9	519	2,263	5.6	2.2
Attached.....	3.3	83.1	81.2	506	1,812	6.2	6.1
Mobile Home.....	2.0	76.4	74.6	407	975	5.5	5.6
Multifamily.....	16.2	60.5	58.8	368	1,012	6.3	2.9
2 to 4 Units.....	7.4	84.3	81.9	515	1,226	6.3	4.8
5 or More Units.....	8.8	40.8	39.6	246	835	6.2	5.5
Heated Floorspace (square feet)							
Fewer than 1,000.....	17.3	56.3	54.8	325	783	5.9	2.6
1,000 to 1,999	24.4	83.9	81.7	471	1,685	5.8	2.1
2,000 to 2,999	10.9	101.0	98.4	581	2,663	5.9	2.5
3,000 or More	5.1	144.7	141.2	745	4,429	5.3	4.0
Number of Rooms							
1 to 3.....	6.3	43.6	42.4	260	683	6.1	4.9
4 to 6.....	35.7	78.8	76.7	447	1,580	5.8	1.7
7 or More.....	15.7	113.1	110.1	614	2,903	5.6	2.7
Ownership of Unit							
Owned.....	37.5	94.5	92.0	525	2,250	5.7	1.9
Rented.....	20.2	65.3	63.5	375	1,086	5.9	2.4
Public Housing.....	1.5	47.5	46.0	292	936	6.3	12.2
Not Public Housing....	18.8	66.7	64.9	381	1,097	5.9	2.6
Rent Subsidy.....	1.0	70.1	68.5	406	995	5.9	14.0
No Rent Subsidy....	17.8	66.5	64.7	380	1,103	5.9	2.5
Year of Construction							
1939 or Before.....	16.0	98.1	95.6	564	1,848	5.9	2.7
1940 to 1949.....	5.1	87.0	84.8	497	1,708	5.9	3.8
1950 to 1959.....	9.4	86.0	83.8	483	1,868	5.8	3.2
1960 to 1969.....	10.1	76.3	74.2	434	1,768	5.8	4.2
1970 to 1979.....	10.8	72.1	70.3	388	1,695	5.5	3.6
1980 to 1984.....	3.3	62.7	61.1	349	1,845	5.7	7.5
1985 to 1987.....	1.6	84.6	82.5	448	2,364	5.4	10.2
1988 to 19902/.....	1.4	106.2	103.7	511	3,171	4.9	11.2

See footnotes at end of table.

Table 22. Natural Gas Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Households Using	Average per Household						RSE Row Factors
		Consumption			Expenditures	Floorspace	Expenditures	
	Natural Gas (million)	(million Btu)	(thousand cf)	(dollars)	(square feet)	(dollars per thousand cf)		
RSE Column Factors:	1.7	1.0	1.0	1.0	1.0	0.5		
All Gas Paid by Household								
Yes	46.7	89.5	87.2	498	2,048	5.7		2.1
No	11.0	61.9	60.1	361	968	6.0		4.5
1990 Family Income								
Less than $10,000	9.6	72.5	70.5	410	1,285	5.8		4.2
$10,000 to $19,999	11.8	74.8	72.9	423	1,451	5.8		2.7
$20,000 to $34,999	14.4	81.2	79.1	444	1,717	5.6		2.6
$35,000 to $49,999	10.4	86.8	84.5	495	1,964	5.9		3.4
$50,000 or More	11.5	105.2	102.6	590	2,752	5.8		3.1
Below Poverty Line								
100 Percent	7.9	71.6	69.6	412	1,242	5.9		3.9
125 Percent	10.7	72.7	70.7	415	1,302	5.9		3.3
Eligible for Federal Assistance3/	16.7	75.3	73.2	430	1,383	5.9		2.8
Age of Householder								
Under 35 Years	17.3	75.5	73.5	422	1,454	5.7		2.9
35 to 44 Years	12.0	93.3	91.0	523	2,049	5.8		2.3
45 to 59 Years	11.9	89.4	87.0	496	2,141	5.7		3.3
60 Years and Over	16.6	83.1	81.0	471	1,880	5.8		2.3
Education of Householder								
12 Years or Fewer	31.0	81.5	79.4	464	1,603	5.8		2.1
13 to 16 Years	20.0	86.3	84.1	471	2,038	5.6		2.4
17 Years or More	6.8	90.7	88.1	512	2,351	5.8		4.4
Race of Householder								
White	48.2	84.6	82.4	468	1,920	5.7		1.9
Black	8.1	85.7	83.4	515	1,443	6.2		3.9
Other	1.5	66.0	64.2	378	1,442	5.9		8.7
Householder of Hispanic Descent								
Yes	4.7	66.0	64.3	374	1,354	5.8		5.6
No	53.0	85.9	83.6	481	1,885	5.8		1.8
Household Size								
1 Person	14.1	66.8	65.1	372	1,408	5.7		3.4
2 Persons	19.1	83.6	81.5	473	1,894	5.8		2.3
3 to 5 Persons	22.3	94.8	92.2	528	2,058	5.7		2.2
6 or More Persons	2.3	94.6	91.5	538	1,969	5.9		5.8

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 23. Fuel Oil Consumption and Expenditures in U.S. Households, 1990

Characteristics	Households Using	Average per Household					RSE Row
		Consumption				Expenditures	
	Fuel Oil (million)	(million Btu)	(gallons)	Expenditures (dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	2.0	1.2	1.2	1.3	1.0	0.3	Factors
Total U.S. Households.....	11.7	83.4	606	652	2,169	1.08	2.9
Urban Status							
Urban.....	8.8	85.2	619	665	2,145	1.07	3.4
Central City.....	2.9	71.9	527	529	1,714	1.00	7.0
Suburban.....	5.9	91.7	665	733	2,360	1.10	3.9
Rural.....	2.9	78.0	566	610	2,240	1.08	5.7
Climate Zone1/							
Under 2,000 CDD and							
Over 7,000 HDD.....	2.3	88.9	645	686	2,546	1.06	6.0
5,500 to 7,000 HDD....	4.3	97.9	709	773	2,339	1.09	4.1
4,000 to 5,499 HDD....	4.4	73.8	538	573	1,904	1.06	7.1
Under 4,000 HDD.....	.5	33.0	240	266	1,396	1.11	9.8
2,000 CDD or More and							
Under 4,000 HDD.....	Q	Q	Q	Q	Q	Q	NF
Type of Housing Unit							
Single-Family.....	8.2	92.4	669	736	2,613	1.10	3.2
Detached.....	7.5	93.6	677	745	2,669	1.10	3.4
Attached.....	.7	79.7	578	645	2,021	1.12	8.9
Mobile Home.....	.4	49.5	364	408	798	1.12	11.9
Multifamily.....	3.1	63.6	468	457	1,151	.98	4.9
2 to 4 Units.....	1.3	89.6	657	726	1,419	1.11	6.3
5 or More Units.....	1.8	45.6	338	271	965	.80	6.3
Heated Floorspace (square feet)							
Fewer than 1,000.....	2.9	53.7	395	401	792	1.02	4.8
1,000 to 1,999	4.2	75.3	547	600	1,906	1.10	3.8
2,000 to 2,999	3.1	90.3	655	695	2,692	1.06	4.1
3,000 or More	1.5	148.4	1074	1185	4,435	1.10	5.7
Number of Rooms							
1 to 3.....	1.3	43.7	323	303	756	.94	9.7
4 to 6.....	6.6	73.4	534	568	1,823	1.06	2.7
7 or More.....	3.8	114.1	825	913	3,240	1.11	4.7
Ownership of Unit							
Owned.....	8.7	90.4	655	716	2,526	1.09	3.1
Rented.....	3.0	63.3	466	470	1,150	1.01	4.8
Public Housing.....	Q	48.9	360	313	1,176	.87	32.2
Not Public Housing....	2.6	65.9	485	498	1,145	1.03	6.3
Rent Subsidy.....	.2	49.0	362	362	871	1.00	20.5
No Rent Subsidy....	2.4	67.3	495	509	1,167	1.03	5.9
Year of Construction							
1939 or Before.....	4.4	91.1	663	706	2,232	1.07	5.2
1940 to 1949.....	1.0	69.8	509	554	1,717	1.09	8.4
1950 to 1959.....	2.4	85.1	617	679	2,032	1.10	7.4
1960 to 1969.....	1.8	75.2	546	581	2,113	1.06	6.6
1970 to 1979.....	1.7	81.0	588	629	2,467	1.07	10.3
1980 to 1984.....	.2	55.7	406	423	2,457	1.04	20.0
1985 to 1987.....	Q	Q	Q	Q	Q	Q	NF
1988 to 19902/.....	Q	Q	Q	Q	Q	Q	NF

See footnotes at end of table.

Table 23. Fuel Oil Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Households Using	Average per Household					RSE Row Factors
		Consumption				Expenditures	
	Fuel Oil (million)	(million Btu)	(gallons)	Expenditures (dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	2.0	1.2	1.2	1.3	1.0	0.3	
All Fuel Oil Paid by Household							
Yes	9.0	90.8	658	725	2,501	1.10	3.1
No	2.7	58.7	434	409	1,060	.94	4.9
1990 Family Income							
Less than $10,000	2.0	69.3	505	530	1,546	1.05	9.7
$10,000 to $19,999	2.2	69.5	507	533	1,656	1.05	5.2
$20,000 to $34,999	3.0	77.1	561	597	2,135	1.06	4.2
$35,000 to $49,999	2.2	85.2	618	669	2,169	1.08	4.8
$50,000 or More	2.3	114.7	830	919	3,212	1.11	5.3
Below Poverty Line							
100 Percent	1.4	67.7	495	519	1,492	1.05	8.6
125 Percent	2.1	65.1	475	496	1,545	1.04	7.2
Eligible for Federal Assistance3/	3.6	71.2	519	546	1,691	1.05	5.1
Age of Householder							
Under 35 Years	2.7	77.2	564	600	1,714	1.06	6.1
35 to 44 Years	2.5	83.4	605	658	2,378	1.09	5.2
45 to 59 Years	2.5	87.1	632	685	2,442	1.08	4.9
60 Years and Over	4.0	85.3	619	663	2,178	1.07	4.9
Education of Householder							
12 Years or Fewer	7.6	75.2	547	585	1,948	1.07	4.0
13 to 16 Years	2.9	94.6	687	741	2,395	1.08	4.8
17 Years or More	1.2	108.6	787	862	3,035	1.10	10.3
Race of Householder							
White	10.6	85.3	620	668	2,242	1.08	3.0
Black	1.0	66.6	489	516	1,488	1.05	11.0
Other	Q	Q	Q	Q	Q	Q	NF
Householder of Hispanic Descent							
Yes	.6	75.4	551	554	1,796	1.01	7.7
No	11.1	83.8	609	657	2,189	1.08	3.0
Household Size							
1 Person	2.6	68.2	498	519	1,549	1.04	6.2
2 Persons	3.8	86.8	630	672	2,206	1.07	4.0
3 to 5 Persons	4.9	88.0	639	700	2,444	1.10	4.2
6 or More Persons	.5	92.5	674	723	2,439	1.07	11.4

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 24. Kerosene Consumption and Expenditures in U.S. Households, 1990

Characteristics	Households Using	Average per Household					RSE Row
		Consumption				Expenditures	
	Kerosene (million)	(million Btu)	(gallons)	Expenditures (dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	1.2	1.7	1.7	1.8	0.6	0.3	Factors
Total U.S. Households.....	5.3	12.3	91	116	1,753	1.27	7.7
Urban Status							
Urban.....	3.1	9.8	73	93	1,902	1.28	10.4
Central City.....	1.0	13.3	99	130	1,893	1.32	18.1
Suburban.....	2.1	8.2	61	76	1,907	1.24	11.0
Rural.....	2.2	15.8	117	148	1,541	1.26	11.0
Climate Zone1/							
Under 2,000 CDD and							
Over 7,000 HDD.....	.5	28.3	210	269	1,670	1.28	17.2
5,500 to 7,000 HDD....	1.8	7.8	58	72	2,168	1.24	17.0
4,000 to 5,499 HDD....	1.2	11.5	85	113	1,859	1.33	9.8
Under 4,000 HDD.....	1.6	11.9	88	107	1,340	1.21	12.0
2,000 CDD or More and							
Under 4,000 HDD.....	.2	Q	Q	Q	1,123	1.38	36.4
Type of Housing Unit							
Single-Family.....	4.1	9.2	68	88	1,984	1.28	7.3
Detached.....	3.8	9.4	70	90	1,975	1.28	7.7
Attached.....	.3	6.7	50	66	2,098	1.32	19.8
Mobile Home.....	.9	26.2	194	245	869	1.26	13.3
Multifamily.....	.3	Q	Q	Q	1,330	1.15	45.0
2 to 4 Units.....	Q	Q	Q	Q	Q	Q	NF
5 or More Units.....	Q	Q	Q	Q	Q	Q	NF
Heated Floorspace (square feet)							
Fewer than 1,000.....	1.8	21.4	159	203	875	1.28	9.8
1,000 to 1,999	2.3	10.4	77	96	1,685	1.25	9.3
2,000 to 2,999	1.0	3.8	28	36	2,772	1.30	13.3
3,000 or More	.3	.8	6	7	4,216	1.26	25.6
Number of Rooms							
1 to 3.....	.3	20.5	152	205	893	1.35	32.9
4 to 6.....	3.7	13.8	102	129	1,449	1.26	8.6
7 or More.....	1.4	6.6	49	63	2,740	1.28	13.8
Ownership of Unit							
Owned.....	4.0	11.1	82	102	1,887	1.25	8.7
Rented.....	1.3	16.1	119	158	1,331	1.32	13.0
Public Housing.....	NC	NC	NC	NC	NC	NC	NC
Not Public Housing....	1.3	16.1	119	158	1,331	1.32	13.0
Rent Subsidy.....	Q	Q	Q	Q	Q	Q	NF
No Rent Subsidy....	1.2	15.6	116	154	1,358	1.33	14.2
Year of Construction							
1939 or Before.....	1.3	14.2	105	135	1,941	1.28	12.2
1940 to 1949.....	.4	8.3	62	79	1,606	1.27	22.9
1950 to 1959.....	.6	9.0	67	93	1,683	1.40	18.6
1960 to 1969.....	.7	Q	Q	Q	1,909	1.20	16.4
1970 to 1979.....	1.5	17.9	132	168	1,722	1.27	14.3
1980 to 1984.....	.5	Q	Q	Q	1,433	1.19	25.4
1985 to 1987.....	Q	Q	Q	Q	Q	Q	NF
1988 to 19902/.....	Q	Q	Q	Q	Q	Q	NF

See footnotes at end of table.

Table 24. Kerosene Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Households Using	Average per Household					RSE Row
		Consumption			Expenditures		
	Kerosene (million)	(million Btu)	(gallons)	Expenditures (dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	1.2	1.7	1.7	1.8	0.6	0.3	Factors
All Kerosene Paid by Household							
Yes	5.3	12.3	91	116	1,757	1.27	7.8
No	Q	Q	Q	Q	Q	Q	NF
1990 Family Income							
Less than $10,000	.9	13.5	100	132	1,082	1.33	16.8
$10,000 to $19,999	1.1	18.8	139	171	1,477	1.23	10.6
$20,000 to $34,999	1.8	13.4	100	130	1,608	1.30	12.0
$35,000 to $49,999	.9	4.5	33	41	2,276	1.24	11.8
$50,000 or More	.6	6.0	44	50	2,991	1.14	19.6
Below Poverty Line							
100 Percent	.8	15.6	116	152	1,237	1.31	14.5
125 Percent	1.1	16.1	119	154	1,197	1.29	15.3
Eligible for Federal Assistance3/	1.8	14.0	104	134	1,355	1.29	11.1
Age of Householder							
Under 35 Years	1.7	11.5	85	110	1,329	1.29	12.6
35 to 44 Years	1.3	14.1	105	130	1,886	1.24	13.3
45 to 59 Years	1.3	12.5	93	120	2,095	1.29	14.5
60 Years and Over	1.0	10.9	81	101	1,836	1.25	12.9
Education of Householder							
12 Years or Fewer	3.7	14.5	107	137	1,616	1.27	7.6
13 to 16 Years	1.3	7.9	58	74	1,869	1.26	16.8
17 Years or More	.3	Q	Q	Q	3,139	1.19	19.4
Race of Householder							
White	4.5	11.2	83	104	1,800	1.25	8.8
Black	.8	19.0	141	187	1,508	1.33	19.3
Other	Q	Q	Q	Q	Q	Q	NF
Householder of Hispanic Descent							
Yes	Q	Q	Q	Q	Q	Q	NF
No	5.2	12.3	91	115	1,747	1.26	7.7
Household Size							
1 Person	.8	10.3	77	100	1,216	1.31	16.7
2 Persons	1.4	13.0	96	120	1,924	1.25	11.1
3 to 5 Persons	2.7	11.7	87	109	1,846	1.26	9.9
6 or More Persons	.4	18.7	138	186	1,607	1.34	18.2

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 25. Liquefied Petroleum Gas Consumption and Expenditures in U.S. Households, 1990

Characteristics	Households Using	Average per Household					RSE Row
		Consumption		Expenditures		Expenditures	
	LPG (million)	(million Btu)	(gallons)	(dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	1.7	1.3	1.3	1.1	0.7	0.5	Factors
Total U.S. Households.....	8.2	34.1	373	381	1,684	1.02	5.5
Urban Status							
Urban.....	3.8	29.4	321	336	1,786	1.05	7.5
Central City.....	.5	19.1	209	272	1,376	1.30	20.1
Suburban.....	3.3	31.0	340	346	1,852	1.02	8.3
Rural.....	4.4	38.2	418	420	1,594	1.00	7.4
Climate Zone1/							
Under 2,000 CDD and							
Over 7,000 HDD.....	1.5	48.0	526	485	1,991	.92	12.4
5,500 to 7,000 HDD....	1.8	33.6	368	378	2,055	1.03	10.4
4,000 to 5,499 HDD....	1.6	37.4	410	418	1,561	1.02	12.4
Under 4,000 HDD.....	1.8	31.5	345	364	1,402	1.05	12.0
2,000 CDD or More and							
Under 4,000 HDD.....	1.5	20.6	226	267	1,404	1.18	11.6
Type of Housing Unit							
Single-Family.....	6.2	36.3	397	399	1,932	1.00	6.2
Detached.....	6.1	36.6	401	402	1,938	1.00	6.2
Attached.....	Q	Q	Q	Q	Q	Q	NF
Mobile Home.....	1.7	29.4	322	344	861	1.07	8.4
Multifamily.....	.4	19.1	209	258	1,293	1.23	21.0
2 to 4 Units.....	.3	23.6	259	310	1,412	1.20	22.3
5 or More Units.....	Q	Q	Q	Q	Q	Q	NF
Heated Floorspace (square feet)							
Fewer than 1,000.....	3.2	25.7	281	312	868	1.11	6.2
1,000 to 1,999	3.3	37.7	413	417	1,685	1.01	7.1
2,000 to 2,999	1.2	39.9	437	426	2,918	.97	7.7
3,000 or More	.5	50.5	553	483	4,016	.87	12.1
Number of Rooms							
1 to 3.....	1.1	25.5	279	320	810	1.15	16.2
4 to 6.....	5.3	33.1	363	376	1,550	1.04	5.5
7 or More.....	1.8	42.4	464	435	2,633	.94	9.1
Ownership of Unit							
Owned.....	6.7	35.6	390	397	1,840	1.02	5.6
Rented.....	1.6	27.5	301	315	1,029	1.04	11.6
Public Housing.....	Q	Q	Q	Q	Q	Q	NF
Not Public Housing....	1.5	27.7	303	317	1,036	1.05	11.8
Rent Subsidy.....	.2	19.2	210	285	973	1.36	27.6
No Rent Subsidy....	1.4	28.7	315	321	1,043	1.02	12.6
Year of Construction							
1939 or Before.....	1.8	40.8	447	438	1,944	.98	8.9
1940 to 1949.....	.7	35.2	386	429	1,462	1.11	14.5
1950 to 1959.....	.9	32.8	359	383	1,272	1.07	14.5
1960 to 1969.....	1.0	22.6	247	279	1,602	1.13	11.7
1970 to 1979.....	1.8	31.2	342	352	1,670	1.03	9.2
1980 to 1984.....	.9	41.0	449	430	1,791	.96	13.3
1985 to 1987.....	.4	28.6	313	334	1,648	1.07	16.8
1988 to 19902/.....	.6	37.2	408	375	1,890	.92	15.7

See footnotes at end of table.

Table 25. Liquefied Petroleum Gas Consumption and Expenditures in U.S. Households, 1990 (Continued)

Characteristics	Households Using	Average per Household					RSE Row
		Consumption			Expenditures		
	LPG (million)	(million Btu)	(gallons)	Expenditures (dollars)	Floorspace (square feet)	(dollars per gallon)	
RSE Column Factors:	1.7	1.3	1.3	1.1	0.7	0.5	Factors
All LPG Paid by Household							
Yes	7.8	33.7	369	376	1,714	1.02	5.6
No	.4	42.1	461	476	1,094	1.03	16.1
1990 Family Income							
Less than $10,000	2.3	28.9	317	349	1,139	1.10	7.8
$10,000 to $19,999	1.9	35.8	392	403	1,411	1.03	7.6
$20,000 to $34,999	1.9	35.5	389	388	1,855	1.00	8.5
$35,000 to $49,999	1.2	33.3	365	375	2,153	1.03	11.6
$50,000 or More	.9	41.3	452	407	2,645	.90	12.8
Below Poverty Line							
100 Percent	2.1	28.6	314	333	1,079	1.06	7.4
125 Percent	2.7	31.7	347	372	1,155	1.07	6.7
Eligible for Federal Assistance3/	3.7	32.4	355	385	1,263	1.09	5.8
Age of Householder							
Under 35 Years	2.1	32.9	360	369	1,527	1.02	6.7
35 to 44 Years	1.6	39.6	434	401	1,776	.92	10.2
45 to 59 Years	1.8	27.1	296	324	1,781	1.09	8.3
60 Years and Over	2.7	36.4	398	417	1,684	1.05	9.1
Education of Householder							
12 Years or Fewer	6.2	33.4	366	378	1,528	1.03	6.1
13 to 16 Years	1.7	37.2	407	408	2,047	1.00	8.4
17 Years or More	.3	Q	Q	299	2,790	.93	25.6
Race of Householder							
White	7.3	34.3	376	381	1,750	1.01	5.7
Black	.7	32.4	355	384	1,170	1.08	14.7
Other	.3	31.0	339	361	1,199	1.06	21.9
Householder of Hispanic Descent							
Yes	.2	16.6	182	226	1,468	1.25	31.3
No	8.0	34.5	378	385	1,690	1.02	5.5
Household Size							
1 Person	1.7	26.1	285	314	1,072	1.10	9.8
2 Persons	2.7	33.3	364	369	1,855	1.01	7.7
3 to 5 Persons	3.3	39.0	427	424	1,848	.99	6.9
6 or More Persons	.5	33.8	370	396	1,790	1.07	11.7

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and D of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 26. Wood Consumption in U.S. Households,
December 1989 Through November 1990

Characteristics	Households Using Wood					Wood Used as Main Space-Heating Fuel					RSE Row Factors
		Consumption					Consumption				
		Total		Average per Household			Total		Average per Household		
	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	
RSE Column Factors:	0.6	1.0	1.0	0.7	0.7	1.4	1.7	1.7	0.9	0.9	
Total U.S. Households.....	22.9	0.58	29.1	25.4	1.3	3.9	0.30	15.0	77.2	3.9	10.1
Urban Status											
Urban.....	16.8	.30	15.1	18.0	.9	1.5	.11	5.6	73.9	3.7	11.5
Central City.....	4.2	.04	2.1	10.0	.5	.2	.01	.6	60.4	3.0	17.2
Suburban.....	12.5	.26	13.0	20.8	1.0	1.3	.10	5.0	75.8	3.8	11.8
Rural.....	6.1	.28	14.0	45.6	2.3	2.4	.19	9.4	79.3	4.0	15.7
Climate Zone1/											
Under 2,000 CDD and											
Over 7,000 HDD.....	3.1	.16	7.8	49.5	2.5	1.0	.11	5.5	112.6	5.6	27.2
5,500 to 7,000 HDD....	6.2	.15	7.7	24.9	1.2	.9	.07	3.4	77.6	3.9	15.2
4,000 to 5,499 HDD....	5.9	.15	7.5	25.2	1.3	1.2	.08	4.0	65.1	3.3	17.4
Under 4,000 HDD.....	4.8	.08	4.1	17.2	.9	.6	.03	1.6	53.2	2.7	17.1
2,000 CDD or More and											
Under 4,000 HDD.....	2.9	.04	2.1	14.5	.7	Q	Q	Q	Q	Q	22.6
Type of Housing Unit											
Single-Family.....	20.9	.54	27.2	26.0	1.3	3.6	.28	14.0	78.7	3.9	10.4
Detached.....	19.7	.53	26.3	26.7	1.3	3.5	.28	13.9	78.7	3.9	10.5
Attached.....	1.2	.02	.9	15.0	.8	Q	Q	Q	Q	Q	34.9
Mobile Home.....	.6	.02	1.2	38.6	1.9	.2	.02	.9	74.2	3.7	31.6
Multifamily.....	1.4	.01	.7	10.2	.5	Q	Q	Q	Q	Q	39.7
2 to 4 Units.....	.8	.01	.6	Q	Q	Q	Q	Q	Q	Q	45.2
5 or More Units.....	.6	(*)	.1	3.5	.2	Q	Q	Q	Q	Q	38.9
Heated Floorspace (square feet)											
Fewer than 1,000.....	2.3	.07	3.3	29.6	1.5	.9	.05	2.5	54.7	2.7	15.9
1,000 to 1,999	10.2	.26	12.9	25.4	1.3	1.7	.14	6.8	77.5	3.9	13.6
2,000 to 2,999	6.6	.19	9.4	28.6	1.4	1.0	.10	4.8	92.9	4.6	12.9
3,000 or More	3.9	.07	3.4	17.8	.9	.2	.02	1.0	94.7	4.7	18.3
Number of Rooms											
1 to 3.....	.7	.02	.9	26.2	1.3	.3	.01	.6	45.8	2.3	28.0
4 to 6.....	11.9	.33	16.6	28.0	1.4	2.5	.20	9.8	77.3	3.9	13.3
7 or More.....	10.4	.23	11.6	22.5	1.1	1.1	.09	4.5	85.3	4.3	11.0
Ownership of Unit											
Owned.....	20.6	.52	26.2	25.5	1.3	3.3	.26	13.2	80.9	4.0	10.5
Rented.....	2.3	.06	2.9	24.7	1.2	.6	.04	1.8	57.4	2.9	19.4
Public Housing.....	Q	Q	Q	Q	Q	NC	NC	NC	NC	NC	NF
Not Public Housing....	2.2	.05	2.7	23.8	1.2	.6	.04	1.8	57.4	2.9	21.7
Rent Subsidy.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
No Rent Subsidy....	2.2	.05	2.5	23.2	1.2	.6	.03	1.6	56.5	2.8	22.6
Year of Construction											
1939 or Before.....	3.8	.16	8.1	42.9	2.1	1.1	.11	5.5	96.3	4.8	16.8
1940 to 1949.....	1.2	.04	2.0	35.0	1.7	.3	.02	1.2	82.8	4.1	25.7
1950 to 1959.....	2.8	.06	3.2	22.8	1.1	.5	.04	1.9	71.2	3.6	14.9
1960 to 1969.....	3.7	.08	3.9	21.1	1.1	.5	.04	2.0	76.1	3.8	18.8
1970 to 1979.....	5.9	.13	6.3	21.1	1.1	.8	.05	2.5	61.7	3.1	13.7
1980 to 1984.....	2.8	.06	3.1	22.4	1.1	.3	.02	1.0	66.9	3.3	23.8
1985 to 1987.....	1.8	.03	1.4	15.2	.8	.2	.01	.7	62.5	3.1	30.4
1988 to 19902/.....	.8	.02	1.0	24.8	1.2	Q	Q	Q	Q	Q	33.4

See footnotes at end of table.

Table 26. Wood Consumption in U.S. Households,
December 1989 through November 1990 (Continued)

Characteristics	Households Using Wood					Wood Used as Main Space-Heating Fuel					RSE Row Factors
		Consumption					Consumption				
		Total		Average per Household			Total		Average per Household		
	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	
RSE Column Factors:	0.6	1.0	1.0	0.7	0.7	1.4	1.7	1.7	0.9	0.9	
1990 Family Income											
Less than $10,000	1.8	0.07	3.7	41.7	2.1	0.7	0.05	2.4	71.5	3.6	19.2
$10,000 to $19,999	3.1	.12	5.8	38.1	1.9	.8	.07	3.6	88.4	4.4	21.0
$20,000 to $34,999	5.2	.17	8.5	32.7	1.6	1.1	.10	5.1	88.7	4.4	13.9
$35,000 to $49,999	5.0	.11	5.6	22.4	1.1	.7	.05	2.3	61.5	3.1	10.6
$50,000 or More	7.9	.11	5.5	14.0	.7	.5	.03	1.6	63.6	3.2	15.1
Below Poverty Line											
100 Percent	2.0	.09	4.4	44.0	2.2	.8	.06	3.1	73.0	3.7	19.2
125 Percent	2.7	.12	5.8	43.1	2.2	1.1	.08	4.1	75.1	3.8	17.3
Eligible for Federal Assistance3/	4.0	.18	9.0	45.3	2.3	1.5	.13	6.3	84.8	4.2	17.1
Age of Householder											
Under 35 Years	4.2	.10	5.2	24.9	1.2	.8	.05	2.7	66.9	3.3	16.7
35 to 44 Years	7.6	.17	8.4	22.1	1.1	1.0	.08	3.9	74.6	3.7	10.4
45 to 59 Years	6.1	.16	7.9	25.9	1.3	1.1	.09	4.4	80.3	4.0	19.0
60 Years and Over	5.0	.15	7.5	30.3	1.5	1.0	.08	4.1	85.0	4.3	10.8
Education of Householder											
12 Years or Fewer	9.9	.37	18.5	37.3	1.9	2.8	.23	11.5	80.8	4.0	11.6
13 Years or More	13.0	.21	10.6	16.3	.8	1.0	.07	3.5	67.5	3.4	10.9
Race of Householder											
White	21.8	.55	27.7	25.5	1.3	3.8	.29	14.5	77.2	3.9	10.4
Black	.7	.02	.8	24.2	1.2	Q	Q	Q	Q	Q	31.4
Other	.4	.01	.5	24.7	1.2	Q	Q	Q	Q	Q	29.3
Householder of Hispanic Descent											
Yes	.9	.02	.8	17.8	.9	Q	Q	Q	Q	Q	31.3
No	22.0	.57	28.3	25.7	1.3	3.8	.29	14.6	77.4	3.9	10.2
Household Size											
1 Person	3.1	.06	2.8	18.4	.9	.5	.03	1.5	63.8	3.2	19.4
2 Persons	7.5	.19	9.4	24.8	1.2	1.3	.09	4.7	73.4	3.7	10.9
3 to 5 Persons	11.3	.31	15.4	27.2	1.4	1.9	.16	8.1	83.8	4.2	13.0
6 or More Persons	.9	.03	1.5	32.3	1.6	.2	.02	.8	69.4	3.5	23.7
Main Heating Fuel											
Natural Gas	9.9	.11	5.4	10.9	.5	--	--	--	--	--	9.9
Electricity	5.0	.08	4.0	15.9	.8	--	--	--	--	--	17.6
Fuel Oil or Kerosene	2.9	.06	3.2	22.0	1.1	--	--	--	--	--	16.3
Wood	3.9	.30	15.0	77.2	3.9	3.9	.30	15.0	77.2	3.9	13.3
Heating Stove	2.9	.22	10.9	75.0	3.8	2.9	.22	10.9	75.0	3.8	16.0
Fireplace	.3	.01	.5	39.0	2.0	.3	.01	.5	39.0	2.0	27.9
Furnace/Other	.7	.07	3.5	101.6	5.1	.7	.07	3.5	101.6	5.1	21.9
LPG	1.0	.03	1.5	28.3	1.4	--	--	--	--	--	27.2
Other	Q	Q	Q	Q	Q	--	--	--	--	--	NF

See footnotes at end of table.

Table 26. Wood Consumption in U.S. Households,
December 1989 through November 1990 (Continued)

Characteristics	Households Using Wood					Wood Used as Main Space-Heating Fuel					RSE Row Factors
		Consumption					Consumption				
		Total		Average per Household			Total		Average per Household		
	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	Households (millions)	(quadrillion Btu	(million cords)	(million Btu)	(cords)	
RSE Column Factors:	0.6	1.0	1.0	0.7	0.7	1.4	1.7	1.7	0.9	0.9	
Secondary Heating Equipment Used	21.9	0.49	24.7	22.5	1.1	3.0	0.22	11.0	72.8	3.6	10.3
Amount of Wood Burned in Past 12 Months											
Less than one-half Cord.	10.8	.04	1.9	3.6	.2	Q	Q	Q	Q	Q	5.7
One-half to Less than 1.	3.9	.05	2.3	11.6	.6	.2	(*)	.1	12.6	.6	8.1
1 to Less than 2	2.7	.06	3.1	23.3	1.2	.5	.01	.6	26.5	1.3	8.1
2 to 4 Cords	3.9	.23	11.3	57.1	2.9	1.9	.12	5.9	61.9	3.1	5.8
More than 4 Cords	1.6	.21	10.5	132.8	6.6	1.2	.17	8.4	138.3	6.9	16.8
Hours Wood Burned in Winter											
Less than 1 Hour per week	6.3	.03	1.5	4.6	.2	Q	Q	Q	Q	Q	13.4
Less than 1 Hour per day	5.1	.05	2.5	9.6	.5	NC	NC	NC	NC	NC	12.0
1 to 4 Hours per day	4.6	.08	4.0	17.6	.9	.3	.01	.4	28.3	1.4	16.7
More than 4 Hours per day	2.7	.11	5.4	39.5	2.0	.6	.03	1.7	59.9	3.0	13.3
Almost Continuously	4.2	.32	15.8	75.2	3.8	3.0	.25	12.7	85.4	4.3	12.4
Purchased Firewood											
Yes	8.0	.24	11.8	29.4	1.5	1.3	.11	5.6	86.2	4.3	14.2
No	14.6	.33	16.6	22.8	1.1	2.5	.18	9.0	71.7	3.6	9.7

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Data not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 27. Average Expenditures for Major Energy Sources in U.S. Households, 1990
(Dollars per Million Btu)

Characteristics	Major Energy Sources1/	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas	
RSE Column Factors:	0.9	0.8	0.7	0.7	1.5	1.9	RSE Row Factors
Total U.S. Households.....	12.0	23.6	5.6	7.8	9.4	11.2	1.3
Urban Status							
Urban.....	11.9	24.6	5.7	7.8	9.5	11.4	1.7
Central City.....	11.2	24.3	5.8	7.3	9.8	14.3	3.1
Suburban.....	12.4	24.8	5.6	8.0	9.2	11.2	1.8
Rural.....	12.2	20.8	5.2	7.8	9.4	11.0	2.6
Climate Zone2/							
Under 2,000 CDD and Over 7,000 HDD.....	10.2	21.6	5.0	7.7	9.5	10.1	3.5
5,500 to 7,000 HDD.....	10.1	24.6	5.3	7.9	9.2	11.2	2.8
4,000 to 5,499 HDD.....	12.0	23.5	6.3	7.8	9.9	11.2	3.6
Under 4,000 HDD.....	13.8	24.3	5.8	8.0	9.0	11.5	2.5
2,000 CDD or More and Under 4,000 HDD.....	15.9	23.0	5.9	Q	10.3	12.9	5.2
Type of Housing Unit							
Single-Family.....	11.9	23.3	5.5	8.0	9.5	11.0	1.5
Detached.....	11.8	23.2	5.4	8.0	9.5	11.0	1.6
Attached.....	12.9	24.5	6.1	8.1	9.8	Q	3.6
Mobile Home.....	13.0	21.6	5.3	8.2	9.4	11.7	2.9
Multifamily.....	11.9	25.6	6.1	7.2	8.5	13.5	3.8
2 to 4 Units.....	10.7	26.5	6.1	8.1	Q	13.1	4.3
5 or More Units.....	13.4	24.9	6.0	5.9	Q	Q	3.3
Heated Floorspace (square feet)							
Fewer than 1,000.....	12.6	23.7	5.8	7.5	9.5	12.1	1.8
1,000 to 1,999	12.1	23.2	5.6	8.0	9.3	11.1	1.8
2,000 to 2,999	12.0	24.0	5.7	7.7	9.6	10.7	2.5
3,000 or More	10.5	24.5	5.1	8.0	9.3	9.6	3.4
Number of Rooms							
1 to 3.....	13.3	24.3	6.0	6.9	10.0	12.6	3.9
4 to 6.....	12.1	23.6	5.7	7.7	9.3	11.4	1.5
7 or More.....	11.5	23.5	5.4	8.0	9.5	10.3	2.2
Ownership of Unit							
Owned.....	12.0	23.5	5.6	7.9	9.2	11.1	1.4
Rented.....	11.9	23.9	5.7	7.4	9.8	11.4	1.9
Public Housing.....	11.3	20.9	6.2	6.4	NC	Q	10.6
Not Public Housing....	12.0	24.1	5.7	7.6	9.8	11.5	2.3
Rent Subsidy.....	12.4	25.9	5.8	7.4	Q	14.9	8.5
No Rent Subsidy....	11.9	24.0	5.7	7.6	9.9	11.2	2.3
Year of Construction							
1939 or Before.....	10.2	25.5	5.7	7.8	9.5	10.7	2.2
1940 to 1949.....	10.7	23.3	5.7	7.9	9.4	12.2	3.3
1950 to 1959.....	11.5	24.7	5.6	8.0	10.4	11.7	2.5
1960 to 1969.....	12.1	23.7	5.7	7.7	8.9	12.4	2.5
1970 to 1979.....	13.4	22.3	5.4	7.8	9.4	11.3	2.3
1980 to 1984.....	15.6	23.0	5.6	7.6	8.8	10.5	4.6
1985 to 1987.....	15.6	23.4	5.3	Q	Q	11.7	4.5
1988 to 19903/.....	12.0	22.8	4.8	Q	Q	10.1	5.8

See footnotes at end of table.

Table 27. Average Expenditures for Major Energy Sources in U.S. Households, 1990 (Continued)
(Dollars per Million Btu)

Characteristics	Major Energy Sources1/	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas	
RSE Column Factors:	0.9	0.8	0.7	0.7	1.5	1.9	RSE Row Factors
All Utilities Paid by Household							
Yes	12.1	23.3	5.5	8.0	9.4	11.2	1.4
No	10.8	27.3	6.0	7.0	Q	11.0	3.1
1990 Family Income							
Less than $10,000	11.1	22.9	5.7	7.7	9.8	12.1	2.5
$10,000 to $19,999	11.7	23.0	5.7	7.7	9.1	11.3	1.9
$20,000 to $34,999	11.9	23.1	5.5	7.7	9.6	10.9	2.0
$35,000 to $49,999	12.4	23.6	5.7	7.9	9.2	11.3	2.0
$50,000 or More	12.3	24.8	5.6	8.0	8.5	9.9	2.6
Below Poverty Line							
100 Percent	11.6	23.1	5.8	7.7	9.7	11.6	2.6
125 Percent	11.7	23.0	5.7	7.6	9.6	11.7	2.1
Eligible for Federal Assistance4/	11.6	23.3	5.7	7.7	9.6	11.9	1.7
Age of Householder							
Under 35 Years	12.0	23.9	5.6	7.8	9.6	11.2	2.1
35 to 44 Years	12.2	23.6	5.6	7.9	9.2	10.1	2.0
45 to 59 Years	12.5	23.4	5.5	7.9	9.6	12.0	1.9
60 Years and Over	11.3	23.5	5.7	7.8	9.2	11.5	1.9
Education of Householder							
12 Years or Fewer	11.9	23.4	5.7	7.8	9.4	11.3	1.5
13 to 16 Years	12.0	23.5	5.5	7.8	9.4	11.0	1.9
17 Years or More	12.1	24.8	5.7	7.9	8.8	10.1	3.6
Race of Householder							
White	12.0	23.6	5.5	7.8	9.3	11.1	1.5
Black	11.2	23.8	6.0	7.7	9.8	11.8	2.6
Other	13.2	24.1	5.7	Q	Q	11.6	8.0
Householder of Hispanic Descent							
Yes	12.3	26.0	5.7	7.4	Q	13.6	4.1
No	11.9	23.5	5.6	7.8	9.4	11.1	1.3
Household Size							
1 Person	11.4	23.7	5.6	7.6	9.7	12.0	2.2
2 Persons	11.8	23.4	5.7	7.7	9.3	11.1	1.7
3 to 5 Persons	12.3	23.6	5.6	8.0	9.3	10.9	1.6
6 or More Persons	12.4	23.9	5.7	7.8	10.0	11.7	3.4

1/ Major Energy Sources include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas.
2/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
3/ Does not include all new construction for 1990.
4/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 28. Total Consumption and Expenditures by End Uses in U.S. Households, 1990

Characteristics	Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE Row Factors
	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	
RSE Column Factors:	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	
Total U.S. Households	4.79	34.17	0.49	11.28	1.67	15.27	0.50	12.42	1.77	37.03	1.7
Urban Status											
Urban	3.73	26.13	.40	9.43	1.35	11.42	.39	9.94	1.37	29.04	2.0
Central City	1.53	10.31	.15	3.45	.56	4.44	.15	3.90	.52	10.56	2.7
Suburban	2.19	15.82	.25	5.97	.79	6.98	.23	6.04	.85	18.48	2.5
Rural	1.06	8.04	.09	1.86	.32	3.85	.11	2.48	.40	7.99	4.0
Climate Zone1/											
Under 2,000 CDD and											
Over 7,000 HDD	.71	4.86	.01	.32	.18	1.78	.04	.96	.17	3.55	14.4
5,500 to 7,000 HDD	2.02	13.12	.06	1.44	.57	4.56	.12	3.26	.51	11.00	7.6
4,000 to 5,499 HDD	1.14	8.68	.09	2.03	.39	3.63	.11	2.81	.40	8.42	10.1
Under 4,000 HDD	.55	4.49	.09	2.14	.31	2.87	.10	2.54	.35	7.38	9.9
2,000 CDD or More and											
Under 4,000 HDD	.36	3.02	.24	5.35	.23	2.44	.12	2.85	.33	6.69	8.4
Type of Housing Unit											
Single-Family	3.76	26.33	.38	8.83	1.19	10.86	.39	9.42	1.42	29.56	2.7
Detached	3.48	24.14	.36	8.13	1.09	9.93	.36	8.68	1.32	27.35	2.9
Attached	.27	2.20	.03	.69	.09	.93	.03	.74	.10	2.21	12.0
Mobile Home	.21	1.76	.02	.49	.07	.91	.02	.47	.09	1.64	12.9
Multifamily	.82	6.08	.08	1.97	.41	3.50	.09	2.53	.26	5.83	5.5
2 to 4 Units	.55	3.87	.03	.69	.20	1.63	.04	1.14	.13	2.82	10.2
5 or More Units	.27	2.20	.06	1.28	.22	1.87	.05	1.40	.13	3.01	8.5
Heated Floorspace (square feet)											
Fewer than 1,000	.90	7.06	.11	2.37	.44	4.40	.13	3.17	.36	7.52	4.6
1,000 to 1,999	1.94	13.94	.22	5.03	.70	6.38	.22	5.28	.78	16.03	3.2
2,000 to 2,999	1.14	8.04	.11	2.59	.34	3.12	.11	2.70	.41	8.86	5.1
3,000 or More	.81	5.13	.05	1.29	.18	1.37	.05	1.28	.22	4.63	10.0
Number of Rooms											
1 to 3	.25	2.19	.04	.86	.15	1.46	.04	1.05	.10	2.16	8.3
4 to 6	2.72	19.59	.28	6.41	.99	9.29	.30	7.39	1.02	21.45	2.7
7 or More	1.82	12.39	.17	4.01	.53	4.53	.16	3.99	.64	13.42	5.2
Ownership of Unit											
Owned	3.66	25.96	.37	8.43	1.13	10.45	.37	9.04	1.36	28.47	2.6
Rented	1.13	8.21	.13	2.85	.54	4.83	.13	3.38	.41	8.57	4.4
Public Housing	.06	.46	(*)	.11	.04	.33	.01	.20	.03	.50	19.7
Not Public Housing	1.07	7.76	.12	2.75	.50	4.50	.12	3.18	.38	8.07	4.9
Rent Subsidy	.06	.44	(*)	.10	.03	.29	.01	.17	.02	.48	21.4
No Rent Subsidy	1.01	7.31	.12	2.65	.47	4.20	.12	3.01	.36	7.59	4.9
Year of Construction											
1939 or Before	1.63	10.69	.04	1.00	.42	3.48	.10	2.75	.38	8.18	5.3
1940 to 1949	.43	2.84	.02	.55	.13	1.11	.04	.92	.13	2.53	8.3
1950 to 1959	.79	5.42	.06	1.43	.26	2.09	.08	2.02	.28	5.81	5.4
1960 to 1969	.69	4.82	.09	2.08	.26	2.27	.08	2.03	.29	5.90	7.4
1970 to 1979	.79	6.41	.15	3.38	.36	3.61	.12	2.70	.40	8.40	5.3
1980 to 1984	.21	1.94	.06	1.39	.12	1.39	.04	1.06	.15	3.20	9.6
1985 to 1987	.13	1.14	.04	.98	.07	.83	.02	.59	.08	1.79	15.4
1988 to 19902/	.13	.90	.02	.47	.05	.50	.02	.35	.06	1.21	19.8
All Utilities Paid by Household											
Yes	4.20	30.16	.45	10.36	1.38	13.27	.45	10.87	1.60	33.25	2.2
No	.59	4.01	.04	.92	.28	2.01	.05	1.56	.17	3.78	7.8
1990 Family Income											
Less than $10,000	.72	5.10	.04	1.03	.23	2.05	.07	1.76	.21	4.18	7.3
$10,000 to $19,999	.89	6.40	.08	1.72	.30	2.89	.09	2.31	.30	6.05	4.7
$20,000 to $34,999	1.17	8.30	.12	2.61	.42	4.03	.12	3.02	.44	9.13	4.1
$35,000 to $49,999	.87	6.32	.11	2.59	.33	2.99	.09	2.30	.35	7.47	4.7
$50,000 or More	1.15	8.05	.14	3.32	.39	3.30	.12	3.03	.47	10.20	5.9
Below Poverty Line											
100 Percent	.54	3.91	.04	.83	.22	2.03	.06	1.45	.20	3.99	7.5
125 Percent	.76	5.55	.05	1.25	.30	2.81	.08	2.04	.28	5.67	6.4
Eligible for Federal Assistance3/	1.27	9.15	.09	2.04	.45	4.31	.13	3.24	.44	8.96	4.9
Age of Householder											
Under 35 Years	1.16	8.23	.13	3.08	.52	4.70	.12	3.09	.46	9.64	4.3
35 to 44 Years	1.05	7.51	.11	2.51	.42	3.88	.11	2.75	.45	9.51	4.1
45 to 59 Years	1.03	7.47	.14	3.28	.38	3.54	.12	2.99	.44	9.17	4.7
60 Years and Over	1.55	10.96	.11	2.41	.34	3.16	.14	3.60	.42	8.72	3.8
Education of Householder											
Less than 13 Years	2.61	18.91	.23	5.14	.89	8.56	.27	6.63	.94	19.33	2.8
13 to 16 Years	1.60	11.22	.20	4.51	.59	5.06	.17	4.30	.61	13.07	3.5
17 Years or More	.58	4.04	.07	1.63	.19	1.65	.06	1.50	.22	4.64	8.2

Table 28. Total Consumption and Expenditures by End Uses in U.S. Households, 1990

Characteristics	Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE Row Factors
	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	
RSE Column Factors:	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	
Race of Householder											
White	4.16	29.77	.42	9.71	1.39	12.99	.43	10.70	1.53	32.35	2.1
Black	.55	3.87	.06	1.34	.23	1.90	.06	1.39	.19	3.81	8.4
Other	.07	.53	.01	.24	.04	.38	.01	.33	.04	.88	12.8
Householder of Hispanic Descent											
Yes	.22	1.56	.03	.82	.13	1.02	.03	.88	.12	2.28	10.1
No	4.57	32.61	.46	10.46	1.54	14.26	.47	11.55	1.65	34.75	2.0
Household Size											
1 Person	1.00	7.21	.08	1.85	.24	2.26	.10	2.60	.23	4.94	3.0
2 Persons	1.62	11.50	.16	3.70	.50	4.56	.17	4.15	.54	11.17	3.0
3 to 5 Persons	1.98	14.10	.23	5.35	.82	7.51	.21	5.14	.89	18.74	3.0
6 or More Persons	.19	1.36	.02	.39	.10	.94	.02	.53	.11	2.19	9.7

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
(*) = Data cannot be displayed due to rounding.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * Consumption and Expenditure data are for major energy sources which include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 29. Consumption by End Uses, per U.S. Household, 1990

Characteristics	All Uses		Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE
	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	
RSE Column Factors:	1.1	0.7	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	Row Factors
Total U.S. Households	94.0	98.1	92.3	51.9	60.6	8.1	93.6	17.8	93.8	5.3	94.0	18.8	1.9
Urban Status													
Urban	72.9	99.2	72.2	51.6	48.1	8.3	72.6	18.6	72.7	5.3	72.9	18.7	2.1
Central City	29.8	97.7	29.7	51.7	18.2	8.4	29.8	18.9	29.7	5.1	29.8	17.3	2.9
Suburban	43.0	100.2	42.5	51.6	29.9	8.3	42.9	18.4	43.0	5.5	43.0	19.8	2.6
Rural	21.1	94.2	20.1	52.9	12.5	7.3	21.0	15.1	21.0	5.4	21.1	19.1	4.0
Climate Zone1/													
Under 2,000 CDD and													
Over 7,000 HDD	10.1	110.6	9.9	71.9	4.9	3.0	10.1	17.4	10.1	4.3	10.1	17.2	8.3
5,500 to 7,000 HDD	26.7	123.3	26.4	76.6	15.0	3.9	26.6	21.5	26.6	4.7	26.7	19.2	4.6
4,000 to 5,499 HDD	20.9	101.6	20.5	55.5	14.3	6.2	20.8	18.7	20.9	5.3	20.9	19.0	6.3
Under 4,000 HDD	19.3	72.9	19.0	29.2	12.3	7.5	19.2	16.0	19.3	5.2	19.3	18.3	5.8
2,000 CDD or More and													
Under 4,000 HDD	17.0	75.2	16.5	22.0	14.1	16.8	16.9	13.3	17.0	7.1	17.0	19.6	6.0
Type of Housing Unit													
Single-Family	64.4	110.9	63.0	59.6	42.2	9.1	64.1	18.5	64.3	6.0	64.4	22.1	1.9
Detached	58.4	113.3	57.1	61.0	38.1	9.3	58.2	18.8	58.3	6.1	58.4	22.6	2.1
Attached	6.0	87.3	5.9	46.4	4.1	6.9	6.0	15.7	6.0	4.7	6.0	16.5	8.5
Mobile Home	5.2	78.0	5.2	40.5	3.0	7.5	5.2	13.0	5.2	4.0	5.2	16.5	7.8
Multifamily	24.4	68.5	24.1	34.1	15.4	5.5	24.3	17.0	24.3	3.8	24.4	10.7	3.8
2 to 4 Units	10.0	94.5	9.8	56.0	5.8	5.0	10.0	19.7	9.9	4.1	10.0	12.9	6.3
5 or More Units	14.4	50.5	14.3	19.0	9.7	5.8	14.3	15.1	14.4	3.6	14.4	9.3	5.6
Heated Floorspace (square feet)													
Fewer than 1,000	30.6	63.6	29.5	30.6	17.5	6.1	30.3	14.7	30.4	4.1	30.6	11.9	3.1
1,000 to 1,999	39.1	98.5	38.8	50.0	26.0	8.4	39.1	17.9	39.1	5.5	39.1	19.9	2.2
2,000 to 2,999	16.9	125.2	16.7	68.2	11.8	9.4	16.8	20.5	16.8	6.4	16.9	24.3	3.3
3,000 or More	7.4	176.4	7.3	110.8	5.3	10.2	7.4	24.0	7.4	6.8	7.4	29.6	6.2
Number of Rooms													
1 to 3	11.7	49.9	11.4	22.3	6.5	6.0	11.6	12.7	11.6	3.5	11.7	8.6	5.6
4 to 6	58.0	91.5	56.9	47.7	36.9	7.5	57.8	17.2	57.9	5.1	58.0	17.7	1.9
7 or More	24.3	136.9	24.0	75.9	17.2	10.1	24.2	21.8	24.3	6.7	24.3	26.4	3.4
Ownership of Unit													
Owned	62.3	110.5	61.1	59.9	42.4	8.6	62.1	18.2	62.2	5.9	62.3	21.8	1.9
Rented	31.7	73.7	31.2	36.1	18.2	6.9	31.5	17.2	31.6	4.2	31.7	13.0	3.1
Public Housing	2.5	57.4	2.5	23.7	1.1	4.5	2.5	17.3	2.5	3.6	2.5	10.9	12.3
Not Public Housing	29.2	75.1	28.7	37.2	17.1	7.1	29.1	17.1	29.1	4.2	29.2	13.1	3.4
Rent Subsidy	1.7	69.7	1.7	36.5	1.0	4.3	1.7	15.5	1.7	3.7	1.7	12.5	15.8
No Rent Subsidy	27.5	75.4	27.0	37.3	16.2	7.3	27.3	17.2	27.4	4.3	27.5	13.2	3.5
Year of Construction													
1939 or Before	21.5	119.7	21.1	77.1	10.2	4.0	21.4	19.7	21.4	4.8	21.5	17.7	3.5
1940 to 1949	7.0	105.2	6.9	62.1	3.9	6.0	7.0	17.9	7.0	5.3	7.0	17.9	5.2
1950 to 1959	13.4	109.5	13.0	60.7	8.3	7.3	13.3	19.6	13.3	5.8	13.4	20.6	3.8
1960 to 1969	14.8	95.4	14.6	47.0	10.4	8.7	14.8	17.6	14.8	5.6	14.8	19.7	4.9
1970 to 1979	21.4	85.1	21.2	37.3	15.6	9.7	21.3	17.0	21.4	5.4	21.4	18.9	4.2
1980 to 1984	8.0	71.9	7.9	26.2	6.1	9.9	8.0	14.9	8.0	5.5	8.0	18.5	6.9
1985 to 1987	5.1	67.6	5.0	25.5	4.2	10.2	5.1	13.1	5.1	4.8	5.1	16.3	11.6
1988 to 19902/	2.8	103.1	2.7	50.7	2.0	10.5	2.8	19.7	2.8	5.5	2.8	21.7	13.1
All Utilities Paid by Household													
Yes	79.3	101.9	77.8	54.0	52.4	8.6	79.1	17.5	79.2	5.6	79.3	20.2	1.6
No	14.7	77.3	14.5	40.5	8.2	4.7	14.5	19.5	14.6	3.7	14.7	11.6	5.4
1990 Family Income													
Less than $10,000	15.9	79.9	15.7	45.7	7.9	5.7	15.8	14.4	15.8	4.6	15.9	13.3	4.5
$10,000 to $19,999	19.8	83.7	19.2	46.4	11.6	6.6	19.7	15.2	19.8	4.8	19.8	15.0	3.1
$20,000 to $34,999	24.3	93.4	23.8	49.1	15.7	7.5	24.2	17.5	24.3	5.1	24.3	18.0	2.8
$35,000 to $49,999	16.7	104.5	16.6	52.3	12.2	9.2	16.7	19.5	16.7	5.6	16.7	21.0	3.4
$50,000 or More	17.3	131.6	17.1	67.3	13.3	10.5	17.2	22.8	17.3	6.8	17.3	27.4	4.1
Below Poverty Line													
100 Percent	13.2	80.1	12.8	42.0	6.0	6.1	13.1	16.8	13.0	4.5	13.2	15.2	4.8
125 Percent	18.2	81.3	17.7	43.2	8.7	6.3	18.1	16.4	18.0	4.6	18.2	15.5	4.1
Eligible for Federal Assistance3/	27.9	85.4	27.1	46.7	14.3	6.2	27.7	16.4	27.7	4.7	27.9	15.8	3.1
Age of Householder													
Less than 35 Years	27.5	86.9	27.1	42.7	17.6	7.6	27.5	18.9	27.4	4.4	27.5	16.8	3.2
35 to 44 Years	20.2	106.5	19.7	53.2	12.4	8.9	20.1	21.1	20.1	5.5	20.2	22.5	3.0
45 to 59 Years	19.7	107.6	19.4	53.4	13.6	10.5	19.6	19.5	19.7	6.2	19.7	22.2	3.2
60 Years and Over	26.6	96.2	26.1	59.4	17.1	6.2	26.5	13.0	26.6	5.5	26.6	15.7	2.7
Education of Householder													
Less than 13 Years	52.6	93.9	51.2	51.0	31.2	7.3	52.4	17.0	52.4	5.1	52.6	17.8	2.0
13 to 16 Years	31.7	100.1	31.4	51.0	22.3	8.8	31.5	18.6	31.6	5.5	31.7	19.4	2.6
17 Years or More	9.7	114.0	9.7	59.5	7.2	9.4	9.7	19.7	9.7	5.9	9.7	22.3	5.4

Table 29. Consumption by End Uses, per U.S. Household, 1990

Characteristics	All Uses		Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE
	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Households (million)	Consumption (million Btu)	Row Factors
RSE Column Factors:	1.1	0.7	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	
Race of Householder													
White	80.9	98.2	79.6	52.3	53.0	7.9	80.7	17.3	80.8	5.4	80.9	19.0	1.4
Black	10.6	103.6	10.5	52.9	6.3	10.2	10.5	21.9	10.5	5.3	10.6	18.4	5.4
Other	2.5	71.5	2.3	31.5	1.3	7.4	2.4	18.5	2.5	4.8	2.5	16.3	8.9
Householder of Hispanic Descent													
Yes	6.3	83.7	6.2	35.8	3.4	10.1	6.3	20.1	6.3	5.1	6.3	18.3	7.6
No	87.6	99.1	86.1	53.0	57.2	8.0	87.3	17.6	87.4	5.3	87.6	18.9	1.9
Household Size													
1 Person	23.4	71.1	23.0	43.5	14.8	5.4	23.2	10.5	23.3	4.5	23.4	10.0	3.3
2 Persons	30.6	97.6	30.2	53.7	20.0	8.1	30.5	16.3	30.5	5.5	30.6	17.6	2.3
3 to 5 Persons	36.4	113.6	35.7	55.6	24.0	9.7	36.3	22.7	36.3	5.7	36.4	24.5	2.1
6 or More Persons	3.6	119.7	3.5	53.7	1.7	9.6	3.6	28.6	3.6	5.6	3.6	29.0	6.3

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * Consumption and Expenditure data are for major energy sources which include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 30. Expenditures by End Uses, per U.S. Household, 1990

Characteristics	All Uses		Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE Row Factors
	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	
RSE Column Factors:	1.2	0.6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	
Total U.S. Households	94.0	1,172	92.3	370	60.6	186	93.6	163	93.8	133	94.0	394	1.8
Urban Status													
Urban	72.9	1,180	72.2	362	48.1	196	72.6	157	72.7	137	72.9	399	1.9
Central City	29.8	1,095	29.7	348	18.2	189	29.8	149	29.7	131	29.8	354	2.8
Suburban	43.0	1,239	42.5	372	29.9	200	42.9	163	43.0	141	43.0	430	2.4
Rural	21.1	1,146	20.1	400	12.5	148	21.0	184	21.0	118	21.1	378	4.5
Climate Zone1/													
Under 2,000 CDD and													
Over 7,000 HDD	10.1	1,132	9.9	490	4.9	65	10.1	177	10.1	95	10.1	350	8.7
5,500 to 7,000 HDD	26.7	1,251	26.4	497	15.0	96	26.6	172	26.6	123	26.7	412	4.3
4,000 to 5,499 HDD	20.9	1,222	20.5	422	14.3	142	20.8	174	20.9	134	20.9	402	6.2
Under 4,000 HDD	19.3	1,008	19.0	237	12.3	174	19.2	149	19.3	132	19.3	383	5.6
2,000 CDD or More and													
Under 4,000 HDD	17.0	1,197	16.5	183	14.1	379	16.9	144	17.0	168	17.0	393	5.5
Type of Housing Unit													
Single-Family	64.4	1,321	63.0	418	42.2	209	64.1	169	64.3	147	64.4	459	1.9
Detached	58.4	1,340	57.1	423	38.1	214	58.2	171	58.3	149	58.4	469	2.0
Attached	6.0	1,129	5.9	371	4.1	169	6.0	156	6.0	123	6.0	369	7.6
Mobile Home	5.2	1,011	5.2	340	3.0	163	5.2	175	5.2	90	5.2	315	8.2
Multifamily	24.4	815	24.1	252	15.4	127	24.3	144	24.3	104	24.4	239	3.5
2 to 4 Units	10.0	1,015	9.8	394	5.8	120	10.0	163	9.9	115	10.0	282	6.2
5 or More Units	14.4	677	14.3	154	9.7	132	14.3	131	14.4	97	14.4	209	5.3
Heated Floorspace (square feet)													
Fewer than 1,000	30.6	802	29.5	239	17.5	136	30.3	145	30.4	104	30.6	246	2.9
1,000 to 1,999	39.1	1,192	38.8	359	26.0	193	39.1	163	39.1	135	39.1	410	2.2
2,000 to 2,999	16.9	1,500	16.7	482	11.8	219	16.8	185	16.8	161	16.9	525	3.3
3,000 or More	7.4	1,845	7.3	703	5.3	243	7.4	186	7.4	172	7.4	624	6.4
Number of Rooms													
1 to 3	11.7	662	11.4	192	6.5	133	11.6	126	11.6	91	11.7	185	5.4
4 to 6	58.0	1,106	56.9	344	36.9	174	57.8	161	57.9	128	58.0	370	1.8
7 or More	24.3	1,576	24.0	517	17.2	233	24.2	187	24.3	164	24.3	552	3.4
Ownership of Unit													
Owned	62.3	1,322	61.1	425	42.4	199	62.1	168	62.2	145	62.3	457	1.8
Rented	31.7	878	31.2	264	18.2	157	31.5	153	31.6	107	31.7	270	2.9
Public Housing	2.5	646	2.5	185	1.1	97	2.5	134	2.5	83	2.5	201	11.5
Not Public Housing	29.2	898	28.7	270	17.1	161	29.1	155	29.1	109	29.2	276	3.1
Rent Subsidy	1.7	863	1.7	264	1.0	105	1.7	169	1.7	101	1.7	278	14.5
No Rent Subsidy	27.5	900	27.0	271	16.2	164	27.3	154	27.4	110	27.5	276	3.2
Year of Construction													
1939 or Before	21.5	1,216	21.1	507	10.2	98	21.4	163	21.4	129	21.5	381	3.6
1940 to 1949	7.0	1,130	6.9	412	3.9	142	7.0	158	7.0	131	7.0	360	5.3
1950 to 1959	13.4	1,254	13.0	416	8.3	174	13.3	157	13.3	152	13.4	435	4.0
1960 to 1969	14.8	1,155	14.6	330	10.4	200	14.8	153	14.8	138	14.8	399	4.7
1970 to 1979	21.4	1,143	21.2	302	15.6	216	21.3	169	21.4	126	21.4	392	3.9
1980 to 1984	8.0	1,120	7.9	247	6.1	230	8.0	175	8.0	133	8.0	399	6.2
1985 to 1987	5.1	1,051	5.0	231	4.2	232	5.1	164	5.1	116	5.1	353	9.8
1988 to 19902/	2.8	1,237	2.7	340	2.0	237	2.8	179	2.8	126	2.8	436	10.4
All Utilities Paid by Household													
Yes	79.3	1,234	77.8	388	52.4	198	79.1	168	79.2	137	79.3	419	1.5
No	14.7	838	14.5	277	8.2	112	14.5	138	14.6	107	14.7	258	5.0
1990 Family Income													
Less than $10,000	15.9	888	15.7	326	7.9	130	15.8	130	15.8	112	15.9	263	4.4
$10,000 to $19,999	19.8	978	19.2	332	11.6	149	19.7	147	19.8	117	19.8	305	3.0
$20,000 to $34,999	24.3	1,115	23.8	349	15.7	167	24.2	166	24.3	124	24.3	376	2.7
$35,000 to $49,999	16.7	1,296	16.6	382	12.2	212	16.7	180	16.7	138	16.7	446	3.0
$50,000 or More	17.3	1,618	17.1	472	13.3	251	17.2	192	17.3	176	17.3	591	3.8
Below Poverty Line													
100 Percent	13.2	928	12.8	305	6.0	139	13.1	155	13.0	112	13.2	303	4.7
125 Percent	18.2	951	17.7	313	8.7	144	18.1	155	18.0	113	18.2	311	4.1
Eligible for Federal Assistance3/	27.9	994	27.1	337	14.3	143	27.7	156	27.7	117	27.9	321	3.1
Age of Householder													
Less than 35 Years	27.5	1,044	27.1	304	17.6	175	27.5	171	27.4	113	27.5	350	3.0
35 to 44 Years	20.2	1,297	19.7	380	12.4	203	20.1	193	20.1	137	20.2	471	2.8
45 to 59 Years	19.7	1,343	19.4	385	13.6	241	19.6	181	19.7	152	19.7	466	3.0
60 Years and Over	26.6	1,084	26.1	420	17.1	141	26.5	119	26.6	135	26.6	328	2.7
Education of Householder													
Less than 13 Years	52.6	1,114	51.2	369	31.2	165	52.4	163	52.4	127	52.6	368	2.0
13 to 16 Years	31.7	1,205	31.4	358	22.3	203	31.5	161	31.6	136	31.7	413	2.5
17 Years or More	9.7	1,381	9.7	417	7.2	227	9.7	170	9.7	154	9.7	476	5.1
Race of Householder													
White	80.9	1,181	79.6	374	53.0	183	80.7	161	80.8	133	80.9	400	1.4
Black	10.6	1,162	10.5	369	6.3	213	10.5	181	10.5	133	10.6	359	5.2
Other	2.5	944	2.3	234	1.3	180	2.4	157	2.5	131	2.5	352	8.3

Table 30. Expenditures by End Uses, per U.S. Household, 1990

Characteristics	All Uses		Space Heating		Air Conditioning		Water Heating		Refrigerator		Appliances		RSE Row Factors
	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	Households (million)	Expenditures (dollars)	
RSE Column Factors:	1.2	0.6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	
Householder of Hispanic Descent													
Yes	6.3	1,034	6.2	252	3.4	240	6.3	161	6.3	138	6.3	360	7.1
No	87.6	1,182	86.1	379	57.2	183	87.3	163	87.4	132	87.6	396	1.8
Household Size													
1 Person	23.4	807	23.0	314	14.8	125	23.2	97	23.3	112	23.4	211	2.9
2 Persons	30.6	1,148	30.2	381	20.0	185	30.5	150	30.5	136	30.6	365	2.2
3 to 5 Persons	36.4	1,396	35.7	395	24.0	223	36.3	207	36.3	142	36.4	514	2.0
6 or More Persons	3.6	1,488	3.5	387	1.7	226	3.6	260	3.6	145	3.6	602	6.3

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * Consumption and Expenditure data are for major energy sources which include: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 31. Total Electricity and Natural Gas Consumption and Expenditures for Space Heating in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				RSE Row Factors
	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion kWh)	Total Expenditures (billion dollars)	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion cubic feet)	Total Expenditures (billion dollars)	
RSE Column Factors:	0.9	NF	NF	NF	0.7	NF	NF	NF	
Total U.S. Households	37.2	0.30	89	6.16	52.7	3.37	3,282	18.59	4.5
Urban Status									
Urban	28.8	.21	61	4.48	43.8	2.77	2,693	15.47	5.2
Central City	11.8	.08	22	1.59	19.8	1.26	1,234	7.20	6.1
Suburban	17.0	.13	39	2.88	24.0	1.50	1,459	8.27	6.5
Rural	8.4	.09	28	1.68	8.9	.60	589	3.12	9.4
Climate Zone1/									
Under 2,000 CDD and									
Over 7,000 HDD	2.9	.04	10	.66	5.0	.42	410	2.07	20.3
5,500 to 7,000 HDD	7.8	.08	25	1.66	17.2	1.51	1,468	7.91	12.0
4,000 to 5,499 HDD	8.0	.08	23	1.50	10.6	.73	715	4.46	13.9
Under 4,000 HDD	8.6	.06	17	1.28	11.6	.42	406	2.43	12.0
2,000 CDD or More and									
Under 4,000 HDD	9.9	.05	14	1.06	8.3	.29	284	1.71	11.3
Number of Rooms									
1 to 3	5.6	.03	9	.70	5.0	.16	151	.90	10.7
4 to 6	22.1	.18	53	3.68	32.8	1.94	1,890	10.83	5.3
7 or More	9.5	.09	27	1.77	14.9	1.27	1,241	6.86	7.1
Type of Housing Unit									
Single-Family	25.0	.22	65	4.47	37.7	2.65	2,588	14.42	5.7
Detached	22.0	.19	57	3.86	34.8	2.46	2,400	13.27	5.5
Attached	3.0	.03	8	.61	2.9	.19	188	1.15	16.9
Mobile Home	1.9	.02	6	.38	2.0	.11	107	.59	21.9
Multifamily	10.3	.06	17	1.30	13.1	.60	586	3.58	8.2
2 to 4 Units	3.2	.02	6	.49	6.4	.42	412	2.53	15.0
5 or More Units	7.1	.04	11	.82	6.6	.18	174	1.05	14.6
Heated Floorspace (square feet)									
Fewer than 1,000	12.9	.08	24	1.73	14.9	.60	587	3.40	6.8
1,000 to 1,999	15.6	.14	40	2.72	23.1	1.41	1,377	7.83	5.8
2,000 to 2,999	6.7	.06	18	1.27	9.9	.79	765	4.45	7.8
3,000 or More	2.1	.02	6	.44	4.8	.57	553	2.91	12.9
Ownership of Unit									
Owned	24.1	.21	62	4.27	35.2	2.54	2,472	13.92	5.2
Rented	13.1	.09	26	1.88	17.5	.83	810	4.67	6.2
Public Housing	1.1	.01	2	.14	1.2	.04	35	.22	27.6
Not Public Housing	12.0	.08	24	1.75	16.3	.80	775	4.45	6.6
Rent Subsidy	.8	(*)	(*)	.08	.9	.05	45	.26	28.3
No Rent Subsidy	11.2	.08	23	1.66	15.5	.75	730	4.19	6.6
Year of Construction									
1939 or Before	5.7	.03	10	.69	14.0	1.16	1,130	6.48	8.4
1940 to 1949	2.0	.01	4	.25	4.8	.33	319	1.85	11.7
1950 to 1959	4.3	.03	9	.61	8.7	.56	544	3.10	8.7
1960 to 1969	4.9	.04	11	.82	9.7	.51	497	2.88	9.2
1970 to 1979	11.3	.11	32	2.16	9.8	.50	485	2.64	8.8
1980 to 1984	4.5	.04	13	.91	3.1	.13	123	.69	14.1
1985 to 1987	3.3	.02	7	.54	1.5	.09	86	.46	22.7
1988 to 19902/	1.1	.01	3	.17	1.3	.10	97	.48	20.8
Electric Space-Heating Paid by Household	35.5	.29	84	5.85	--	--	--	--	6.2
Natural Gas Space-Heating Paid by Household	--	--	--	--	44.8	2.99	2,918	16.42	5.9
1990 Family Income									
Less than $10,000	5.7	.04	12	.78	8.5	.49	481	2.73	10.0
$10,000 to $19,999	7.7	.06	17	1.12	10.7	.63	612	3.48	7.0
$20,000 to $34,999	9.8	.08	24	1.63	13.3	.81	791	4.37	6.9
$35,000 to $49,999	6.8	.06	18	1.31	9.4	.61	594	3.42	8.1
$50,000 or More	7.3	.06	18	1.31	10.7	.82	803	4.58	9.4
Below Poverty Line									
100 Percent	4.7	.03	10	.62	6.9	.37	360	2.08	10.1
125 Percent	6.4	.05	14	.91	9.5	.52	510	2.93	8.8
Eligible for Federal Assistance3/	9.6	.07	21	1.42	14.8	.86	837	4.81	7.5
Age of Householder									
Less than 35 Years	10.6	.08	22	1.57	15.3	.84	815	4.58	7.2
35 to 44 Years	8.1	.07	20	1.44	11.3	.75	729	4.13	6.8
45 to 59 Years	8.3	.07	22	1.50	10.9	.72	703	3.96	7.1
60 Years and Over	10.3	.08	24	1.65	15.1	1.06	1,035	5.91	6.7

Table 31. Total Electricity and Natural Gas Consumption and Expenditures for Space Heating in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				RSE Row Factors
		Total Consumed				Total Consumed			
	House-holds (million)	(quad-rillion Btu)	(billion kWh)	Total Expenditures (billion dollars)	House-holds (million)	(quad-rillion Btu)	(billion cubic feet)	Total Expenditures (billion dollars)	
RSE Column Factors:	0.9	NF	NF	NF	0.7	NF	NF	NF	
Education of Householder									
Less than 13 Years	18.7	.15	45	3.09	27.9	1.76	1,713	9.82	5.4
13 to 16 Years	14.4	.12	34	2.37	18.6	1.18	1,155	6.39	6.0
17 Years or More	4.1	.03	9	.69	6.3	.43	414	2.38	11.3
Race of Householder									
White	32.2	.27	79	5.52	44.1	2.86	2,789	15.61	5.1
Black	3.9	.02	7	.49	7.3	.45	440	2.67	10.7
Other	1.1	.01	3	.15	1.3	.05	53	.31	19.9
Householder of Hispanic Descent									
Yes	2.3	.01	4	.32	3.9	.17	164	.92	14.1
No	34.9	.29	85	5.83	48.8	3.20	3,118	17.67	4.6
Household Size									
1 Person	10.2	.08	22	1.57	12.6	.72	705	3.95	6.7
2 Persons	12.2	.10	29	1.94	17.6	1.14	1,116	6.40	6.0
3 to 5 Persons	13.6	.12	35	2.44	20.5	1.38	1,341	7.54	5.4
6 or More Persons	1.2	.01	3	.20	2.0	.12	121	.69	15.5

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
(*) = Data cannot be displayed due to rounding.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, E, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 32. Total Fuel Oil, Kerosene, and LPG Consumption and Expenditures for Space Heating in U.S. Households, 1990

Characteristics	Fuel Oil				Kerosene				Liquefied Petroleum Gas				RSE Row Factors
		Total Consumed				Total Consumed				Total Consumed			
	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	
RSE Column Factors:	0.6	NF	NF	NF	0.9	NF	NF	NF	1.1	NF	NF	NF	
Total U.S. Households	11.4	0.87	6.29	6.80	5.3	0.07	0.48	0.62	5.1	0.19	2.07	2.01	10.9
Urban Status													
Urban	8.6	.65	4.73	5.12	3.1	.03	.23	.29	2.3	.07	.78	.78	13.2
Central City	2.8	.18	1.29	1.33	1.0	.01	.10	.13	.3	(*)	.05	.07	23.3
Suburban	5.8	.47	3.44	3.79	2.1	.02	.13	.16	2.1	.07	.73	.72	14.2
Rural	2.9	.22	1.56	1.68	2.2	.03	.26	.33	2.7	.12	1.29	1.23	18.4
Climate Zone1/													
Under 2,000 CDD and													
Over 7,000 HDD	2.3	.20	1.42	1.51	.5	Q	Q	Q	.9	.05	.56	.49	36.2
5,500 to 7,000 HDD	4.3	.38	2.75	2.99	1.7	.01	.10	.13	.8	.04	.45	.43	20.7
4,000 to 5,499 HDD	4.2	.27	2.00	2.16	1.2	.01	.10	.14	.9	.04	.44	.42	21.2
Under 4,000 HDD	.5	.02	.12	.13	1.6	.02	.14	.17	1.5	.04	.45	.47	26.3
2,000 CDD or More and													
Under 4,000 HDD	Q	Q	Q	Q	Q	Q	Q	Q	1.0	.02	.17	.20	35.5
Number of Rooms													
1 to 3	1.2	.04	.32	.31	.3	.01	.04	.06	.5	.02	.22	.23	31.9
4 to 6	6.4	.43	3.13	3.35	3.6	.05	.38	.47	3.4	.12	1.26	1.25	12.2
7 or More	3.8	.39	2.85	3.14	1.4	.01	.07	.09	1.2	.05	.59	.53	17.5
Type of Housing Unit													
Single-Family	8.2	.69	5.02	5.51	4.0	.04	.28	.36	3.8	.15	1.64	1.57	10.9
Detached	7.5	.64	4.65	5.10	3.7	.04	.27	.34	3.8	.15	1.64	1.57	11.3
Attached	.7	.05	.37	.41	Q	Q	Q	Q	NC	NC	NC	NC	32.7
Mobile Home	.4	.02	.13	.15	.9	.02	.18	.23	1.2	.04	.40	.41	30.9
Multifamily	2.9	.16	1.14	1.14	Q	Q	Q	Q	Q	Q	Q	Q	16.6
2 to 4 Units	1.2	.10	.73	.81	Q	Q	Q	Q	Q	Q	Q	Q	25.0
5 or More Units	1.6	.06	.41	.33	Q	Q	Q	Q	NC	NC	NC	NC	33.3
Heated Floorspace (square feet)													
Fewer than 1,000	2.7	.13	.93	.97	1.8	.04	.28	.36	1.7	.05	.59	.60	17.0
1,000 to 1,999	4.1	.28	2.03	2.24	2.2	.02	.17	.22	2.3	.09	.94	.93	14.1
2,000 to 2,999	3.1	.26	1.86	1.98	1.0	(*)	.03	.04	.7	.03	.35	.31	15.8
3,000 or More	1.5	.20	1.47	1.61	Q	Q	Q	Q	.3	.02	.19	.17	25.2
Ownership of Unit													
Owned	8.7	.71	5.13	5.60	4.0	.04	.33	.41	4.3	.16	1.78	1.75	11.8
Rented	2.8	.16	1.16	1.20	1.3	.02	.15	.20	.7	.03	.29	.26	19.1
Public Housing	.3	.01	.10	.09	NC	NC	NC	NC	Q	Q	Q	Q	67.0
Not Public Housing	2.5	.14	1.06	1.10	1.3	.02	.15	.20	.7	.03	.28	.25	19.9
Rent Subsidy	.2	.01	.06	.06	Q	Q	Q	Q	Q	Q	Q	Q	57.4
No Rent Subsidy	2.3	.14	1.00	1.04	1.1	.02	.13	.18	.6	.02	.26	.24	19.9
Year of Construction													
1939 or Before	4.4	.36	2.64	2.84	1.3	.02	.14	.18	1.0	.05	.55	.50	15.9
1940 to 1949	1.0	.07	.49	.54	.4	(*)	.02	.03	.3	.02	.17	.17	31.0
1950 to 1959	2.3	.18	1.27	1.41	.6	.01	.04	.05	.6	.02	.24	.25	25.2
1960 to 1969	1.7	.12	.86	.91	.7	(*)	.02	Q	.7	.02	.17	.18	23.1
1970 to 1979	1.6	.12	.86	.93	1.5	.03	.20	.26	1.1	.04	.43	.43	20.4
1980 to 1984	.2	.01	.07	.07	.4	Q	Q	Q	.7	.02	.26	.25	38.4
1985 to 1987	Q	Q	Q	Q	Q	Q	Q	Q	.3	.01	.08	.08	27.4
1988 to 19902/	Q	Q	Q	Q	Q	Q	Q	Q	.4	.02	.17	.15	24.8
Fuel Oil Space-Heating Paid by Household	9.0	.75	5.41	5.95	--	--	--	--	--	--	--	--	16.3
Kerosene Space-Heating Paid by Household	--	--	--	--	5.2	.07	.48	.61	--	--	--	--	18.3
Liquefied Petroleum Gas Space-Heating Paid by Household	--	--	--	--	--	--	--	--	4.9	.18	1.96	1.91	26.4
1990 Family Income													
Less than $10,000	2.0	.12	.89	.95	.9	.01	.09	.12	1.4	.05	.50	.53	21.1
$10,000 to $19,999	2.1	.14	1.01	1.07	1.1	.02	.15	.19	1.3	.05	.53	.54	16.3
$20,000 to $34,999	2.9	.21	1.49	1.60	1.8	.02	.18	.24	1.1	.05	.49	.46	16.5
$35,000 to $49,999	2.2	.16	1.18	1.28	.8	(*)	.03	.03	.7	.03	.29	.27	20.0
$50,000 or More	2.3	.24	1.72	1.91	.6	(*)	.03	.03	.5	.02	.25	.21	23.1
Below Poverty Line													
100 Percent	1.4	.09	.63	.67	.8	.01	.10	.13	1.2	.04	.41	.42	21.3
125 Percent	2.1	.12	.88	.93	1.1	.02	.13	.17	1.6	.05	.60	.62	19.1
Eligible for Federal Assistance3/	3.5	.23	1.67	1.78	1.8	.03	.19	.24	2.3	.08	.87	.91	14.6

Table 32. Total Fuel Oil, Kerosene, and LPG Consumption and Expenditures for Space Heating in U.S. Households, 1990

Characteristics	Fuel Oil				Kerosene				Liquefied Petroleum Gas				
		Total Consumed				Total Consumed				Total Consumed			
	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	Total Expenditures (billion dollars)	RSE Row Factors
RSE Column Factors:	0.6	NF	NF	NF	0.9	NF	NF	NF	1.1	NF	NF	NF	
Age of Householder													
Less than 35 Years	2.6	.18	1.32	1.41	1.7	.02	.14	.19	1.3	.05	.50	.48	16.6
35 to 44 Years	2.4	.18	1.28	1.41	1.3	.02	.14	.17	.9	.04	.42	.36	17.5
45 to 59 Years	2.5	.19	1.37	1.49	1.3	.02	.12	.16	1.0	.03	.35	.36	17.8
60 Years and Over	4.0	.32	2.32	2.49	.9	.01	.08	.10	1.8	.07	.80	.81	15.9
Education of Householder													
Less than 13 Years	7.5	.51	3.70	3.97	3.7	.05	.40	.51	3.8	.14	1.54	1.52	12.6
13 to 16 Years	2.9	.25	1.79	1.94	1.3	.01	.08	.10	1.1	.04	.44	.42	15.6
17 Years or More	1.1	.11	.81	.89	.3	(*)	.01	.01	.2	.01	.08	.07	32.7
Race of Householder													
White	10.6	.81	5.89	6.36	4.5	.05	.37	.47	4.5	.17	1.89	1.83	11.7
Black	.8	.05	.38	.42	.8	.02	.11	.15	.4	.01	.13	.14	31.0
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Householder of Hispanic Descent													
Yes	.6	.04	.27	.27	Q	Q	Q	Q	Q	Q	Q	Q	21.8
No	10.8	.83	6.02	6.53	5.2	.06	.48	.60	5.0	.19	2.04	1.99	11.0
Household Size													
1 Person	2.5	.16	1.16	1.23	.8	.01	.06	.08	1.1	.03	.36	.37	18.9
2 Persons	3.7	.29	2.13	2.28	1.4	.02	.13	.17	1.8	.07	.73	.71	15.1
3 to 5 Persons	4.8	.38	2.72	2.99	2.7	.03	.24	.30	1.9	.08	.89	.84	13.3
6 or More Persons	.4	.04	.27	.30	.4	.01	.05	.07	.3	.01	.09	.09	31.7

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, D, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 33. Electricity Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Electricity Space-Heating Intensity Consumption (kWh/HDD* 1000 square feet)	Electricity Space-Heating Intensity Expenditures (cents/HDD* 1000 square feet)	RSE Row Factors
RSE Column Factors:	1.5	NF	NF	NF	0.6	1.1	0.9	NF	NF	
Total U.S. Households....	21.5	12.3	3,604	244	1,327	2,955	3,562	0.92	6.2	4.5
Urban Status										
Urban.....	17.4	10.5	3,071	221	1,287	2,712	3,311	.88	6.3	5.4
Central City.....	7.1	9.3	2,717	191	1,129	2,667	3,302	.90	6.3	7.6
Suburban.....	10.3	11.3	3,318	241	1,397	2,743	3,318	.87	6.3	7.3
Rural.....	4.1	19.9	5,843	344	1,493	3,978	4,616	.98	5.8	7.8
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	1.4	22.7	6,650	406	1,336	6,854	7,603	.73	4.4	14.5
5,500 to 7,000 HDD...	3.7	20.0	5,853	381	1,287	5,182	5,880	.88	5.7	6.8
4,000 to 5,499 HDD...	4.2	16.2	4,747	307	1,405	4,086	4,787	.83	5.4	6.6
Under 4,000 HDD.....	5.1	9.7	2,857	212	1,243	2,225	2,879	1.03	7.7	6.1
2,000 CDD or More and										
Under 4,000 HDD.....	7.1	5.8	1,708	128	1,358	899	1,341	1.40	10.5	9.0
Type of Housing Unit										
Single-Family.....	12.2	15.6	4,576	304	1,706	2,823	3,410	.95	6.3	5.4
Detached.....	9.8	16.7	4,897	320	1,817	2,823	3,403	.95	6.2	5.5
Attached.....	2.5	11.3	3,299	237	1,267	2,820	3,437	.92	6.6	14.2
Mobile Home.....	1.1	17.3	5,074	308	983	3,749	4,345	1.38	8.4	10.4
Multifamily.....	8.2	6.7	1,951	147	808	3,043	3,680	.79	6.0	6.9
2 to 4 Units.....	2.0	9.6	2,822	209	920	3,272	3,963	.94	6.9	14.0
5 or More Units.....	6.2	5.7	1,664	126	771	2,967	3,586	.73	5.5	8.5
Heated Floorspace (square feet)										
Fewer than 1,000.....	9.3	8.2	2,409	170	733	3,044	3,648	1.08	7.6	5.3
1,000 to 1,999	8.7	14.0	4,093	269	1,416	2,858	3,458	1.01	6.6	6.2
2,000 to 2,999	2.7	17.6	5,148	356	2,426	2,808	3,447	.76	5.2	5.9
3,000 or More	.7	24.3	7,135	468	3,660	3,528	4,124	.55	3.6	9.2
Number of Rooms										
1 to 3.....	4.6	6.5	1,897	145	658	3,107	3,730	.93	7.1	8.0
4 to 6.....	12.9	12.4	3,646	248	1,279	2,897	3,497	.98	6.7	5.5
7 or More.....	4.1	18.4	5,397	346	2,232	2,968	3,579	.81	5.2	5.4
Ownership of Unit										
Owned.....	11.9	15.3	4,481	299	1,685	3,066	3,698	.87	5.8	5.3
Rented.....	9.7	8.6	2,528	177	887	2,819	3,395	1.01	7.1	6.0
Public Housing.....	1.0	7.8	2,281	137	710	3,476	4,090	.92	5.5	14.3
Not Public Housing...	8.7	8.7	2,555	182	906	2,747	3,318	1.03	7.3	6.5
Rent Subsidy.....	.5	6.0	1,750	137	740	2,745	3,443	.86	6.7	29.4
No Rent Subsidy...	8.2	8.9	2,604	185	917	2,747	3,311	1.03	7.3	6.8
Year of Construction										
1939 or Before.....	1.2	20.8	6,110	401	1,260	4,335	4,887	1.12	7.3	11.0
1940 to 1949.....	.6	18.4	5,397	295	1,241	3,236	3,738	1.34	7.3	15.2
1950 to 1959.....	1.3	17.8	5,209	333	1,215	3,313	3,867	1.29	8.3	9.0
1960 to 1969.....	2.6	12.6	3,694	260	1,388	2,668	3,236	1.00	7.0	8.4
1970 to 1979.....	8.2	12.4	3,628	243	1,292	3,103	3,688	.91	6.1	7.4
1980 to 1984.....	3.9	10.3	3,017	215	1,367	2,638	3,262	.84	6.0	7.3
1985 to 1987.....	3.0	7.9	2,324	173	1,396	2,430	3,148	.69	5.1	13.5
1988 to 19902/.....	.7	10.3	3,006	203	1,378	3,095	3,810	.70	4.8	16.6
Main Space-Heating Fuel Paid by Household										
Yes.....	20.3	12.4	3,635	246	1,364	2,920	3,522	.91	6.2	4.5
No.....	1.3	10.6	3,101	215	727	3,515	4,207	1.21	8.4	14.6
1990 Family Income										
Less than $10,000.....	3.3	11.1	3,243	202	862	3,179	3,753	1.18	7.4	8.2
$10,000 to $19,999.....	4.5	11.7	3,434	221	1,083	3,065	3,659	1.03	6.6	6.4
$20,000 to $34,999.....	5.8	12.2	3,562	242	1,268	3,046	3,653	.92	6.3	7.5
$35,000 to $49,999.....	4.2	12.8	3,746	267	1,604	2,848	3,450	.82	5.8	6.9
$50,000 or More.....	3.7	13.8	4,044	290	1,826	2,592	3,250	.85	6.1	8.2
Below Poverty Line										
100 Percent.....	2.7	10.7	3,122	197	926	3,002	3,582	1.12	7.1	9.1
125 Percent.....	3.8	11.2	3,284	207	953	3,033	3,601	1.14	7.2	8.2
Eligible for Federal Assistance3/.....	5.6	11.7	3,429	220	978	3,107	3,669	1.13	7.2	6.5
Age of Householder										
Less than 35 Years.....	7.2	9.4	2,757	193	1,057	2,835	3,471	.92	6.4	6.4
35 to 44 Years.....	4.6	13.2	3,857	265	1,508	2,994	3,626	.85	5.9	6.9
45 to 59 Years.....	4.6	13.9	4,071	272	1,620	2,723	3,294	.92	6.2	6.0
60 Years and Over.....	5.2	14.2	4,152	273	1,285	3,293	3,868	.98	6.5	7.7
Education of Householder										
Less than 13 Years.....	10.7	12.7	3,729	250	1,236	3,048	3,643	.99	6.6	5.3
13 to 16 Years.....	8.6	11.9	3,483	235	1,400	2,882	3,502	.86	5.8	5.9
17 Years or More.....	2.2	11.8	3,461	256	1,482	2,787	3,400	.84	6.2	10.4

Table 33. Electricity Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Electricity Space-Heating Intensity Consumption (kWh/HDD* 1000 square feet)	Electricity Space-Heating Intensity Expenditures (cents/HDD* 1000 square feet)	RSE Row Factors
RSE Column Factors:	1.5	NF	NF	NF	0.6	1.1	0.9	NF	NF	
Race of Householder										
White	18.9	12.6	3,687	250	1,353	3,019	3,626	.90	6.1	4.8
Black	1.9	9.7	2,847	204	1,121	2,161	2,812	1.18	8.4	10.0
Other	.7	11.6	3,408	185	1,165	3,381	3,866	.87	4.7	15.8
Householder of Hispanic Descent										
Yes	1.7	7.3	2,146	173	1,259	1,600	2,059	1.07	8.6	13.5
No	19.9	12.7	3,726	250	1,332	3,069	3,688	.91	6.1	4.5
Household Size										
1 Person	6.8	10.4	3,054	215	969	3,364	3,985	.94	6.6	6.5
2 Persons	6.8	12.4	3,626	240	1,417	2,896	3,499	.88	5.9	7.0
3 to 5 Persons	7.4	13.6	3,987	271	1,538	2,659	3,267	.97	6.6	5.2
6 or More Persons	.5	17.1	5,020	300	1,792	2,593	3,052	1.08	6.5	14.8
Main Heating Equipment Using Electricity										
Central Warm-Air Furnace	7.4	10.4	3,055	202	1,295	2,208	2,734	1.07	7.1	9.9
Built-In Electric Units	6.7	16.5	4,828	317	1,150	4,431	5,073	.95	6.2	5.2
Heat Pump	6.4	10.2	2,999	217	1,591	2,373	3,067	.79	5.7	6.4
Other	.9	11.4	3,354	246	1,026	2,326	2,723	1.40	10.3	16.4
Age of Main Heating Equipment										
Less than 5 Years	4.2	11.2	3,289	234	1,477	2,564	3,185	.87	6.2	7.1
5 to 9 Years	5.1	10.4	3,052	214	1,385	2,544	3,176	.87	6.1	7.1
10 to 19 Years	6.8	13.5	3,971	262	1,327	3,330	3,907	.90	5.9	7.2
20 Years or More	2.7	16.8	4,936	322	1,263	3,596	4,250	1.09	7.1	6.2
Don't Know	2.7	9.9	2,900	196	1,045	2,768	3,332	1.00	6.8	10.7

See footnotes at end of table.

Table 33. Electricity Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990 (Continued)

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Electricity Space-Heating Intensity Consumption (kWh/HDD* 1000 square feet)	Electricity Space-Heating Intensity Expenditures (cents/HDD* 1000 square feet)	RSE Row Factors
RSE Column Factors:	1.5	NF	NF	NF	0.6	1.1	0.9	NF	NF	
Secondary Heating Fuel (more than one may apply)										
No	13.2	10.2	3,002	203	1,082	2,891	3,486	0.96	6.5	6.0
Yes	8.4	15.5	4,549	309	1,711	3,056	3,682	.87	5.9	5.4
Wood	5.6	16.3	4,775	320	1,889	3,161	3,788	.80	5.4	6.7
Electricity	1.1	10.7	3,139	219	1,153	2,710	3,282	1.01	7.0	12.7
Natural Gas	.5	10.9	3,208	264	1,726	1,685	2,091	1.10	9.1	17.2
Kerosene	1.2	18.4	5,399	374	1,512	3,624	4,419	.99	6.8	9.1
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Average Electricity Expenditures for Main Space Heat (cents per kWh)										
Less than 6	4.5	20.5	6,000	287	1,336	4,353	4,901	1.03	4.9	8.7
6 to Less than 9	13.9	10.4	3,055	225	1,372	2,441	3,071	.91	6.7	5.5
9 or More	3.2	8.9	2,599	267	1,115	3,214	3,801	.73	7.4	8.7
Winter Temperature Inside Housing Unit Prefer										
Usual Temperature	17.4	11.9	3,474	236	1,299	2,870	3,465	.93	6.3	4.8
Warmer Temperature	3.5	14.4	4,206	289	1,482	3,291	3,963	.86	5.9	7.3
Cooler Temperature	.6	13.1	3,843	224	1,204	3,485	4,032	.92	5.3	19.0
Adequacy of Insulation										
Well Insulated	8.6	13.3	3,897	261	1,469	3,193	3,832	.83	5.6	5.7
Adequately Insulated	8.7	11.1	3,239	219	1,303	2,667	3,265	.93	6.3	6.3
Poorly Insulated	3.6	13.2	3,876	272	1,092	3,104	3,656	1.14	8.0	7.3
Don't Know	.6	10.2	3,002	202	1,039	2,822	3,416	1.02	6.9	17.2
Participation in Demand-Side Management Programs (more than one may apply)										
No/Don't Know	20.2	12.4	3,625	244	1,313	2,962	3,567	.93	6.3	4.8
Yes	1.4	11.2	3,288	251	1,532	2,853	3,484	.75	5.7	12.0
Rebate	.4	8.5	2,494	194	1,588	2,508	3,125	.63	4.9	31.3
Load Control	.6	9.9	2,890	225	1,533	2,411	3,150	.78	6.1	14.2
Energy Audit	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Conservation	.3	15.0	4,410	326	1,639	4,209	4,758	.64	4.7	16.2
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

1/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 34. Natural Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (1000 cubic feet)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Natural Gas Space-Heating Intensity Consumption (cubic feet/ HDD*1000 square feet)	Natural Gas Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.75	NF	NF	NF	0.9	0.8	0.7	NF	NF	
Total U.S. Households....	51.7	64.5	62.9	356	1,647	4,028	4,661	9.5	5.4	2.0
Urban Status										
Urban.....	43.1	63.8	62.1	357	1,664	3,943	4,585	9.5	5.4	2.2
Central City.....	19.4	64.8	63.3	369	1,489	3,902	4,531	10.9	6.4	2.7
Suburban.....	23.7	62.9	61.1	347	1,808	3,976	4,630	8.5	4.8	3.0
Rural.....	8.7	68.3	67.0	354	1,560	4,455	5,037	9.6	5.1	4.8
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	5.0	83.4	82.3	416	1,722	7,090	7,829	6.7	3.4	3.5
5,500 to 7,000 HDD...	17.0	88.2	86.0	464	1,858	5,430	6,215	8.5	4.6	2.8
4,000 to 5,499 HDD...	10.5	69.5	67.7	423	1,762	4,131	4,904	9.3	5.8	3.8
Under 4,000 HDD.....	11.2	36.6	35.5	213	1,360	2,122	2,498	12.3	7.4	4.5
2,000 CDD or More and										
Under 4,000 HDD.....	8.1	35.7	34.5	208	1,407	1,725	2,147	14.2	8.6	6.4
Type of Housing Unit										
Single-Family.....	36.7	71.6	69.8	389	1,928	3,963	4,586	9.1	5.1	2.4
Detached.....	34.0	71.7	69.9	386	1,951	3,908	4,526	9.2	5.1	2.5
Attached.....	2.8	69.6	67.9	417	1,647	4,644	5,329	8.9	5.5	6.9
Mobile Home.....	2.0	55.4	54.1	297	950	4,505	5,078	12.7	6.9	7.4
Multifamily.....	13.0	46.2	44.9	274	961	4,141	4,810	11.3	6.9	3.8
2 to 4 Units.....	6.4	66.0	64.1	394	1,127	4,348	5,070	13.1	8.0	4.8
5 or More Units.....	6.6	27.1	26.3	158	800	3,940	4,558	8.3	5.0	6.1
Heated Floorspace (square feet)										
Fewer than 1000.....	14.8	40.5	39.5	229	725	3,833	4,438	14.2	8.2	2.7
1,000 to 1,999	22.5	62.0	60.5	344	1,439	3,814	4,407	11.0	6.3	2.5
2,000 to 2,999	9.6	80.6	78.5	456	2,386	4,376	5,089	7.5	4.4	2.8
3,000 or More	4.7	119.4	116.5	613	4,032	4,958	5,706	5.8	3.1	4.0
Number of Rooms										
1 to 3.....	5.0	30.9	30.2	179	651	3,860	4,472	12.0	7.1	5.3
4 to 6.....	32.1	59.8	58.3	334	1,407	3,987	4,610	10.4	6.0	2.2
7 or More.....	14.6	86.6	84.4	467	2,516	4,177	4,839	8.0	4.4	3.2
Ownership of Unit										
Owned.....	34.3	73.1	71.3	401	1,960	4,083	4,719	8.9	5.0	2.3
Rented.....	17.4	47.6	46.4	268	1,030	3,921	4,546	11.5	6.6	2.7
Public Housing.....	1.2	30.8	29.8	187	886	3,775	4,252	8.9	5.6	14.9
Not Public Housing...	16.2	48.9	47.6	273	1,040	3,932	4,567	11.6	6.7	2.8
Rent Subsidy.....	.9	53.9	52.7	306	933	4,157	4,831	13.6	7.9	13.2
No Rent Subsidy...	15.4	48.6	47.3	272	1,046	3,919	4,553	11.5	6.6	2.8
Year of Construction										
1939 or Before.....	13.8	83.4	81.3	467	1,648	4,521	5,241	10.9	6.3	3.0
1940 to 1949.....	4.7	68.8	67.0	387	1,545	4,014	4,697	10.8	6.2	4.6
1950 to 1959.....	8.6	64.6	63.0	358	1,688	3,810	4,426	9.8	5.6	3.5
1960 to 1969.....	9.5	53.5	52.1	302	1,555	3,545	4,141	9.4	5.5	5.0
1970 to 1979.....	9.5	52.0	50.7	276	1,534	3,966	4,538	8.3	4.5	4.0
1980 to 1984.....	2.9	42.0	41.0	228	1,607	3,772	4,233	6.8	3.8	9.4
1985 to 1987.....	1.5	59.7	58.3	314	2,018	4,397	4,986	6.6	3.5	10.5
1988 to 19902/.....	1.3	77.8	76.0	377	2,923	4,457	5,253	5.8	2.9	11.5
Main Space-Heating Fuel Paid by Household										
Yes.....	43.9	67.5	65.9	371	1,769	3,951	4,569	9.4	5.3	2.2
No.....	7.8	47.7	46.4	276	959	4,464	5,177	10.8	6.5	5.0
1990 Family Income										
Less than $10,000.....	8.5	58.3	56.8	323	1,163	3,925	4,523	12.4	7.1	4.6
$10,000 to $19,999.....	10.6	58.8	57.3	326	1,298	4,029	4,666	11.0	6.2	2.8
$20,000 to $34,999.....	13.0	61.4	59.9	331	1,535	4,050	4,678	9.6	5.3	2.9
$35,000 to $49,999.....	9.1	66.0	64.3	370	1,738	4,058	4,709	9.1	5.2	3.8
$50,000 or More.....	10.5	78.1	76.1	435	2,452	4,058	4,705	7.7	4.4	3.5
Below Poverty Line										
100 Percent.....	6.9	53.8	52.3	302	1,145	3,640	4,210	12.6	7.3	4.6
125 Percent.....	9.4	55.4	53.9	309	1,171	3,724	4,292	12.4	7.1	4.0
Eligible for Federal Assistance3/.....	14.7	58.2	56.7	325	1,232	3,834	4,426	12.0	6.9	3.1
Age of Householder										
Less than 35 Years.....	15.3	54.6	53.2	299	1,335	3,943	4,554	10.1	5.7	3.4
35 to 44 Years.....	11.2	66.2	64.7	366	1,808	4,174	4,811	8.6	4.9	2.9
45 to 59 Years.....	10.6	67.6	65.8	370	1,899	3,969	4,617	8.7	4.9	3.6
60 Years and Over.....	14.7	71.4	69.6	398	1,667	4,049	4,689	10.3	5.9	2.7
Education of Householder										
Less than 13 Years.....	27.5	63.3	61.7	354	1,428	4,049	4,697	10.7	6.1	2.5
13 to 16 Years.....	18.2	64.7	63.1	349	1,814	4,053	4,660	8.6	4.7	2.8
17 Years or More.....	6.1	69.6	67.7	389	2,137	3,860	4,503	8.2	4.7	4.8

Table 34. Natural Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (1000 cubic feet)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Natural Gas Space-Heating Intensity Consumption (cubic feet/ HDD*1000 square feet)	Natural Gas Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.75	NF	NF	NF	0.9	0.8	0.7	NF	NF	
Race of Householder										
White	43.2	65.6	63.9	358	1,708	4,200	4,832	8.9	5.0	2.1
Black	7.2	62.5	60.8	369	1,343	3,206	3,871	14.1	8.6	4.6
Other	1.3	41.9	40.8	238	1,308	2,862	3,328	10.9	6.3	9.9
Householder of Hispanic Descent										
Yes	3.8	43.8	42.8	241	1,202	3,021	3,489	11.8	6.6	7.3
No	47.9	66.2	64.5	365	1,682	4,108	4,754	9.3	5.3	2.1
Household Size										
1 Person	12.3	58.5	57.1	320	1,258	4,168	4,813	10.9	6.1	3.5
2 Persons	17.1	65.9	64.3	369	1,694	4,137	4,785	9.2	5.3	2.8
3 to 5 Persons	20.2	67.5	65.7	370	1,837	3,907	4,527	9.2	5.1	2.5
6 or More Persons	2.0	60.9	59.0	340	1,713	3,487	4,027	9.9	5.7	6.8
Main Heating Equipment Using Natural Gas										
Central Warm-Air Furnace	34.9	67.2	65.5	360	1,802	4,165	4,798	8.7	4.8	2.3
Steam or Hot-Water System	8.3	80.7	78.5	495	1,621	4,994	5,837	9.7	6.1	4.0
Floor, Wall, or Pipeless Furnace	5.1	36.2	35.3	190	1,044	2,482	2,852	13.6	7.3	4.7
Room Heater/Other	3.5	41.2	40.2	235	1,036	2,633	3,140	14.7	8.6	7.9
Age of Main Heating Equipment										
Less than 5 Years	9.0	73.2	71.4	396	2,030	4,369	5,062	8.1	4.5	3.5
5 to 9 Years	8.0	60.3	58.8	332	1,677	3,938	4,516	8.9	5.0	4.3
10 to 19 Years	13.2	66.5	64.9	364	1,730	4,072	4,678	9.2	5.2	3.3
20 Years or More	14.4	66.9	65.2	373	1,595	3,889	4,515	10.5	6.0	3.2
Don't Know	7.2	50.0	48.7	287	1,088	3,901	4,582	11.5	6.8	4.1

See footnotes at end of table.

Table 34. Natural Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990 (Continued)

Characteristics	Households (million)	Consumption (million Btu)	Consumption (1000 cubic feet)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Natural Gas Space-Heating Intensity Consumption (cubic feet/ HDD*1000 square feet)	Natural Gas Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.75	NF	NF	NF	0.9	0.8	0.7	NF	NF	
Secondary Heating Fuel (more than one may apply)										
No	30.9	61.0	59.4	343	1,427	4,096	4,748	10.2	5.9	2.4
Yes	20.8	69.9	68.1	376	1,973	3,927	4,532	8.8	4.8	2.8
Wood	10.8	73.8	71.9	390	2,337	4,021	4,609	7.7	4.1	3.9
Electricity	10.1	67.0	65.3	368	1,810	3,707	4,305	9.7	5.5	3.5
Kerosene	1.5	74.6	72.7	419	1,820	4,427	5,193	9.0	5.2	7.0
Other	1.8	66.9	65.0	363	1,657	3,914	4,480	10.0	5.6	7.7
Average Natural Gas Expenditures for Main Space Heat (dollars per 1000 cf)										
Less than 4.50	6.7	83.8	83.0	331	1,838	5,059	5,553	8.9	3.6	7.0
4.50 to Less than 6	24.6	66.4	64.7	338	1,627	4,250	4,888	9.3	4.9	2.9
6 or More	20.5	56.1	54.3	386	1,608	3,425	4,097	9.9	7.0	3.5
Winter Temperature Inside Housing Unit										
Prefer										
Usual Temperature	41.8	65.0	63.4	358	1,664	4,019	4,651	9.5	5.4	2.2
Warmer Temperature	8.3	64.8	63.1	360	1,606	4,098	4,738	9.6	5.5	3.3
Cooler Temperature	1.6	50.4	48.9	282	1,416	3,912	4,525	8.8	5.1	7.2
Adequacy of Insulation										
Well Insulated	17.6	66.0	64.3	366	1,867	4,095	4,743	8.4	4.8	2.9
Adequately Insulated	21.0	64.7	63.1	358	1,635	4,129	4,773	9.4	5.3	2.4
Poorly Insulated	11.1	64.7	63.0	354	1,408	3,759	4,357	11.9	6.7	3.2
Don't Know	2.1	50.1	48.7	270	1,178	3,885	4,455	10.6	5.9	7.8

1/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 35. Fuel Oil Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Fuel Oil Space-Heating Intensity Consumption (gallons/ HDD*1000 square feet)	Fuel Oil Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	2.0	NF	NF	NF	1.0	0.5	0.4	NF	NF	
Total U.S. Households....	10.4	79.3	576	625	1,867	4,950	5,777	0.062	6.8	3.4
Urban Status										
Urban.....	8.0	78.8	572	621	1,857	4,822	5,663	.064	6.9	3.9
Central City.....	2.6	64.8	474	490	1,562	4,644	5,535	.065	6.8	7.6
Suburban.....	5.3	85.7	621	686	2,002	4,909	5,727	.063	7.0	4.1
Rural.....	2.5	81.0	587	635	1,902	5,369	6,146	.058	6.2	7.0
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	1.8	97.7	709	754	2,122	7,009	7,820	.048	5.1	5.8
5,500 to 7,000 HDD...	4.2	88.7	643	702	1,924	5,221	6,024	.064	7.0	3.8
4,000 to 5,499 HDD...	3.9	67.4	491	533	1,765	4,110	4,978	.068	7.3	6.3
Under 4,000 HDD.....	.5	33.9	246	272	1,331	2,290	3,088	.081	8.9	17.3
2,000 CDD or More and										
Under 4,000 HDD.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Type of Housing Unit										
Single-Family.....	7.4	89.2	646	711	2,173	5,025	5,844	.059	6.5	3.6
Detached.....	6.7	91.0	659	724	2,219	5,063	5,879	.059	6.4	3.7
Attached.....	.7	71.8	521	584	1,717	4,650	5,498	.065	7.3	11.1
Mobile Home.....	.3	50.6	372	419	828	5,159	5,981	.087	9.8	22.2
Multifamily.....	2.7	55.1	405	408	1,138	4,725	5,573	.075	7.6	6.3
2 to 4 Units.....	1.2	81.5	597	659	1,320	5,117	5,918	.088	9.8	7.5
5 or More Units.....	1.5	33.7	250	204	990	4,407	5,292	.057	4.7	6.8
Heated Floorspace (square feet)										
Fewer than 1000.....	2.4	48.5	357	372	697	4,622	5,469	.111	11.6	5.2
1,000 to 1,999	3.7	71.5	519	572	1,451	4,926	5,729	.073	8.0	3.4
2,000 to 2,999	2.8	85.4	619	663	2,402	5,101	5,929	.051	5.4	4.2
3,000 or More	1.4	139.4	1009	1,111	3,865	5,269	6,120	.050	5.5	5.7
Number of Rooms										
1 to 3.....	1.1	36.5	269	263	747	4,616	5,506	.078	7.6	10.4
4 to 6.....	5.8	70.2	511	549	1,601	4,927	5,742	.065	7.0	3.6
7 or More.....	3.5	107.3	777	859	2,647	5,092	5,918	.058	6.4	4.8
Ownership of Unit										
Owned.....	7.9	85.9	622	681	2,125	5,012	5,836	.058	6.4	3.5
Rented.....	2.5	58.9	433	449	1,066	4,760	5,595	.085	8.9	5.7
Public Housing.....	.3	43.3	319	Q	1,143	4,807	5,671	.058	Q	36.2
Not Public Housing...	2.2	61.0	448	470	1,056	4,754	5,585	.089	9.4	6.5
Rent Subsidy.....	.2	43.8	323	338	893	4,475	5,304	.081	8.4	13.5
No Rent Subsidy...	2.1	62.4	459	480	1,070	4,776	5,608	.090	9.4	6.3
Year of Construction										
1939 or Before.....	4.1	85.6	622	669	1,796	5,047	5,873	.069	7.4	4.8
1940 to 1949.....	.9	71.6	521	568	1,456	4,859	5,694	.074	8.0	10.3
1950 to 1959.....	2.1	78.7	570	633	1,844	4,662	5,523	.066	7.4	8.2
1960 to 1969.....	1.5	73.8	536	576	1,928	4,702	5,532	.059	6.4	8.0
1970 to 1979.....	1.5	76.2	553	597	2,221	5,242	6,020	.047	5.1	7.9
1980 to 1984.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
1985 to 1987.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
1988 to 19902/.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Main Space-Heating Fuel Paid by Household										
Yes.....	8.1	87.7	635	700	2,093	5,057	5,871	.060	6.6	3.5
No.....	2.3	49.7	367	358	1,075	4,574	5,445	.075	7.3	6.0
1990 Family Income										
Less than $10,000.....	1.8	64.2	468	500	1,270	4,805	5,614	.077	8.2	8.4
$10,000 to $19,999.....	1.9	69.0	504	537	1,431	4,644	5,494	.076	8.1	6.4
$20,000 to $34,999.....	2.7	74.8	544	582	1,842	5,141	5,941	.057	6.1	4.6
$35,000 to $49,999.....	1.9	78.0	566	618	1,857	4,970	5,821	.061	6.7	5.9
$50,000 or More.....	2.2	107.4	777	862	2,780	5,080	5,914	.055	6.1	5.3
Below Poverty Line										
100 Percent.....	1.2	63.4	463	497	1,302	4,746	5,557	.075	8.0	9.0
125 Percent.....	1.8	59.7	436	465	1,291	4,815	5,633	.070	7.5	7.1
Eligible for Federal Assistance3/.....	3.1	68.2	497	532	1,444	4,802	5,636	.072	7.7	5.5
Age of Householder										
Less than 35 Years.....	2.4	70.8	517	557	1,552	4,904	5,730	.068	7.3	5.7
35 to 44 Years.....	2.0	81.4	590	650	2,196	4,869	5,724	.055	6.1	5.1
45 to 59 Years.....	2.3	80.1	581	631	1,975	4,979	5,816	.059	6.4	5.7
60 Years and Over.....	3.7	83.2	604	651	1,828	5,009	5,813	.066	7.1	5.2
Education of Householder										
Less than 13 Years.....	6.6	72.0	524	565	1,650	4,955	5,774	.064	6.9	4.2
13 to 16 Years.....	2.7	88.7	644	699	2,039	4,901	5,727	.064	7.0	5.4
17 Years or More.....	1.1	99.7	722	796	2,745	5,040	5,918	.052	5.8	8.5

Table 35. Fuel Oil Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Fuel Oil Space-Heating Intensity Consumption (gallons/ HDD*1000 square feet)	Fuel Oil Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	2.0	NF	NF	NF	1.0	0.5	0.4	NF	NF	
Race of Householder										
White	9.5	80.7	586	635	1,899	5,022	5,842	.061	6.7	3.4
Black	.8	66.4	487	532	1,577	4,088	5,015	.075	8.3	11.4
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Householder of Hispanic Descent										
Yes	.6	62.8	458	474	1,622	4,233	5,165	.067	6.9	9.2
No	9.9	80.2	583	633	1,881	4,991	5,812	.062	6.7	3.6
Household Size										
1 Person	2.3	66.1	482	510	1,341	4,942	5,775	.073	7.7	6.3
2 Persons	3.4	82.7	600	644	1,876	5,000	5,820	.064	6.9	4.8
3 to 5 Persons	4.3	82.5	598	659	2,114	4,942	5,767	.057	6.3	4.3
6 or More Persons	.4	94.3	686	761	2,225	4,634	5,509	.067	7.4	12.6
Main Heating Equipment Using Fuel Oil										
Central Warm-Air Furnace	4.4	68.5	497	539	1,872	5,107	5,893	.052	5.6	5.2
Steam or Hot-Water System	5.7	89.7	651	705	1,917	4,910	5,767	.069	7.5	4.2
Other	.3	45.7	335	382	989	3,648	4,484	.093	10.6	18.4
Age of Main Heating Equipment										
Less than 5 Years	2.0	83.8	607	661	1,887	5,190	6,027	.062	6.8	6.5
5 to 9 Years	1.2	85.6	620	681	2,253	5,295	6,108	.052	5.7	9.3
10 to 19 Years	1.9	80.4	584	628	2,160	5,033	5,786	.054	5.8	6.5
20 Years or More	3.5	83.8	608	672	1,800	4,811	5,648	.070	7.8	4.6
Don't Know	1.7	59.4	436	443	1,389	4,631	5,517	.068	6.9	8.1

See footnotes at end of table.

Table 35. Fuel Oil Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990 (Continued)

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Fuel Oil Space-Heating Intensity Consumption (gallons/ HDD*1000 square feet)	Fuel Oil Space-Heating Intensity Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	2.0	NF	NF	NF	1.0	0.5	0.4	NF	NF	
Secondary Heating Fuel (more than one may apply)										
No	5.4	72.0	524	560	1,594	4,938	5,775	0.067	7.1	4.7
Yes	5.0	87.2	632	694	2,164	4,964	5,779	.059	6.5	4.6
Wood	3.1	92.7	671	734	2,491	5,112	5,929	.053	5.8	5.9
Electricity	2.0	85.5	621	687	2,002	4,841	5,645	.064	7.1	6.4
Kerosene	.6	84.3	610	678	1,767	4,652	5,455	.074	8.3	7.9
Other	.3	87.4	635	673	1,864	5,280	6,154	.065	6.8	12.5
Average Fuel Oil Expenditures for Main Space Heat (dollars per gallon)										
Less than .95	2.2	44.2	322	264	1,528	4,690	5,540	.045	3.7	7.2
.95 to Less than 1.10	4.8	86.4	630	673	1,908	5,129	5,952	.064	6.9	3.9
1.10 or More	3.4	91.7	662	786	2,027	4,865	5,683	.067	8.0	5.3
Winter Temperature Inside Housing Unit										
Prefer										
Usual Temperature	8.4	79.7	579	624	1,885	4,914	5,732	.063	6.7	3.6
Warmer Temperature	1.7	81.1	588	658	1,897	5,138	5,995	.060	6.7	6.8
Cooler Temperature	.3	58.1	428	452	1,232	4,927	5,813	.070	7.4	18.7
Adequacy of Insulation										
Well Insulated	4.1	76.1	552	597	2,049	4,830	5,671	.056	6.0	5.4
Adequately Insulated	4.3	80.9	587	639	1,875	5,023	5,848	.062	6.8	4.7
Poorly Insulated	1.7	88.1	641	700	1,591	5,015	5,815	.080	8.8	5.2
Don't Know	.3	45.4	335	336	688	5,229	6,028	.093	9.3	18.7

1/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 36. Liquefied Petroleum Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Liquefied Petroleum Gas Space-Heating Intensity: Consumption (gallons/ HDD*1000 square feet)	Liquefied Petroleum Gas Space-Heating Intensity: Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.8	NF	NF	NF	0.7	0.9	0.8	NF	NF	
Total U.S. Households....	4.4	41.1	450	434	1,409	3,867	4,470	0.083	8.0	7.6
Urban Status										
Urban.....	2.0	33.1	363	360	1,516	3,482	4,085	.069	6.8	10.8
Central City.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Suburban.....	1.9	34.5	378	368	1,570	3,686	4,293	.065	6.4	13.6
Rural.....	2.3	48.0	526	500	1,316	4,203	4,807	.095	9.0	9.4
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	.8	64.7	709	620	1,602	7,170	7,821	.062	5.4	7.9
5,500 to 7,000 HDD...	.7	55.9	612	580	1,926	5,364	6,044	.059	5.6	8.5
4,000 to 5,499 HDD...	.8	49.7	544	521	1,269	4,227	4,824	.101	9.7	10.5
Under 4,000 HDD.....	1.2	31.0	340	353	1,251	2,725	3,374	.100	10.3	14.3
2,000 CDD or More and										
Under 4,000 HDD.....	.9	16.2	178	205	1,174	1,188	1,633	.128	14.7	16.8
Type of Housing Unit										
Single-Family.....	3.2	44.8	491	466	1,578	4,064	4,668	.076	7.3	9.0
Detached.....	3.2	44.8	491	466	1,578	4,064	4,668	.076	7.3	9.0
Attached.....	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mobile Home.....	1.2	31.0	340	349	910	3,295	3,887	.113	11.6	8.5
Multifamily.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
2 to 4 Units.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
5 or More Units.....	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Heated Floorspace (square feet)										
Fewer than 1000.....	1.6	33.4	366	373	761	3,501	4,071	.137	14.0	7.7
1,000 to 1,999	2.0	40.5	443	438	1,357	3,727	4,337	.088	8.7	9.2
2,000 to 2,999	.5	56.1	614	525	2,497	4,753	5,432	.052	4.4	11.6
3,000 or More	.3	62.5	684	599	3,571	5,402	6,006	.035	3.1	15.1
Number of Rooms										
1 to 3.....	.4	46.7	512	546	700	4,964	5,438	.147	15.7	21.3
4 to 6.....	3.0	36.2	397	390	1,289	3,598	4,208	.086	8.4	7.6
7 or More.....	.9	54.7	599	531	2,128	4,264	4,901	.066	5.9	14.0
Ownership of Unit										
Owned.....	3.7	41.8	458	445	1,487	3,934	4,557	.078	7.6	8.4
Rented.....	.7	37.4	409	375	987	3,502	4,002	.118	10.8	12.6
Public Housing.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Not Public Housing...	.7	37.8	414	379	992	3,477	3,971	.120	11.0	13.1
Rent Subsidy.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
No Rent Subsidy...	.6	38.8	425	386	1,016	3,646	4,149	.115	10.4	13.2
Year of Construction										
1939 or Before.....	.8	58.1	636	572	1,420	4,502	5,160	.100	8.9	9.4
1940 to 1949.....	.3	49.7	544	565	1,168	4,586	5,155	.102	10.5	25.7
1950 to 1959.....	.5	40.9	447	456	1,067	3,381	3,891	.124	12.6	22.3
1960 to 1969.....	.5	28.9	317	323	1,240	3,493	4,030	.073	7.5	19.4
1970 to 1979.....	1.0	37.0	406	406	1,509	3,203	3,861	.084	8.4	10.7
1980 to 1984.....	.6	36.9	404	374	1,540	4,242	4,771	.062	5.7	18.8
1985 to 1987.....	.2	28.5	312	324	1,443	3,586	4,186	.060	6.3	26.1
1988 to 19902/.....	.4	39.2	429	393	1,758	4,384	5,088	.056	5.1	18.6
Main Space-Heating Fuel Paid by Household										
Yes.....	4.2	40.8	447	431	1,431	3,830	4,433	.081	7.9	7.9
No.....	.2	47.3	518	495	976	4,590	5,208	.116	11.0	26.6
1990 Family Income										
Less than $10,000.....	1.2	35.3	386	406	960	3,309	3,811	.122	12.8	11.4
$10,000 to $19,999.....	1.3	36.8	403	407	1,287	3,793	4,420	.083	8.3	9.4
$20,000 to $34,999.....	.9	46.1	504	465	1,554	4,399	5,077	.074	6.8	11.2
$35,000 to $49,999.....	.6	43.2	473	444	1,775	3,762	4,409	.071	6.6	17.9
$50,000 or More.....	.3	61.6	675	545	2,494	4,903	5,502	.055	4.5	19.7
Below Poverty Line										
100 Percent.....	1.1	32.3	354	362	1,013	3,325	3,863	.105	10.7	10.6
125 Percent.....	1.5	34.9	382	395	1,017	3,405	3,934	.110	11.4	10.2
Eligible for Federal Assistance3/.....	2.1	36.5	399	416	1,099	3,615	4,179	.101	10.5	8.2
Age of Householder										
Less than 35 Years.....	1.2	36.6	401	384	1,286	4,125	4,737	.076	7.2	11.3
35 to 44 Years.....	.8	45.5	498	425	1,699	4,432	5,065	.066	5.6	13.3
45 to 59 Years.....	.8	36.7	402	408	1,465	3,209	3,831	.085	8.7	11.9
60 Years and Over.....	1.6	44.5	487	491	1,327	3,722	4,293	.099	9.9	11.7
Education of Householder										
Less than 13 Years.....	3.3	40.6	445	435	1,259	3,768	4,388	.094	9.2	7.7
13 to 16 Years.....	1.0	39.9	437	413	1,792	4,128	4,673	.059	5.6	12.9
17 Years or More.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

Table 36. Liquefied Petroleum Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Liquefied Petroleum Gas Space-Heating Intensity: Consumption (gallons/ HDD*1000 square feet)	Liquefied Petroleum Gas Space-Heating Intensity: Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.8	NF	NF	NF	0.7	0.9	0.8	NF	NF	
Race of Householder										
White	3.9	42.6	466	447	1,441	4,015	4,620	.081	7.7	7.4
Black	.4	29.0	317	344	1,125	2,281	2,919	.124	13.4	18.7
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Householder of Hispanic Descent										
Yes	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
No	4.3	41.1	450	434	1,406	3,849	4,455	.083	8.0	7.5
Household Size										
1 Person	.9	34.6	379	392	874	3,325	3,848	.131	13.5	12.6
2 Persons	1.5	41.8	458	441	1,544	3,749	4,371	.079	7.6	11.7
3 to 5 Persons	1.7	46.1	505	471	1,539	4,372	5,006	.075	7.0	8.6
6 or More Persons	.3	28.1	308	318	1,619	3,192	3,763	.060	6.2	23.4
Main Heating Equipment Using LPG										
Central Warm-Air Furnace	2.6	44.7	490	448	1,588	4,255	4,878	.072	6.6	7.6
Room Heater/Other	1.8	35.7	391	414	1,143	3,290	3,864	.104	11.0	12.2
Age of Main Heating Equipment										
Less than 5 Years	1.4	41.0	449	421	1,608	4,255	4,908	.066	6.2	11.6
5 to 9 Years	1.1	35.0	383	387	1,310	3,548	4,148	.082	8.3	12.5
10 to 19 Years	1.0	47.2	517	502	1,420	3,724	4,328	.098	9.5	12.4
20 Years or More	.7	41.1	450	426	1,246	3,860	4,371	.094	8.9	13.6
Don't Know	.2	42.7	467	463	1,076	3,646	4,234	.119	11.8	21.2
Secondary Heating Fuel (more than one may apply)										
No	2.2	42.3	463	447	1,248	3,742	4,323	.099	9.6	8.0
Yes	2.2	39.9	437	423	1,566	3,989	4,614	.070	6.8	9.9
Wood	1.1	45.3	496	454	1,942	4,791	5,380	.053	4.9	10.8
Electricity	1.0	34.3	376	398	1,418	3,186	3,819	.083	8.8	14.0
Kerosene	.4	39.2	429	465	1,407	3,859	4,593	.079	8.6	15.1
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

See footnotes at end of table.

Table 36. Liquefied Petroleum Gas Consumption and Expenditures for Main Space Heating, per U.S. Household, 1990 (Continued)

Characteristics	Households (million)	Consumption (million Btu)	Consumption (gallons)	Expenditures (dollars)	Heated Floorspace (square feet)	Annual Heating Degree-Days 1990	Annual Heating Degree-Days 30-Year Average1/	Liquefied Petroleum Gas Space-Heating Intensity: Consumption (gallons/ HDD*1000 square feet)	Liquefied Petroleum Gas Space-Heating Intensity: Expenditures (cents/ HDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	1.8	NF	NF	NF	0.7	0.9	0.8	NF	NF	
Average LPG Expenditures for Main Space Heat (dollars per gallon)										
Less than .75	0.4	55.7	609	386	1,824	5,638	6,300	0.059	3.8	9.9
.75 to Less than 1.00	1.9	45.3	496	439	1,461	4,522	5,104	.075	6.6	9.2
1.00 or More	2.0	34.0	372	441	1,271	2,867	3,478	.102	12.1	11.3
Winter Temperature Inside Housing Unit										
Prefer										
Usual Temperature	3.5	40.9	448	428	1,435	3,740	4,335	.084	8.0	7.4
Warmer Temperature	.8	42.3	464	468	1,260	4,428	5,076	.083	8.4	15.5
Cooler Temperature	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Adequacy of Insulation										
Well Insulated	2.1	40.9	448	422	1,645	4,023	4,640	.068	6.4	10.0
Adequately Insulated	1.3	41.0	449	454	1,317	3,750	4,368	.091	9.2	11.1
Poorly Insulated	.9	42.0	460	441	1,032	3,657	4,212	.122	11.7	10.6
Don't Know	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

1/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-D of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 37. Electricity Consumption and Expenditures for All Air Conditioning and Central Air Conditioning, U.S. Households, 1990

Characteristics	Electricity Used for All Air Conditioning			Electricity Used for Central Air Conditioning1/									
				per Household									
				Consumption					Annual Cooling Degree-Days		Electric Air-Conditioning Intensity		
	Households (million)	Total Consumption (quadrillion Btu)	Total Expenditures (billion dollars)	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	1990	30-Year Average2/	Consumption (kWh/CDD*1000 square feet)	Expenditures (cents/CDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	0.9	NF	NF	1.4	NF	NF	NF	0.7	0.8	0.8	NF	NF	
Total U.S. Households....	60.3	0.48	11.19	35.1	11.0	3,231	255	1,966	1,797	1,615	0.91	7.2	3.0
Urban Status													
Urban.....	47.9	.39	9.35	29.4	11.1	3,248	262	1,959	1,849	1,643	.90	7.2	3.2
Central City.....	18.1	.15	3.42	10.1	11.8	3,463	264	1,626	2,028	1,796	1.05	8.0	5.2
Suburban.....	29.7	.24	5.93	19.3	10.7	3,136	261	2,133	1,755	1,563	.84	7.0	3.6
Rural.....	12.5	.09	1.84	5.7	10.7	3,144	218	2,000	1,531	1,474	1.03	7.1	7.9
Climate Zone2/													
Under 2,000 CDD and Over 7,000 HDD.....	4.9	.01	.32	2.6	4.4	1,280	96	2,212	684	619	.85	6.3	9.0
5,500 to 7,000 HDD...	15.0	.06	1.42	6.5	6.2	1,822	155	2,364	856	811	.90	7.6	6.9
4,000 to 5,499 HDD...	14.1	.08	1.99	7.7	8.6	2,512	196	2,224	1,281	1,179	.88	6.9	7.1
Under 4,000 HDD.....	12.2	.09	2.11	7.9	8.9	2,622	215	1,711	1,729	1,481	.89	7.3	7.2
2,000 CDD or More and Under 4,000 HDD.....	14.1	.24	5.34	10.3	19.2	5,634	434	1,653	3,120	2,812	1.09	8.4	5.7
Type of Housing Unit													
Single-Family.....	42.0	.38	8.77	25.3	12.1	3,554	281	2,368	1,785	1,599	.84	6.7	3.4
Detached.....	37.9	.35	8.07	22.6	12.6	3,684	291	2,469	1,784	1,603	.84	6.6	3.5
Attached.....	4.1	.03	.69	2.8	8.5	2,493	203	1,548	1,788	1,562	.90	7.3	11.9
Mobile Home.....	3.0	.02	.49	1.6	9.8	2,869	212	1,039	1,337	1,283	2.07	15.2	11.7
Multifamily.....	15.3	.08	1.93	8.2	7.8	2,297	181	893	1,925	1,730	1.34	10.5	7.0
2 to 4 Units.....	5.7	.03	.68	2.4	8.7	2,563	205	1,062	2,025	1,803	1.19	9.5	14.0
5 or More Units.....	9.6	.05	1.24	5.8	7.5	2,187	171	823	1,884	1,700	1.41	11.0	9.4
Heated Floorspace (square feet)													
Fewer than 1,000.....	17.3	.10	2.33	8.2	8.5	2,479	195	778	2,033	1,818	1.57	12.3	6.1
1,000 to 1,999	25.9	.22	5.01	15.3	11.1	3,247	255	1,662	1,895	1,705	1.03	8.1	4.0
2,000 to 2,999	11.8	.11	2.57	7.9	12.4	3,625	285	2,664	1,609	1,448	.85	6.6	4.3
3,000 or More	5.3	.05	1.29	3.7	13.6	3,980	323	4,339	1,280	1,157	.72	5.8	8.4
Number of Rooms													
1 to 3.....	6.4	.04	.83	3.2	8.1	2,370	186	691	2,162	1,946	1.59	12.4	10.5
4 to 6.....	36.8	.27	6.37	19.9	10.3	3,023	238	1,619	1,842	1,662	1.01	8.0	4.1
7 or More.....	17.1	.17	3.98	12.0	13.0	3,806	301	2,881	1,626	1,450	.81	6.4	4.8
Ownership of Unit													
Owned.....	42.2	.36	8.37	25.5	11.5	3,365	267	2,309	1,683	1,513	.87	6.9	3.6
Rented.....	18.1	.12	2.82	9.5	9.8	2,873	224	1,049	2,104	1,888	1.30	10.1	6.1
Public Housing.....	1.1	(*)	.11	.5	5.8	1,696	121	841	1,688	1,537	1.19	8.5	19.6
Not Public Housing...	17.0	.12	2.71	9.1	10.0	2,933	229	1,060	2,126	1,906	1.30	10.2	6.2
Rent Subsidy.....	1.0	(*)	.10	.4	5.9	1,742	142	831	1,494	1,373	1.40	11.4	25.8
No Rent Subsidy...	16.0	.11	2.61	8.7	10.2	2,984	233	1,070	2,153	1,929	1.30	10.1	6.4

See footnotes at end of table.

Table 37. Electricity Consumption and Expenditures for All Air Conditioning and Central Air Conditioning, U.S. Households, 1990 (Continued)

Characteristics	Electricity Used for All Air Conditioning			Electricity Used for Central Air Conditioning1/									
				per Household									
				Consumption					Annual Cooling Degree-Days		Electric Air-Conditioning Intensity		
	Households (million)	Total Consumption (quadrillion Btu)	Total Expenditures (billion dollars)	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	1990	30-Year Average2/	Consumption (kWh/CDD*1000 square feet)	Expenditures (cents/CDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	0.9	NF	NF	1.4	NF	NF	NF	0.7	0.8	0.8	NF	NF	
Year of Construction													
1939 or Before	10.2	0.04	1.00	1.9	8.4	2,448	192	2,223	1,253	1,142	0.88	6.9	8.4
1940 to 1949	3.9	.02	.55	1.3	9.8	2,872	224	2,005	1,562	1,418	.92	7.1	9.4
1950 to 1959	8.2	.06	1.43	4.0	10.4	3,039	253	2,182	1,547	1,394	.90	7.5	6.0
1960 to 1969	10.3	.09	2.06	5.9	12.3	3,594	281	1,957	1,992	1,834	.92	7.2	7.5
1970 to 1979	15.5	.15	3.34	11.4	11.3	3,322	257	1,832	1,776	1,611	1.02	7.9	5.7
1980 to 1984	6.1	.06	1.39	4.8	11.6	3,392	270	1,812	2,054	1,788	.91	7.3	7.3
1985 to 1987	4.2	.04	.95	3.9	9.9	2,890	236	1,777	1,981	1,719	.82	6.7	13.0
1988 to 19903/	2.0	.02	.47	1.8	11.3	3,298	254	2,859	1,542	1,389	.75	5.8	13.6
Electric Air-Conditioning Paid by Household													
Yes	59.2	.47	11.00	34.0	11.1	3,256	258	1,999	1,795	1,611	.91	7.2	3.0
No	1.1	.01	.19	1.1	8.4	2,454	172	934	1,888	1,743	1.39	9.8	17.7
1990 Family Income													
Less than $10,000	7.9	.04	1.03	2.8	9.1	2,658	206	1,256	1,962	1,793	1.08	8.4	9.0
$10,000 to $19,999	11.5	.08	1.72	5.5	9.3	2,720	210	1,452	1,860	1,693	1.01	7.8	5.5
$20,000 to $34,999	15.6	.11	2.58	8.9	10.0	2,931	226	1,664	1,851	1,671	.95	7.3	4.8
$35,000 to $49,999	12.1	.11	2.57	8.0	11.8	3,453	272	1,996	1,884	1,679	.92	7.2	4.7
$50,000 or More	13.2	.14	3.29	9.8	12.9	3,773	306	2,708	1,595	1,418	.87	7.1	5.4
Below Poverty Line													
100 Percent	6.0	.04	.83	2.1	9.4	2,758	214	1,291	2,053	1,849	1.04	8.1	9.6
125 Percent	8.7	.05	1.25	3.2	10.1	2,947	229	1,323	2,082	1,885	1.07	8.3	8.9
Eligible for Federal Assistance4/	14.3	.09	2.03	5.5	9.9	2,910	228	1,389	1,994	1,810	1.05	8.2	6.0
Age of Householder													
Less than 35 Years	17.5	.13	3.06	10.3	10.2	2,981	238	1,508	1,929	1,717	1.02	8.2	5.5
35 to 44 Years	12.2	.11	2.48	8.0	11.2	3,285	260	2,238	1,732	1,565	.85	6.7	4.4
45 to 59 Years	13.5	.14	3.26	8.5	14.0	4,114	320	2,244	1,859	1,670	.99	7.7	4.9
60 Years and Over	17.0	.10	2.39	8.2	8.8	2,581	204	1,988	1,632	1,479	.80	6.3	4.9
Education of Householder													
Less than 13 Years	31.1	.22	5.10	14.8	10.7	3,123	242	1,715	1,839	1,664	.99	7.7	4.0
13 to 16 Years	22.2	.19	4.48	15.0	11.3	3,313	260	2,084	1,793	1,615	.89	7.0	4.2
17 Years or More	7.1	.06	1.60	5.3	11.3	3,299	276	2,332	1,694	1,479	.83	7.0	7.2
Race of Householder													
White	52.8	.41	9.64	31.1	10.8	3,156	252	2,023	1,759	1,582	.89	7.1	3.1
Black	6.2	.06	1.31	3.1	13.9	4,075	294	1,467	2,149	1,926	1.29	9.3	8.1
Other	1.3	.01	.24	.8	9.8	2,858	234	1,714	1,920	1,686	.87	7.1	14.6

See footnotes at end of table.

Table 37. Electricity Consumption and Expenditures for All Air Conditioning and Central Air Conditioning, U.S. Households, 1990 (Continued)

Characteristics	Electricity Used for All Air Conditioning			Electricity Used for Central Air Conditioning1/									
				per Household									
				Consumption					Annual Cooling Degree-Days		Electric Air-Conditioning Intensity		
	Households (million)	Total Consumption (quadrillion Btu)	Total Expenditures (billion dollars)	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	1990	30-Year Average2/	Consumption (kWh/CDD*1000 square feet)	Expenditures (cents/CDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	0.9	NF	NF	1.4	NF	NF	NF	0.7	0.8	0.8	NF	NF	
Householder of Hispanic Descent													
Yes	3.4	0.03	0.81	2.1	12.7	3,712	310	1,646	2,375	2,039	0.95	7.9	7.8
No	56.9	.45	10.38	32.9	10.9	3,200	251	1,987	1,760	1,588	.92	7.2	3.2
Household Size													
1 Person	14.7	.08	1.82	7.7	7.2	2,109	169	1,383	1,710	1,544	.89	7.1	5.3
2 Persons	19.9	.16	3.66	12.0	10.8	3,173	250	2,004	1,777	1,605	.89	7.0	3.9
3 to 5 Persons	23.9	.23	5.32	14.6	13.0	3,810	300	2,212	1,854	1,656	.93	7.3	3.8
6 or More Persons	1.7	.02	.39	.9	14.5	4,253	338	2,477	1,909	1,713	.90	7.1	9.9
Cooling Degree-Days (CDD)-1990													
2,000 or More	17.1	.27	6.11	12.5	17.9	5,249	409	1,680	2,983	2,653	1.05	8.2	5.6
1,000 to 1,999	21.2	.14	3.14	12.3	8.6	2,532	195	2,003	1,462	1,319	.86	6.7	5.1
500 to 999	19.8	.07	1.83	9.4	5.6	1,652	143	2,285	781	731	.93	8.0	5.8
Fewer than 500	2.2	(*)	.11	.8	3.4	1,008	84	2,118	370	363	1.29	10.7	13.8
Average Humidity for June, July and August 1990 (percent)													
Less than 65	4.9	.03	.78	3.1	9.2	2,709	220	1,749	2,149	1,871	.72	5.8	9.2
65 to Less than 70	21.4	.12	3.00	10.8	8.2	2,412	205	2,013	1,359	1,238	.88	7.5	7.6
70 or Higher	34.0	.33	7.41	21.1	12.7	3,727	286	1,974	1,970	1,770	.96	7.4	5.1
Average Electricity Expenditures (cents per kWh)													
Less than 6	6.1	.06	.88	3.7	11.9	3,486	192	2,146	1,490	1,378	1.09	6.0	9.7
6 to Less than 9	34.5	.35	7.78	22.6	12.6	3,700	284	1,868	2,034	1,837	.97	7.5	4.0
9 or More	19.7	.08	2.53	8.8	6.5	1,914	208	2,142	1,321	1,146	.68	7.4	5.0
Number of Rooms Usually Air Conditioned													
1 to 3	20.3	.07	1.76	4.1	7.8	2,278	181	725	2,036	1,836	1.54	12.2	8.0
4 to 6	28.6	.26	6.07	20.3	10.5	3,075	243	1,670	1,837	1,655	1.00	7.9	4.2
7 or More	11.5	.15	3.36	10.6	13.3	3,904	307	3,019	1,628	1,453	.79	6.2	5.2
Frequency of Use of Air Conditioning5/													
Only a Few Times	23.6	.06	1.61	9.6	4.8	1,416	120	1,951	1,287	1,155	.56	4.8	4.6
Quite a Bit	13.9	.10	2.53	8.3	9.5	2,783	228	2,006	1,596	1,417	.87	7.1	4.4
All Summer	22.4	.31	6.95	17.0	15.3	4,472	344	1,964	2,180	1,967	1.04	8.0	3.9
Other	.3	(*)	.06	.2	10.9	3,203	266	1,204	2,127	1,982	1.25	10.4	31.1

See footnotes at end of table.

Table 37. Electricity Consumption and Expenditures for All Air Conditioning and Central Air Conditioning, U.S. Households, 1990 (Continued)

Characteristics	Electricity Used for All Air Conditioning: Households (million)	Electricity Used for All Air Conditioning: Total Consumption (quadrillion Btu)	Electricity Used for All Air Conditioning: Total Expenditures (billion dollars)	Electricity Used for Central Air Conditioning1/: Households (million)	Per Household: Consumption (million Btu)	Per Household: Consumption (kWh)	Per Household: Expenditures (dollars)	Per Household: Cooled Floorspace (square feet)	Per Household: Annual Cooling Degree-Days: 1990	Per Household: Annual Cooling Degree-Days: 30-Year Average2/	Per Household: Electric Air-Conditioning Intensity: Consumption (kWh/CDD*1000 square feet)	Per Household: Electric Air-Conditioning Intensity: Expenditures (cents/CDD*1000 square feet)	RSE Row Factors
RSE Column Factors:	0.9	NF	NF	1.4	NF	NF	NF	0.7	0.8	0.8	NF	NF	
Age of Air Conditioning Equipment5/													
Less than 5 Years	18.3	0.14	3.32	10.0	11.0	3,237	259	2,314	1,699	1,519	0.82	6.6	4.5
5 to 9 Years	15.5	.12	2.89	8.4	11.2	3,276	262	1,853	1,876	1,658	.94	7.5	5.4
10 or More Years	20.3	.17	3.93	12.7	11.2	3,293	257	1,998	1,766	1,607	.93	7.3	4.8
Don't Know	5.6	.04	.95	3.3	10.5	3,085	237	1,273	2,032	1,841	1.19	9.2	8.7
Participation in Demand-Side Management Programs (more than one may apply)													
No/Don't Know	57.0	.45	10.58	32.7	11.1	3,265	256	1,954	1,802	1,625	.93	7.3	3.1
Yes	3.3	.02	.61	2.4	9.4	2,763	237	2,132	1,734	1,479	.75	6.4	8.8
Rebate	.9	.01	.19	.7	10.1	2,959	246	2,067	1,880	1,647	.76	6.3	19.3
Load Control	1.4	.01	.32	1.2	10.0	2,921	250	2,256	1,778	1,478	.73	6.2	12.4
Energy Audit	.6	(*)	.10	.3	10.1	2,966	290	2,173	1,754	1,518	.78	7.6	23.7
Conservation	.9	.01	.14	.6	8.0	2,335	199	2,290	1,367	1,241	.75	6.4	16.4
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

1/ An estimated 2.0 million households have a central air conditioner and one or more room air conditioners. These households are included only under central air conditioners and not included under room air conditioners.
2/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
3/ Does not include all new construction for 1990.
4/ Below 150 percent of poverty line or 60 percent of median State income.
5/ If a household has both a central and room air conditioner then the usage and age of the equipment is presented only for the central unit.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * This table reflects only those households that used their air conditioning equipment. See Appendix B, "Quality of the Data," for a discussion of households that had air-conditioning equipment but did not use it. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 38.Electricity Consumption and Expenditures for Room Air Conditioning, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	Annual Cooling Degree-Days 1990	Annual Cooling Degree-Days 30-Year Average1/	Electric Air-Conditioning Intensity Consumption (kWh/ CDD*1000 square feet)	Electric Air-Conditioning Intensity Expenditures (cents/ CDD*1000 square feet)	RSE Row Factor
RSE Column Factors:	1.2	NF	NF	NF	0.7	0.7	0.7	NF	NF	
Total U.S. Households....	25.1	3.6	1,069	88	899	1,340	1,219	0.89	7.3	4.2
Urban Status										
Urban.....	18.3	3.4	1,009	88	872	1,343	1,196	.86	7.5	5.3
Central City.....	8.0	3.6	1,045	93	827	1,442	1,276	.88	7.8	7.0
Suburban.....	10.3	3.4	982	85	907	1,267	1,133	.85	7.4	6.8
Rural.....	6.8	4.2	1,231	89	972	1,330	1,283	.95	6.9	6.5
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	2.3	1.4	415	31	1,027	581	487	.70	5.1	7.8
5,500 to 7,000 HDD...	8.4	1.8	536	48	915	795	722	.74	6.6	5.1
4,000 to 5,499 HDD...	6.3	2.6	765	73	910	1,127	1,050	.75	7.1	6.4
Under 4,000 HDD.....	4.2	4.3	1,247	94	800	1,666	1,507	.94	7.0	7.1
2,000 CDD or More and										
Under 4,000 HDD.....	3.8	10.1	2,956	231	879	2,994	2,725	1.12	8.8	7.2
Type of Housing Unit										
Single-Family.....	16.5	4.2	1,217	97	1,040	1,416	1,297	.83	6.6	4.9
Detached.....	15.2	4.2	1,234	97	1,057	1,431	1,314	.82	6.4	5.1
Attached.....	1.3	3.5	1,025	98	840	1,244	1,102	.98	9.4	12.7
Mobile Home.....	1.5	5.0	1,463	111	603	1,310	1,225	1.85	14.0	12.3
Multifamily.....	7.1	2.2	644	63	632	1,168	1,037	.87	8.5	7.6
2 to 4 Units.....	3.3	2.1	628	58	676	1,098	975	.85	7.8	9.3
5 or More Units.....	3.8	2.2	658	67	594	1,229	1,090	.90	9.2	10.2
Heated Floorspace (square feet)										
Fewer than 1,000.....	9.1	3.4	986	80	542	1,426	1,288	1.28	10.4	5.7
1,000 to 1,999	10.5	4.4	1,285	103	907	1,447	1,326	.98	7.8	5.9
2,000 to 2,999	3.9	3.0	888	82	1,404	1,045	957	.60	5.6	7.9
3,000 or More	1.6	1.9	560	53	1,680	842	749	.40	3.8	9.1
Number of Rooms										
1 to 3.....	3.2	2.9	847	75	568	1,374	1,220	1.09	9.6	10.3
4 to 6.....	16.8	4.0	1,175	96	885	1,406	1,285	.94	7.7	4.9
7 or More.....	5.1	2.9	860	73	1,149	1,102	1,003	.68	5.7	5.7
Ownership of Unit										
Owned.....	16.6	3.9	1,134	93	1,046	1,315	1,201	.82	6.7	4.9
Rented.....	8.5	3.2	944	80	612	1,387	1,255	1.11	9.4	5.8
Public Housing.....	.6	3.5	1,020	79	539	1,890	1,656	1.00	7.7	15.5
Not Public Housing...	7.9	3.2	937	80	618	1,346	1,222	1.13	9.6	6.3
Rent Subsidy.....	.6	3.2	933	82	558	1,914	1,656	.87	7.7	22.6
No Rent Subsidy...	7.3	3.2	938	80	623	1,300	1,187	1.16	9.8	6.1
Year of Construction										
1939 or Before.....	8.2	2.9	856	76	965	1,187	1,087	.75	6.6	5.9
1940 to 1949.....	2.6	4.1	1,210	100	881	1,488	1,361	.92	7.6	10.4
1950 to 1959.....	4.2	4.0	1,185	96	1,001	1,417	1,280	.83	6.8	7.6
1960 to 1969.....	4.4	3.6	1,056	88	821	1,358	1,234	.95	7.9	8.9
1970 to 1979.....	4.0	4.4	1,303	101	781	1,403	1,273	1.19	9.2	8.1
1980 to 1984.....	1.3	3.5	1,028	81	816	1,517	1,385	.83	6.5	19.0
1985 to 1987.....	.3	5.9	1,728	124	1,098	1,512	1,347	1.04	7.5	28.7
1988 to 19902/.....	.2	1.8	539	46	586	974	891	.94	8.1	33.1
Electric Air-Conditioning Paid by Household										
Yes.....	23.9	3.7	1,081	90	917	1,342	1,223	.88	7.3	4.3
No.....	1.2	2.8	833	64	538	1,293	1,138	1.20	9.2	11.4
1990 Family Income										
Less than $10,000.....	5.1	3.7	1,096	88	693	1,637	1,492	.97	7.7	7.0
$10,000 to $19,999.....	6.0	4.0	1,161	92	782	1,473	1,352	1.01	8.0	6.7
$20,000 to $34,999.....	6.7	3.6	1,055	85	985	1,261	1,155	.85	6.9	6.3
$35,000 to $49,999.....	4.1	3.8	1,108	92	910	1,199	1,074	1.02	8.5	7.8
$50,000 or More.....	3.3	2.9	845	83	1,237	977	872	.70	6.9	8.2
Below Poverty Line										
100 Percent.....	3.9	4.2	1,232	98	662	1,723	1,590	1.08	8.6	7.6
125 Percent.....	5.5	4.1	1,201	95	704	1,665	1,531	1.03	8.1	6.9
Eligible for Federal Assistance3/.....	8.7	3.8	1,109	89	756	1,557	1,427	.94	7.6	5.6
Age of Householder										
Less than 35 Years.....	7.2	3.5	1,020	83	754	1,306	1,192	1.04	8.4	5.7
35 to 44 Years.....	4.2	3.7	1,074	90	926	1,222	1,119	.95	7.9	7.3
45 to 59 Years.....	5.0	4.2	1,243	107	948	1,293	1,167	1.01	8.7	7.1
60 Years and Over.....	8.8	3.4	1,010	81	977	1,449	1,318	.71	5.8	6.0
Education of Householder										
Less than 13 Years.....	16.2	3.9	1,151	93	853	1,413	1,295	.95	7.7	4.7
13 to 16 Years.....	7.1	3.2	950	81	970	1,213	1,091	.81	6.9	7.4
17 Years or More.....	1.8	2.8	810	74	1,034	1,171	1,040	.67	6.1	8.3

Table 38.Electricity Consumption and Expenditures for Room Air Conditioning, per U.S. Household, 1990

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	Annual Cooling Degree-Days 1990	Annual Cooling Degree-Days 30-Year Average1/	Electric Air-Conditioning Intensity Consumption (kWh/ CDD*1000 square feet)	Electric Air-Conditioning Intensity Expenditures (cents/ CDD*1000 square feet)	RSE Row Factor
RSE Column Factors:	1.2	NF	NF	NF	0.7	0.7	0.7	NF	NF	
Race of Householder										
White	21.6	3.4	1,001	83	922	1,263	1,146	.86	7.1	4.1
Black	3.1	5.3	1,561	126	753	1,855	1,710	1.12	9.0	10.1
Other	.5	3.5	1,028	87	795	1,500	1,359	.86	7.3	25.0
Householder of Hispanic Descent										
Yes	1.3	4.5	1,311	119	591	1,808	1,568	1.23	11.1	18.1
No	23.8	3.6	1,057	87	916	1,315	1,201	.88	7.2	4.2
Household Size										
1 Person	7.0	3.0	879	74	750	1,433	1,303	.82	6.9	6.6
2 Persons	7.9	3.5	1,028	84	984	1,247	1,122	.84	6.9	6.5
3 to 5 Persons	9.3	4.2	1,217	100	945	1,312	1,204	.98	8.1	4.8
6 or More Persons	.9	4.8	1,407	118	837	1,736	1,589	.97	8.1	14.4
Cooling Degree-Days (CDD)-1990										
2,000 or More	4.6	9.4	2,769	215	888	2,857	2,598	1.09	8.5	6.7
1,000 to 1,999	8.8	3.3	978	83	903	1,384	1,261	.78	6.6	5.0
500 to 999	10.4	1.7	496	46	907	759	690	.72	6.6	3.8
Fewer than 500	1.4	1.2	353	27	851	412	381	1.01	7.7	12.7
Average Humidity for June, July and August 1990 (percent)										
Less than 65	1.8	2.4	706	50	767	1,142	974	.81	5.7	10.7
65 to Less than 70	10.5	2.7	791	73	914	1,110	1,022	.78	7.2	8.1
70 or Higher	12.8	4.6	1,349	106	906	1,556	1,415	.96	7.5	6.3

See footnotes at end of table.

Table 38.Electricity Consumption and Expenditures for Room Air Conditioning, per U.S. Household, 1990 (Continued)

Characteristics	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Cooled Floorspace (square feet)	Annual Cooling Degree-Days 1990	Annual Cooling Degree-Days 30-Year Average1/	Electric Air-Conditioning Intensity Consumption (kWh/ CDD*1000 square feet)	Electric Air-Conditioning Intensity Expenditures (cents/ CDD*1000 square feet)	RSE
RSE Column Factors:	1.2	NF	NF	NF	0.7	0.7	0.7	NF	NF	Row Factor
Average Electricity Expenditures (cents per kWh)										
Less than 6	2.3	4.5	1,331	71	946	1,253	1,155	1.12	6.0	9.8
6 to Less than 9	11.9	5.1	1,499	115	987	1,630	1,505	.93	7.2	6.1
9 or More	10.9	1.9	544	63	793	1,041	921	.66	7.6	6.0
Number of Rooms Usually Air Conditioned										
1 Room	5.6	1.7	488	46	324	1,145	1,024	1.31	12.4	6.5
2 Rooms	5.7	2.5	723	62	593	1,279	1,174	.95	8.2	5.8
3 or More	13.8	5.0	1,451	117	1,261	1,444	1,317	.80	6.4	5.0
Frequency of Use of Air Conditioning										
Only a Few Times	14.0	1.2	355	33	843	1,095	992	.38	3.6	3.6
Quite a Bit	5.6	4.6	1,354	114	989	1,424	1,300	.96	8.1	5.0
All Summer	5.4	9.0	2,630	205	958	1,884	1,724	1.46	11.4	5.2
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Age of Air Conditioning Equipment										
Less than 5 Years	8.2	3.6	1,057	89	883	1,300	1,178	.92	7.7	5.5
5 to 9 Years	7.1	4.0	1,172	95	884	1,431	1,305	.93	7.5	6.3
10 or More Years	7.5	3.6	1,068	87	999	1,339	1,219	.80	6.5	6.4
Don't Know	2.2	2.7	794	70	671	1,197	1,099	.99	8.7	10.7
Size of Most-Used Room Air Conditioner										
Small	6.9	2.5	723	64	621	1,157	1,044	1.01	8.9	6.4
Medium	11.6	3.1	902	75	894	1,300	1,178	.78	6.5	4.6
Large	6.1	6.2	1,811	144	1,246	1,640	1,513	.89	7.0	6.9
Don't Know	.6	2.7	782	66	696	1,158	1,040	.97	8.2	16.1
Number of Room Air Conditioners										
1	15.8	2.9	844	69	750	1,243	1,134	.91	7.4	4.7
2	6.6	4.8	1,399	115	1,027	1,497	1,357	.91	7.5	6.6
3 or More	2.7	5.4	1,570	134	1,453	1,517	1,374	.71	6.1	7.5
Participation in Demand-Side Management Programs (more than one may apply)										
No/Don't Know	24.2	3.7	1,090	90	904	1,349	1,229	.89	7.4	4.3
Yes	1.0	1.9	545	47	788	1,091	981	.63	5.4	15.0
Rebate	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Load Control	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
Energy Audit	.3	2.2	657	57	891	967	835	.76	6.6	18.5
Conservation	.3	1.7	499	42	917	1,004	899	.54	4.6	25.2
Other	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF

1/ The 30-year average and climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were s
NF = No applicable RES row/column factor.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of round data may not sum to totals. * This table reflects only those households that used their air conditioning equipment. See Appendix B "Quality of the Data," for a discussion of households that had air-conditioning equipment but did not use it. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Reside Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 39. Total Electricity and Natural Gas Consumption and Expenditures for Water Heating in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				RSE Row Factors
		Total Consumed				Total Consumed			
	Households (million)	(quadrillion Btu)	(billion kWh)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion cubic feet)	Total Expenditures (billion dollars)	
RSE Column Factors:	1.1	NF	NF	NF	0.8	NF	NF	NF	
Total U.S. Households....	36.1	0.34	99	7.21	50.3	1.16	1,128	6.59	3.7
Urban Status									
Urban.....	23.7	.21	61	4.56	43.6	1.01	986	5.82	4.4
Central City.....	8.6	.07	21	1.53	19.7	.45	442	2.65	5.9
Suburban.....	15.1	.14	40	3.03	23.9	.56	544	3.17	5.3
Rural.....	12.4	.13	38	2.64	6.7	.15	143	.77	7.9
Climate Zone1/									
Under 2,000 CDD and									
Over 7,000 HDD.....	4.7	.05	15	1.05	4.2	.10	98	.50	18.6
5,500 to 7,000 HDD...	7.5	.08	24	1.73	16.6	.43	421	2.33	11.5
4,000 to 5,499 HDD...	7.8	.08	24	1.58	10.3	.24	237	1.53	13.5
Under 4,000 HDD.....	7.7	.07	20	1.44	11.1	.23	223	1.31	9.6
2,000 CDD or More and									
Under 4,000 HDD.....	8.4	.06	18	1.40	8.0	.16	150	.92	10.1
Number of Rooms									
1 to 3.....	5.2	.03	10	.77	5.2	.10	92	.55	10.5
4 to 6.....	22.5	.21	62	4.50	31.1	.69	668	3.94	4.2
7 or More.....	8.4	.09	27	1.94	14.0	.38	368	2.09	7.4
Type of Housing Unit									
Single-Family.....	24.3	.25	72	5.17	35.0	.82	802	4.60	4.8
Detached.....	21.5	.23	66	4.69	32.1	.76	738	4.19	5.0
Attached.....	2.8	.02	6	.48	2.9	.07	64	.40	14.3
Mobile Home.....	3.4	.03	9	.68	1.5	.03	30	.16	16.2
Multifamily.....	8.4	.06	18	1.35	13.8	.31	297	1.83	8.2
2 to 4 Units.....	2.8	.02	6	.50	6.5	.16	153	.97	13.8
5 or More Units.....	5.6	.04	11	.85	7.3	.15	144	.86	12.3
Heated Floorspace (square feet)									
Fewer than 1,000.....	13.5	.11	31	2.32	14.6	.30	287	1.71	5.9
1,000 to 1,999	14.9	.15	43	3.02	21.7	.50	482	2.82	4.8
2,000 to 2,999	5.7	.06	19	1.38	9.5	.24	234	1.40	7.8
3,000 or More	2.0	.02	7	.48	4.6	.13	124	.67	11.9
Ownership of Unit									
Owned.....	23.9	.24	69	5.00	32.8	.77	745	4.32	4.7
Rented.....	12.2	.10	30	2.21	17.5	.39	383	2.27	5.7
Public Housing.....	.9	.01	2	.12	1.2	.03	26	.16	27.4
Not Public Housing...	11.3	.10	28	2.09	16.3	.37	357	2.11	6.1
Rent Subsidy.....	.9	.01	2	.17	.7	.02	17	.10	27.4
No Rent Subsidy...	10.4	.09	26	1.92	15.6	.35	340	2.01	6.2
Year of Construction									
1939 or Before.....	5.5	.05	15	1.15	13.7	.32	308	1.89	7.3
1940 to 1949.....	2.3	.02	7	.46	4.2	.09	87	.51	11.0
1950 to 1959.....	3.6	.03	10	.71	8.2	.19	184	1.07	8.0
1960 to 1969.....	4.8	.05	13	.97	9.3	.20	191	1.14	8.8
1970 to 1979.....	10.6	.10	30	2.11	9.6	.23	224	1.25	7.5
1980 to 1984.....	4.5	.04	13	.93	3.0	.07	65	.37	12.8
1985 to 1987.....	3.5	.03	8	.60	1.3	.03	34	.18	20.4
1988 to 19902/.....	1.3	.01	4	.27	1.2	.04	36	.18	19.3
Electric Water-Heating Paid by Household.....	34.1	.32	95	6.89	--	--	--	--	8.6
Natural Gas Water-Heating Paid by Household.....	--	--	--	--	40.3	.94	916	5.31	8.6
1990 Family Income									
Less than $10,000.....	6.0	.04	13	.93	8.1	.16	152	.89	8.3
$10,000 to $19,999.....	8.3	.07	21	1.52	10.1	.20	195	1.15	6.1
$20,000 to $34,999.....	10.1	.10	29	2.07	12.5	.28	274	1.56	6.1
$35,000 to $49,999.....	6.3	.06	19	1.37	9.1	.23	223	1.32	6.6
$50,000 or More.....	5.3	.06	18	1.31	10.5	.29	283	1.66	9.0
Below Poverty Line									
100 Percent.....	5.1	.05	13	.94	6.7	.15	146	.87	8.4
125 Percent.....	7.3	.07	19	1.36	8.9	.20	191	1.13	6.7
Eligible for Federal Assistance3/.....	11.0	.10	29	2.09	14.1	.30	295	1.75	5.6
Age of Householder									
Less than 35 Years.....	10.7	.10	30	2.20	15.0	.37	363	2.11	6.2
35 to 44 Years.....	7.8	.09	25	1.84	10.7	.29	282	1.65	6.1
45 to 59 Years.....	7.7	.08	24	1.73	10.4	.26	254	1.46	6.4
60 Years and Over.....	10.0	.07	20	1.44	14.1	.24	230	1.37	5.6

Table 39. Total Electricity and Natural Gas Consumption and Expenditures for Water Heating in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				RSE Row Factors
		Total Consumed				Total Consumed			
	Households (million)	(quadrillion Btu)	(billion kWh)	Total Expenditures (billion dollars)	Households (million)	(quadrillion Btu)	(billion cubic feet)	Total Expenditures (billion dollars)	
RSE Column Factors:	1.1	NF	NF	NF	0.8	NF	NF	NF	
Education of Householder									
Less than 13 Years.....	21.2	.20	59	4.26	26.3	.59	569	3.37	4.5
13 to 16 Years.....	11.7	.11	32	2.27	18.1	.43	420	2.38	5.0
17 Years or More.....	3.2	.03	9	.68	5.9	.14	139	.83	10.8
Race of Householder									
White.....	32.3	.30	88	6.41	42.2	.95	922	5.31	4.3
Black.....	2.9	.03	9	.65	6.8	.18	174	1.09	11.3
Other.....	.8	.01	2	.15	1.3	.03	32	.19	17.4
Householder of Hispanic Descent									
Yes.....	1.8	.01	4	.35	4.2	.10	101	.60	14.7
No.....	34.3	.32	95	6.86	46.1	1.06	1,028	5.99	3.8
Household Size									
1 Person.....	9.2	.05	15	1.08	12.2	.17	165	.97	6.0
2 Persons.....	12.0	.10	30	2.18	16.4	.35	336	1.96	4.7
3 to 5 Persons.....	13.7	.17	49	3.53	19.8	.58	560	3.26	4.8
6 or More Persons.....	1.2	.02	6	.41	2.0	.07	68	.40	12.6

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, E, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 40. Total Fuel Oil and LPG Consumption and Expenditures for Water Heating in U.S. Households, 1990

Characteristics	Fuel Oil				Liquefied Petroleum Gas				RSE Row Factors
	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion gallons)	Total Expenditures (billion dollars)	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion gallons)	Total Expenditures (billion dollars)	
RSE Column Factors:	0.7	NF	NF	NF	1.2	NF	NF	NF	
Total U.S. Households	5.1	0.11	0.80	0.83	3.2	0.06	0.63	0.64	10.6
Urban Status									
Urban	4.7	.10	.73	.75	1.5	.03	.29	.28	12.7
Central City	1.8	.03	.25	.22	Q	Q	Q	Q	14.7
Suburban	2.9	.07	.48	.53	1.4	.02	.25	.24	16.1
Rural	.4	.01	.07	.07	1.7	.03	.35	.36	23.9
Climate Zone1/									
Under 2,000 CDD and									
Over 7,000 HDD	.6	.01	.09	.10	.6	.01	.14	.13	26.5
5,500 to 7,000 HDD	2.1	.04	.32	.35	.7	.01	.15	.15	19.6
4,000 to 5,499 HDD	2.4	.05	.39	.38	.7	.01	.13	.13	21.3
Under 4,000 HDD	NC	NC	NC	NC	.7	.01	.12	.12	31.7
2,000 CDD or More and									
Under 4,000 HDD	Q	Q	Q	Q	.6	.01	.10	.11	26.4
Number of Rooms									
1 to 3	.9	.01	.10	.08	.4	(*)	.05	.06	33.6
4 to 6	2.5	.06	.40	.40	2.1	.04	.42	.43	12.8
7 or More	1.7	.04	.30	.34	.7	.01	.16	.15	20.2
Type of Housing Unit									
Single-Family	2.9	.07	.49	.55	2.7	.05	.54	.54	12.9
Detached	2.6	.06	.44	.50	2.7	.05	.54	.54	13.5
Attached	.3	.01	.05	.05	NC	NC	NC	NC	39.7
Mobile Home	NC	NC	NC	NC	.4	.01	.06	.07	23.1
Multifamily	2.2	.04	.31	.28	.1	Q	Q	Q	14.6
2 to 4 Units	.6	.01	.10	.11	Q	Q	Q	Q	15.5
5 or More Units	1.6	.03	.21	.17	Q	Q	Q	Q	15.4
Heated Floorspace (square feet)									
Fewer than 1,000	1.6	.03	.20	.18	1.0	.01	.16	.19	18.6
1,000 to 1,999	1.5	.04	.26	.27	1.4	.03	.28	.26	17.4
2,000 to 2,999	1.2	.03	.19	.20	.6	.01	.14	.14	16.9
3,000 or More	.8	.02	.15	.17	.3	.01	.06	.05	29.4
Ownership of Unit									
Owned	3.4	.08	.54	.59	2.7	.05	.53	.53	12.4
Rented	1.7	.03	.26	.23	.5	.01	.10	.11	15.8
Public Housing	Q	Q	Q	Q	NC	NC	NC	NC	NF
Not Public Housing	1.3	.03	.19	.18	.5	.01	.10	.11	23.2
Rent Subsidy	Q	Q	Q	Q	Q	Q	Q	Q	NF
No Rent Subsidy	1.2	.02	.18	.17	.5	.01	.09	.10	24.3
Year of Construction									
1939 or Before	1.8	.04	.26	.26	.8	.02	.17	.17	14.9
1940 to 1949	.3	.01	.04	.05	.3	.01	.08	.09	30.0
1950 to 1959	1.3	.03	.24	.25	.4	.01	.06	.06	21.0
1960 to 1969	.7	.01	.10	.11	.3	(*)	.04	.05	19.4
1970 to 1979	.9	.02	.13	.14	.5	.01	.12	.11	24.7
1980 to 1984	Q	Q	Q	Q	.5	.01	.08	.08	30.3
1985 to 1987	Q	Q	Q	Q	.2	(*)	.04	.05	30.2
1988 to 19902/	Q	Q	Q	Q	.2	(*)	.05	.04	26.6
Fuel OIl Water-Heating Paid by Household	3.1	.07	.51	.57	--	--	--	--	12.6
Liquefied Petroleum Gas Water-Heating Paid by Household	--	--	--	--	3.0	.05	.59	.59	11.8
1990 Family Income									
$20,000 to $34,999	1.2	.03	.21	.22	.8	.02	.17	.17	17.5
$35,000 to $49,999	1.1	.02	.16	.18	.5	.01	.11	.12	21.8
$50,000 or More	1.2	.03	.22	.24	.4	.01	.10	.09	23.3
Below Poverty Line									
100 Percent	.6	.01	.09	.08	.8	.01	.13	.13	23.4
125 Percent	.9	.02	.12	.11	1.1	.02	.20	.20	17.5
Eligible for Federal Assistance3/	1.5	.03	.21	.20	1.4	.02	.25	.27	13.9
Age of Householder									
Less than 35 Years	1.2	.03	.21	.21	.8	.02	.17	.17	15.0
35 to 44 Years	1.0	.03	.21	.21	.8	.02	.20	.18	19.3
45 to 59 Years	1.2	.03	.20	.21	.5	.01	.12	.13	21.3
60 Years and Over	1.7	.02	.18	.19	1.1	.01	.15	.16	15.2
Education of Householder									
Less than 13 Years	3.1	.06	.46	.47	2.4	.04	.44	.45	12.4
13 to 16 Years	1.3	.03	.22	.23	.8	.02	.18	.18	16.3
17 Years or More	.7	.02	.11	.12	Q	Q	Q	Q	35.7

Table 40. Total Fuel Oil and LPG Consumption and Expenditures for Water Heating in U.S. Households, 1990

Characteristics	Fuel Oil				Liquefied Petroleum Gas				RSE Row Factors
	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion gallons)	Total Expenditures (billion dollars)	Households (million)	Total Consumed (quadrillion Btu)	Total Consumed (billion gallons)	Total Expenditures (billion dollars)	
RSE Column Factors:	0.7	NF	NF	NF	1.2	NF	NF	NF	
Race of Householder									
White	4.4	.09	.68	.72	2.7	.05	.53	.54	12.1
Black	.7	.01	.11	.10	.3	.01	.07	.07	32.1
Other	Q	Q	Q	Q	Q	Q	Q	.04	33.3
Householder of Hispanic Descent									
Yes	.4	.01	.06	.06	Q	Q	Q	Q	19.8
No	4.7	.10	.74	.77	3.1	.06	.63	.64	10.8
Household Size									
1 Person	1.3	.02	.13	.12	.8	.01	.08	.09	21.2
2 Persons	1.6	.03	.24	.24	.9	.02	.17	.17	12.7
3 to 5 Persons	2.0	.05	.38	.41	1.3	.03	.31	.30	15.7
6 or More Persons	Q	Q	Q	Q	.3	.01	.07	.08	23.8

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, D, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 41. Electricity and Natural Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990

Characteristics	Electricity					Natural Gas					RSE Row Factors
		Consumption			Electricity Water-Heating		Consumption			Natural Gas Water-Heating	
	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Intensity (kWh per household member)	Households (million)	(million Btu)	(1000 cubic feet)	Expenditures (dollars)	Intensity (1000 cubic feet per household member)	
RSE Column Factors:	2.2	NF	NF	NF	NF	1.8	NF	NF	NF	NF	
Total U.S. Households....	35.1	9.5	2,797	202	1,104	50.0	23.1	22.5	131	8.5	1.7
Urban Status											
Urban.....	22.9	9.0	2,626	195	1,082	43.4	23.3	22.7	134	8.5	2.0
Central City.....	8.2	8.7	2,551	183	1,088	19.6	23.1	22.5	135	8.7	3.1
Suburban.....	14.7	9.1	2,667	202	1,079	23.8	23.5	22.8	133	8.3	2.8
Rural.....	12.1	10.7	3,122	216	1,140	6.6	21.9	21.4	115	9.0	3.8
Climate Zone1/											
Under 2,000 CDD and											
Over 7,000 HDD.....	4.6	10.7	3,135	226	1,268	4.2	23.8	23.4	118	10.3	6.1
5,500 to 7,000 HDD...	7.2	11.2	3,273	236	1,262	16.6	26.0	25.4	140	9.8	3.4
4,000 to 5,499 HDD...	7.6	10.5	3,065	205	1,243	10.3	23.6	23.0	149	8.5	4.3
Under 4,000 HDD.....	7.5	8.8	2,589	190	1,054	11.0	20.8	20.1	118	7.5	4.4
2,000 CDD or More and											
Under 4,000 HDD.....	8.3	7.3	2,138	168	807	8.0	19.4	18.8	115	6.8	4.8
Number of Rooms											
1 to 3.....	5.1	6.6	1,937	148	1,201	5.1	18.3	17.8	106	10.6	5.5
4 to 6.....	22.2	9.5	2,778	202	1,077	31.0	22.1	21.5	127	8.4	2.2
7 or More.....	7.8	11.7	3,420	239	1,135	13.9	27.2	26.4	150	8.4	3.3
Type of Housing Unit											
Single-Family.....	23.4	10.4	3,043	216	1,114	34.8	23.6	23.0	132	8.1	2.2
Detached.....	20.7	10.7	3,140	222	1,118	31.9	23.7	23.1	131	8.1	2.2
Attached.....	2.7	7.9	2,309	171	1,077	2.9	22.5	22.0	139	8.1	7.1
Mobile Home.....	3.4	9.3	2,716	203	943	1.4	21.2	20.7	110	8.9	6.5
Multifamily.....	8.3	7.3	2,135	162	1,163	13.8	22.1	21.5	133	10.0	3.9
2 to 4 Units.....	2.8	7.9	2,320	182	1,108	6.5	24.1	23.4	149	10.3	6.4
5 or More Units.....	5.5	7.0	2,042	153	1,197	7.2	20.4	19.8	118	9.7	5.4
Heated Floorspace (square feet)											
Fewer than 1,000.....	13.3	8.0	2,338	173	1,076	14.4	20.4	19.8	118	9.3	2.8
1,000 to 1,999	14.5	9.9	2,894	205	1,094	21.6	22.9	22.3	130	8.1	2.6
2,000 to 2,999	5.5	11.5	3,380	246	1,141	9.4	25.4	24.7	148	8.3	3.4
3,000 or More	1.8	12.5	3,658	259	1,213	4.5	28.1	27.4	146	9.2	5.2
Ownership of Unit											
Owned.....	23.1	10.1	2,955	212	1,112	32.6	23.4	22.8	132	8.4	2.1
Rented.....	12.0	8.5	2,493	183	1,086	17.4	22.6	21.9	130	8.8	3.0
Public Housing.....	.8	8.5	2,481	144	1,297	1.2	21.6	20.9	129	8.1	14.2
Not Public Housing...	11.1	8.5	2,494	186	1,073	16.2	22.7	22.0	130	8.9	3.2
Rent Subsidy.....	.9	7.4	2,178	181	857	.7	25.4	24.9	147	8.5	14.5
No Rent Subsidy...	10.2	8.6	2,522	187	1,094	15.5	22.5	21.9	129	8.9	3.3
Year of Construction											
1939 or Before.....	5.2	10.0	2,919	217	1,172	13.6	23.2	22.6	139	8.8	3.5
1940 to 1949.....	2.2	10.0	2,940	202	1,072	4.2	21.6	21.1	124	8.3	5.9
1950 to 1959.....	3.4	9.5	2,793	200	1,230	8.1	23.2	22.5	131	8.4	3.6
1960 to 1969.....	4.6	9.7	2,857	206	1,116	9.2	21.3	20.7	123	8.6	4.0
1970 to 1979.....	10.3	9.8	2,875	202	1,112	9.5	24.0	23.4	130	8.7	3.6
1980 to 1984.....	4.5	9.6	2,827	206	1,049	2.9	22.6	22.0	126	7.6	6.1
1985 to 1987.....	3.5	7.6	2,220	170	963	1.3	26.6	25.9	140	8.2	9.7
1988 to 19902/.....	1.3	9.2	2,707	209	1,042	1.2	31.9	31.1	152	9.6	7.8
Electric Water-Heating Paid by Household											
Yes.....	33.1	9.7	2,837	205	1,101	--	--	--	--	--	5.6
No.....	1.9	7.2	2,116	160	1,164	--	--	--	--	--	6.9
Natural Gas Water-Heating Paid by Household											
Yes.....	--	--	--	--	--	40.0	23.5	22.8	132	8.2	2.1
No.....	--	--	--	--	--	10.0	21.8	21.2	128	10.1	4.9
1990 Family Income											
Less than $10,000.....	5.9	7.5	2,196	155	1,057	8.1	19.4	18.8	110	8.7	4.6
$10,000 to $19,999.....	8.2	8.8	2,591	185	1,103	10.0	19.9	19.4	115	8.6	3.2
$20,000 to $34,999.....	9.9	9.8	2,876	208	1,110	12.4	22.7	22.1	126	8.2	3.2
$35,000 to $49,999.....	6.0	10.3	3,028	221	1,098	9.0	25.3	24.6	146	8.6	3.9
$50,000 or More.....	5.1	11.6	3,406	253	1,139	10.4	27.8	27.0	158	8.7	3.4
Below Poverty Line											
100 Percent.....	5.0	9.0	2,625	186	946	6.7	22.6	22.0	131	7.5	4.4
125 Percent.....	7.2	9.0	2,647	188	971	8.9	22.1	21.5	127	7.6	3.7
Eligible for Federal Assistance3/.....	10.8	9.1	2,675	192	999	14.0	21.6	21.0	125	7.7	3.1

Table 41. Electricity and Natural Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990

Characteristics	Electricity					Natural Gas					RSE Row Factors
	Households (million)	Consumption (million Btu)	Consumption (kWh)	Expenditures (dollars)	Electricity Water-Heating Intensity (kWh per household member)	Households (million)	Consumption (million Btu)	Consumption (1000 cubic feet)	Expenditures (dollars)	Natural Gas Water-Heating Intensity (1000 cubic feet per household member)	
RSE Column Factors:	2.2	NF	NF	NF	NF	1.8	NF	NF	NF	NF	
Age of Householder											
Less than 35 Years	10.5	9.5	2,790	208	983	14.9	24.9	24.2	141	8.1	3.0
35 to 44 Years	7.5	11.4	3,330	238	1,089	10.7	27.1	26.4	155	8.0	3.6
45 to 59 Years	7.4	11.0	3,232	230	1,271	10.4	25.1	24.4	140	9.4	3.0
60 Years and Over	9.6	7.0	2,056	147	1,151	14.1	16.8	16.3	97	9.0	2.9
Education of Householder											
Less than 13 Years	20.7	9.6	2,814	203	1,088	26.2	22.3	21.7	129	8.3	2.2
13 to 16 Years	11.3	9.4	2,761	197	1,110	18.0	23.8	23.2	132	8.8	2.6
17 Years or More	3.1	9.6	2,821	214	1,197	5.8	24.5	23.8	142	9.1	5.5
Race of Householder											
White	31.4	9.5	2,777	201	1,119	41.9	22.5	21.9	126	8.5	1.9
Black	2.8	10.3	3,029	224	1,029	6.7	26.6	25.8	161	9.0	5.1
Other	.8	9.5	2,790	178	892	1.3	24.9	24.2	143	6.8	9.7
Householder of Hispanic Descent											
Yes	1.7	8.5	2,482	199	846	4.2	24.8	24.1	144	6.8	7.4
No	33.3	9.6	2,814	202	1,119	45.8	23.0	22.4	130	8.8	1.7
Household Size											
1 Person	9.0	5.5	1,608	119	1,608	12.1	13.9	13.6	79	13.6	3.4
2 Persons	11.7	8.7	2,557	184	1,278	16.2	21.2	20.6	120	10.3	2.3
3 to 5 Persons	13.2	12.4	3,629	262	978	19.6	29.2	28.4	165	7.6	2.3
6 or More Persons	1.1	17.3	5,063	358	773	2.0	35.0	33.8	201	5.1	5.9
Average Electricity Expenditures (cents per kWh)											
Less than 6	7.3	11.7	3,440	174	1,337	--	--	--	--	--	2.4
6 to Less than 9	22.2	9.2	2,696	201	1,061	--	--	--	--	--	6.8
9 or More	5.5	8.0	2,354	246	959	--	--	--	--	--	12.7

See footnotes at end of table.

Table 41. Electricity and Natural Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990 (Continued)

Characteristics	Electricity					Natural Gas					RSE Row Factors
	Consumption				Electricity Water-Heating	Consumption				Natural Gas Water-Heating	
	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Intensity (kWh per household member)	Households (million)	(million Btu)	(1000 cubic feet)	Expenditures (dollars)	Intensity (1000 cubic feet per household member)	
RSE Column Factors:	2.2	NF	NF	NF	NF	1.8	NF	NF	NF	NF	
Average Natural Gas Expenditures (dollars per 1000 cf)											
Less than 4.50	--	--	--	--	--	6.7	26.9	26.6	106	10.4	3.5
4.50 to Less than 6	--	--	--	--	--	22.9	23.0	22.4	118	8.5	2.5
6 or More	--	--	--	--	--	20.3	22.0	21.3	155	8.0	2.8
Water Heater Used											
For One Housing Unit	33.7	9.7	2,832	204	1,104	41.8	23.4	22.8	132	8.3	1.9
For Two or More Units	1.4	6.6	1,945	149	1,106	8.2	21.7	21.1	130	10.4	6.7
Age of Water Heater											
Less than 5 Years	10.4	10.0	2,933	215	1,074	14.4	24.5	23.9	137	8.4	3.4
5 to 9 Years	8.5	9.6	2,819	204	1,131	10.2	22.9	22.3	129	8.0	3.5
10 to 19 Years	8.4	9.7	2,854	201	1,136	9.7	22.7	22.1	127	8.3	3.2
20 Years or More	2.5	8.2	2,418	175	1,135	2.7	20.2	19.7	118	7.9	5.4
Don't Know	3.7	9.7	2,844	203	1,064	4.5	24.3	23.6	139	8.8	5.6
Size of Water Heater											
30 gallons or less	7.0	7.4	2,156	164	962	7.9	19.4	18.9	109	7.5	3.9
31 to 49 gallons	16.0	9.4	2,749	201	1,077	24.9	23.4	22.8	131	8.1	2.6
50 gallons or more	8.8	12.0	3,525	242	1,232	6.7	27.8	27.0	156	9.3	3.8
Don't Know	1.8	9.9	2,904	211	1,168	2.0	24.5	23.8	146	9.5	7.1
Location of Water Heater											
Heated Area	23.6	9.7	2,857	203	1,152	28.4	23.9	23.3	132	8.7	2.3
Unheated Area	9.7	9.5	2,779	208	1,006	12.6	22.2	21.5	131	7.4	3.7
Clothes Washer Present in Household											
Yes	27.1	10.1	2,969	213	1,089	38.2	23.9	23.3	135	8.3	2.1
No	7.9	7.5	2,211	165	1,178	11.8	20.6	20.0	119	9.6	4.1
Dishwasher Present in Household											
Yes	16.9	9.7	2,849	206	1,133	22.4	24.5	23.8	137	8.5	2.6
No	18.1	9.4	2,750	199	1,077	27.6	22.0	21.4	127	8.6	2.3
Children Present in Household											
No	21.6	7.7	2,260	165	1,329	30.5	19.4	18.9	110	10.7	2.0
Yes	13.4	12.5	3,660	262	945	19.5	29.0	28.2	165	7.0	2.4
(more than one may apply)											
Under 13 Years	10.1	12.0	3,510	253	867	15.8	28.8	28.0	165	6.8	2.8
13 to 18 Years	5.7	14.7	4,308	298	1,076	7.4	31.7	30.8	178	7.1	2.9

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, E, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 42. Fuel Oil and Liquefied Petroleum Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990

Characteristics	Fuel Oil					Liquefied Petroleum Gas					RSE Row
		Consumption			Fuel Oil Water-Heating Intensity (gallons per household member)		Consumption			LPG Water-Heating Intensity (gallons per household member)	
	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)		Households (million)	(million Btu)	(gallons)	Expenditures (dollars)		
RSE Column Factors:	1.5	NF	NF	NF	NF	2.3	NF	NF	NF	NF	Factors
Total U.S. Households	5.1	21.5	157	162	61	3.2	18.2	199	201	67	4.6
Urban Status											
Urban	4.7	21.5	157	161	61	1.5	17.6	193	189	69	6.0
Central City	1.8	19.3	143	125	60	Q	Q	Q	Q	Q	9.2
Suburban	2.9	22.9	166	183	61	1.4	17.0	186	179	65	7.2
Rural	.4	21.4	155	169	60	1.7	18.6	204	212	66	8.7
Climate Zone1/											
Under 2,000 CDD and Over 7,000 HDD	.6	20.3	147	158	62	.6	20.7	227	209	67	7.6
5,500 to 7,000 HDD	2.1	21.1	153	166	59	.7	20.2	222	233	73	8.2
4,000 to 5,499 HDD	2.4	22.2	163	160	62	.7	17.9	196	197	72	11.4
Under 4,000 HDD	NC	NC	NC	NC	NC	.7	15.8	173	170	61	16.6
2,000 CDD or More and Under 4,000 HDD	Q	Q	Q	Q	Q	.6	15.9	174	198	60	17.5
Number of Rooms											
1 to 3	.9	14.7	109	93	72	.4	11.5	126	146	97	18.1
4 to 6	2.5	21.9	160	160	60	2.1	18.2	199	204	63	5.7
7 or More	1.7	24.5	177	201	59	.7	22.5	246	228	70	7.8
Type of Housing Unit											
Single-Family	2.9	22.9	165	186	57	2.7	18.5	202	202	66	5.3
Detached	2.6	23.5	170	191	58	2.7	18.5	202	202	66	5.4
Attached	.3	18.4	134	147	51	NC	NC	NC	NC	NC	17.3
Mobile Home	NC	NC	NC	NC	NC	.4	14.9	163	169	65	13.5
Multifamily	2.2	19.7	145	129	67	Q	Q	Q	Q	Q	7.5
2 to 4 Units	.6	24.8	182	200	72	Q	Q	Q	Q	Q	8.3
5 or More Units	1.6	17.8	132	104	65	NC	NC	NC	NC	NC	11.0
Heated Floorspace (square feet)											
Fewer than 1,000	1.6	17.5	129	118	70	1.0	14.7	161	185	71	10.0
1,000 to 1,999	1.5	23.3	169	180	61	1.4	18.7	205	196	60	8.7
2,000 to 2,999	1.2	21.6	158	161	54	.6	21.5	235	245	79	9.5
3,000 or More	.8	25.7	186	212	60	.3	21.3	234	197	70	16.7
Ownership of Unit											
Owned	3.4	22.2	161	175	59	2.7	18.0	197	196	64	4.7
Rented	1.7	20.1	149	136	66	.5	19.3	211	234	84	11.9
Public Housing	Q	21.7	160	126	63	NC	NC	NC	NC	NC	57.0
Not Public Housing	1.3	19.7	145	138	67	.5	19.3	211	234	84	12.1
Rent Subsidy	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	NF
No Rent Subsidy	1.2	19.8	146	140	70	.5	19.0	208	224	86	13.0
Year of Construction											
1939 or Before	1.8	19.7	145	144	56	.8	20.2	222	230	79	6.4
1940 to 1949	.3	17.2	126	135	67	.3	21.7	237	276	79	22.9
1950 to 1959	1.3	25.9	189	196	71	.4	12.3	135	144	72	12.1
1960 to 1969	.7	21.0	153	161	58	.3	15.9	174	192	58	14.7
1970 to 1979	.9	20.7	151	158	59	.5	20.8	228	217	66	18.0
1980 to 1984	Q	Q	Q	Q	Q	.5	16.4	180	168	54	15.8
1985 to 1987	Q	Q	Q	Q	Q	.2	18.2	199	211	58	20.0
1988 to 19902/	Q	Q	Q	Q	Q	.2	17.5	191	148	58	13.9
Fuel Oil Water-Heating Paid by Household											
Yes	3.1	22.8	165	185	58	--	--	--	--	--	5.3
No	2.0	19.5	144	126	67	--	--	--	--	--	8.8
LPG Water-Heating Paid by Household											
Yes	--	--	--	--	--	3.0	17.9	196	197	65	5.1
No	--	--	--	--	--	.2	21.6	237	260	106	21.5
1990 Family Income											
Less than $10,000	.9	15.9	117	111	62	.8	13.0	142	157	67	15.2
$10,000 to $19,999	.7	17.8	131	122	69	.7	16.1	177	169	57	9.9
$20,000 to $34,999	1.2	24.7	181	185	64	.8	20.2	221	225	68	7.8
$35,000 to $49,999	1.1	21.4	156	168	55	.5	22.0	241	257	75	11.5
$50,000 or More	1.2	25.0	181	197	59	.4	25.1	275	249	73	13.0
Below Poverty Line											
100 Percent	.6	19.6	144	137	62	.8	15.3	167	168	48	13.1
125 Percent	.9	18.4	136	128	59	1.1	16.0	176	181	57	12.4
Eligible for Federal Assistance3/	1.5	19.8	145	138	59	1.4	16.3	178	189	58	9.4
Age of Householder											
Less than 35 Years	1.2	23.7	174	174	61	.8	18.8	206	211	54	7.5
35 to 44 Years	1.0	27.6	201	206	56	.8	22.6	248	224	64	8.8
45 to 59 Years	1.2	23.2	169	181	65	.5	20.6	225	249	84	12.5
60 Years and Over	1.7	15.0	109	112	62	1.1	13.1	144	154	80	7.5

Table 42. Fuel Oil and Liquefied Petroleum Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990

Characteristics	Fuel Oil					Liquefied Petroleum Gas					RSE Row Factors
		Consumption			Fuel Oil Water-Heating Intensity		Consumption			LPG Water-Heating Intensity	
	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	(gallons per household member)	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	(gallons per household member)	
RSE Column Factors:	1.5	NF	NF	NF	NF	2.3	NF	NF	NF	NF	
Education of Householder											
Less than 13 Years	3.1	20.5	150	153	58	2.4	17.1	187	191	65	6.3
13 to 16 Years	1.3	23.2	169	174	67	.8	21.2	232	232	70	9.0
17 Years or More	.7	22.7	166	178	60	Q	Q	Q	Q	Q	23.1
Race of Householder											
White	4.4	21.4	156	164	60	2.7	18.2	199	201	67	5.4
Black	.7	22.4	166	151	64	.3	20.9	229	225	75	22.2
Other	Q	Q	Q	Q	Q	Q	14.1	154	171	58	20.5
Householder of Hispanic Descent											
Yes	.4	23.2	171	155	64	Q	Q	Q	Q	Q	13.3
No	4.7	21.4	156	162	61	3.1	18.3	201	203	67	5.1
Household Size											
1 Person	1.3	13.2	97	93	97	.7	9.5	104	123	104	12.1
2 Persons	1.6	20.3	148	151	74	.9	17.3	190	198	95	8.0
3 to 5 Persons	2.0	26.4	192	207	52	1.3	22.7	249	236	63	5.5
6 or More Persons	Q	Q	Q	Q	Q	.3	22.8	250	260	38	12.1
Average Fuel Oil Expenditures (dollars per gallon)											
Less than 95	1.7	17.7	130	99	61	--	--	--	--	--	7.4
95 to Less than 1.10	2.0	22.5	164	177	60	--	--	--	--	--	6.5
1.10 or More	1.5	24.5	177	212	63	--	--	--	--	--	7.6
Average LPG Expenditures (dollars per gallon)											
Less than 75	--	--	--	--	--	.4	24.5	268	175	77	5.8
75 to Less than 1.00	--	--	--	--	--	1.2	17.8	194	171	62	8.3
1.00 or More	--	--	--	--	--	1.6	16.7	183	231	67	8.1

See footnotes at end of table.

Table 42. Fuel Oil and Liquefied Petroleum Gas Consumption and Expenditures for Main Water Heating, per U.S. Household, 1990 (Continued)

Characteristics	Fuel Oil					Liquefied Petroleum Gas					RSE Row Factors
		Consumption			Fuel Oil Water-Heating Intensity		Consumption			LPG Water-Heating Intensity	
	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	(gallons per household member)	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	(gallons per household member)	
RSE Column Factors:	1.5	NF	NF	NF	NF	2.3	NF	NF	NF	NF	
Water Heater Used											
For One Housing Unit	3.1	22.8	165	185	58	3.1	17.9	196	197	66	5.2
For Two or More Units	2.0	19.5	144	126	67	Q	Q	Q	Q	Q	8.8
Age of Water Heater											
Less than 5 Years	.6	22.1	160	177	61	1.1	18.7	205	203	61	8.9
5 to 9 Years	.3	26.5	192	223	50	.7	15.6	171	171	60	13.5
10 to 19 Years	.4	22.8	165	189	54	.8	20.1	220	215	73	13.3
20 Years or More	.6	22.2	161	189	71	.3	17.5	192	214	94	16.0
Don't Know	.1	30.2	220	244	44	Q	Q	Q	Q	Q	28.1
Size of Water Heater											
30 gallons of less	.3	19.7	143	162	55	1.1	16.6	182	189	74	14.4
31 to 49 gallons	.9	23.7	172	193	54	1.2	19.1	209	220	64	7.6
50 gallons or more	.5	28.0	203	240	75	.6	19.4	213	188	63	15.2
Don't Know	.4	20.4	148	168	51	Q	Q	Q	Q	Q	17.2
Location of Water Heater											
Heated Area	1.3	22.9	166	189	57	2.3	18.7	205	200	67	8.4
Unheated Area	.7	24.4	177	203	58	.8	16.9	185	199	67	10.5
Clothes Washer Present in Household											
Yes	3.2	23.4	169	188	57	2.6	19.9	218	218	68	5.2
No	1.9	18.3	135	117	70	.6	10.3	113	125	58	8.8
Dishwasher Present in Household											
Yes	2.1	24.1	175	191	62	1.0	21.7	238	217	70	8.3
No	3.0	19.8	145	143	60	2.2	16.5	181	194	65	7.0
Children Present in Household											
No	3.2	18.0	132	135	75	1.7	13.8	151	163	92	6.3
Yes	1.9	27.6	201	209	50	1.5	23.3	255	247	56	5.3
(more than one may apply)											
Under 13 Years	1.5	26.4	193	197	47	1.1	23.1	253	246	52	6.5
13 to 18 Years	.7	33.3	242	255	57	.7	24.8	271	266	59	7.3

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NC = No cases in sample.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, D, and G of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 43. Total Consumption and Expenditures for Appliances in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				Liquefied Petroleum Gas				RSE Row Factors
		Consumed		Expenditures		Consumed		Expenditures		Consumed		Expenditures	
	Households (million)	(quadrillion Btu)	(billion kWh)	(billion dollars)	Households (million)	(quadrillion Btu)	(billion cubic feet)	(billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	(billion dollars)	
RSE Column Factors:	0.50	NF	NF	NF	0.7	NF	NF	NF	2.0	NF	NF	NF	
Total U.S. Households....	94.0	1.41	413	34.52	40.0	0.33	316	2.03	6.0	0.03	0.37	0.48	4.5
Urban Status													
Urban.....	72.9	1.06	310	26.99	34.8	.29	283	1.83	3.0	.02	.17	.23	5.3
Central City.....	29.8	.38	112	9.66	16.7	.13	128	.86	.4	(*)	.03	.04	7.9
Suburban.....	43.0	.68	199	17.32	18.1	.16	155	.97	2.6	.01	.14	.19	6.3
Rural.....	21.1	.35	103	7.53	5.2	.03	34	.20	3.0	.02	.20	.25	8.9
Climate Zone1/													
Under 2,000 CDD and													
Over 7,000 HDD.....	10.1	.15	44	3.36	2.6	.02	17	.09	1.1	.01	.08	.10	20.8
5,500 to 7,000 HDD...	26.6	.40	118	10.31	12.6	.10	101	.58	1.3	.01	.07	.11	11.1
4,000 to 5,499 HDD...	20.9	.31	92	7.70	10.3	.08	74	.60	1.3	.01	.09	.11	14.5
Under 4,000 HDD.....	19.3	.27	80	6.88	8.1	.07	72	.43	1.1	.01	.05	.07	14.0
2,000 CDD or More and													
Under 4,000 HDD.....	17.0	.27	79	6.27	6.4	.05	53	.32	1.2	.01	.08	.10	15.0
Number of Rooms													
1 to 3.....	11.6	.08	22	1.92	4.1	.02	20	.17	.9	(*)	.05	.07	11.7
4 to 6.....	58.0	.81	239	19.93	25.5	.19	182	1.20	4.0	.02	.24	.31	4.9
7 or More.....	24.3	.52	152	12.66	10.4	.12	114	.66	1.1	.01	.08	.10	9.6
Type of Housing Unit													
Single-Family.....	64.3	1.15	337	27.78	27.3	.25	238	1.43	4.4	.02	.27	.35	5.7
Detached.....	58.3	1.07	313	25.70	25.1	.23	221	1.31	4.3	.02	.27	.34	6.0
Attached.....	6.0	.08	24	2.09	2.2	.02	17	.12	Q	Q	Q	Q	20.2
Mobile Home.....	5.2	.07	19	1.47	1.8	.01	12	.07	1.3	.01	.08	.10	17.3
Multifamily.....	24.4	.19	56	5.26	10.9	.07	66	.53	.3	(*)	.02	.03	10.4
2 to 4 Units.....	10.0	.09	26	2.51	5.7	.04	38	.29	.2	(*)	.01	.02	14.9
5 or More Units.....	14.4	.10	30	2.75	5.2	.03	28	.25	Q	Q	Q	Q	11.3
Heated Floorspace (square feet)													
Fewer than 1,000.....	30.5	.28	81	6.80	11.9	.07	70	.50	2.6	.01	.15	.21	7.2
1,000 to 1,999	39.1	.62	183	15.00	17.1	.14	134	.84	2.3	.01	.15	.18	6.5
2,000 to 2,999	16.9	.34	99	8.33	7.5	.07	67	.45	.8	(*)	.05	.07	8.7
3,000 or More	7.4	.17	50	4.38	3.4	.05	45	.23	.3	(*)	.02	.01	16.2
Ownership of Unit													
Owned.....	62.2	1.10	322	26.69	26.2	.23	228	1.41	4.7	.03	.28	.36	5.6
Rented.....	31.7	.31	91	7.83	13.8	.09	88	.62	1.3	.01	.09	.12	7.4
Public Housing.....	2.5	.02	6	.44	1.0	.01	7	.05	Q	Q	Q	Q	36.7
Not Public Housing...	29.2	.29	86	7.38	12.8	.08	82	.57	1.3	.01	.09	.12	8.3
Rent Subsidy.....	1.7	.02	5	.43	.6	(*)	4	.03	.1	(*)	.01	.02	24.5
No Rent Subsidy...	27.5	.28	81	6.96	12.2	.08	77	.53	1.1	.01	.08	.10	8.6
Year of Construction													
1939 or Before.....	21.5	.28	83	7.43	12.3	.09	86	.62	1.4	.01	.09	.12	7.5
1940 to 1949.....	7.0	.09	28	2.29	3.8	.03	27	.18	.6	(*)	.05	.06	13.4
1950 to 1959.....	13.4	.21	61	5.38	7.0	.06	61	.39	.8	(*)	.04	.05	9.6
1960 to 1969.....	14.8	.22	65	5.47	6.9	.06	63	.37	.8	(*)	.04	.07	12.7
1970 to 1979.....	21.4	.35	102	8.01	6.2	.05	48	.29	1.3	.01	.07	.10	9.4
1980 to 1984.....	8.0	.13	38	3.06	1.7	.02	15	.09	.6	(*)	.04	.05	19.4
1985 to 1987.....	5.1	.07	21	1.73	1.1	.01	8	.04	.3	(*)	.02	.02	22.8
1988 to 19902/.....	2.8	.05	14	1.14	.9	.01	9	.04	.3	(*)	.02	.02	28.0
Electric Appliances Paid by Household.....	89.0	1.37	401	33.55	--	--	--	--	--	--	--	--	4.6
Natural Gas Appliances Paid by Household.....	--	--	--	--	35.0	.30	288	1.84	--	--	--	--	7.0
Liquefied Petroleum Gas Appliances Paid by Household.....	--	--	--	--	--	--	--	--	5.7	.03	.35	.45	8.1
1990 Family Income													
Less than $10,000.....	15.9	.16	46	3.73	6.9	.05	45	.32	1.8	.01	.09	.13	10.5
$10,000 to $19,999.....	19.8	.23	68	5.58	8.3	.05	53	.36	1.5	.01	.09	.11	7.8
$20,000 to $34,999.....	24.3	.36	105	8.57	9.7	.07	68	.43	1.4	.01	.09	.12	6.7
$35,000 to $49,999.....	16.7	.29	85	7.03	7.1	.06	56	.37	.8	(*)	.04	.07	8.6
$50,000 or More.....	17.3	.37	109	9.60	7.9	.10	93	.55	.6	(*)	.05	.05	11.3
Below Poverty Line													
100 Percent.....	13.1	.15	43	3.56	5.8	.04	42	.29	1.6	.01	.10	.13	10.5
125 Percent.....	18.2	.21	62	5.11	7.8	.06	56	.39	2.1	.01	.13	.17	8.8
Eligible for Federal Assistance3/.....	27.8	.33	98	8.11	12.2	.09	88	.61	2.8	.02	.18	.24	7.5

Table 43. Total Consumption and Expenditures for Appliances in U.S. Households, 1990

Characteristics	Electricity				Natural Gas				Liquefied Petroleum Gas				RSE Row Factors
		Consumed		Expenditures		Consumed		Expenditures		Consumed		Expenditures	
	Households (million)	(quadrillion Btu)	(billion kWh)	(billion dollars)	Households (million)	(quadrillion Btu)	(billion cubic feet)	(billion dollars)	Households (million)	(quadrillion Btu)	(billion gallons)	(billion dollars)	
RSE Column Factors:	0.50	NF	NF	NF	0.7	NF	NF	NF	2.0	NF	NF	NF	
Age of Householder													
Less than 35 Years	27.5	.36	106	8.94	11.5	.09	89	.57	1.4	.01	.09	.13	7.2
35 to 44 Years	20.1	.37	107	8.92	8.7	.08	76	.47	1.3	.01	.10	.12	8.5
45 to 59 Years	19.7	.35	103	8.60	8.5	.08	76	.47	1.3	.01	.07	.10	8.1
60 Years and Over	26.6	.33	97	8.07	11.2	.08	76	.52	2.0	.01	.11	.13	7.3
Education of Householder													
Less than 13 Years	52.6	.73	215	17.79	22.7	.18	173	1.16	4.6	.03	.29	.37	5.2
13 to 16 Years	31.6	.50	148	12.36	12.7	.10	100	.61	1.2	.01	.08	.10	7.2
17 Years or More	9.7	.17	50	4.37	4.6	.04	44	.26	.2	(*)	.01	.01	14.9
Race of Householder													
White	80.9	1.24	364	30.33	32.1	.26	255	1.61	5.2	.03	.31	.41	4.8
Black	10.6	.14	40	3.39	6.8	.05	53	.36	.6	(*)	.05	.06	13.0
Other	2.5	.03	9	.81	1.0	.01	8	.05	.3	(*)	.01	.02	19.8
Householder of Hispanic Descent													
Yes	6.3	.08	22	2.03	3.9	.04	38	.23	.2	(*)	.01	.02	18.9
No	87.6	1.33	391	32.49	36.1	.29	278	1.79	5.8	.03	.36	.47	4.7
Household Size													
1 Person	23.3	.18	54	4.56	9.2	.04	43	.30	1.3	.01	.06	.08	7.1
2 Persons	30.6	.43	126	10.43	13.0	.10	98	.63	2.0	.01	.09	.11	6.6
3 to 5 Persons	36.4	.71	209	17.52	15.9	.16	155	.97	2.4	.02	.19	.25	5.9
6 or More Persons	3.6	.08	24	2.01	1.8	.02	21	.13	.4	(*)	.03	.04	14.1

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
(*) = Data cannot be displayed due to rounding.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * Appliances do not include refrigerators. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 44. Electricity Consumption and Expenditures for Appliances and Refrigerators, per U.S. Household, 1990

Characteristics	Electricity Used for Appliances				Electricity Used for Refrigerators					RSE Row Factors
		Consumed				Average	Consumed			
	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Households (million)	Number of Refrigerators	(million Btu)	(kWh)	Expenditures (dollars)	
RSE Column Factors:	1.6	NF	NF	NF	1.6	0.5	NF	NF	NF	
Total U.S. Households....	94.0	15.0	4,395	367	93.8	1.2	5.3	1,562	133	1.4
Urban Status										
Urban.....	72.9	14.5	4,261	370	72.7	1.2	5.3	1,553	137	1.7
Central City.....	29.8	12.8	3,748	324	29.7	1.1	5.1	1,489	131	2.3
Suburban.....	43.0	15.8	4,617	403	43.0	1.2	5.5	1,598	141	2.0
Rural.....	21.1	16.6	4,860	357	21.0	1.2	5.4	1,590	118	2.7
Climate Zone1/										
Under 2,000 CDD and										
Over 7,000 HDD.....	10.1	14.8	4,340	332	10.1	1.2	4.3	1,255	95	4.9
5,500 to 7,000 HDD...	26.6	15.1	4,414	387	26.6	1.2	4.7	1,374	123	3.0
4,000 to 5,499 HDD...	20.9	15.0	4,399	368	20.9	1.2	5.3	1,543	134	4.3
Under 4,000 HDD.....	19.3	14.2	4,148	357	19.3	1.1	5.2	1,533	132	3.2
2,000 CDD or More and										
Under 4,000 HDD.....	17.0	15.9	4,674	369	17.0	1.1	7.1	2,094	168	3.4
Number of Rooms										
1 to 3.....	11.6	6.5	1,899	165	11.6	1.0	3.5	1,028	91	3.4
4 to 6.....	58.0	14.1	4,119	344	57.9	1.1	5.1	1,501	128	1.3
7 or More.....	24.3	21.3	6,250	521	24.3	1.3	6.7	1,959	164	2.4
Type of Housing Unit										
Single-Family.....	64.3	17.9	5,240	432	64.3	1.2	6.0	1,762	147	1.3
Detached.....	58.3	18.3	5,370	441	58.3	1.2	6.1	1,802	149	1.4
Attached.....	6.0	13.6	3,978	348	6.0	1.1	4.7	1,377	123	5.0
Mobile Home.....	5.2	12.7	3,722	283	5.2	1.0	4.0	1,166	90	4.3
Multifamily.....	24.4	7.9	2,313	216	24.3	1.0	3.8	1,116	104	2.2
2 to 4 Units.....	10.0	8.9	2,600	251	9.9	1.1	4.1	1,189	115	3.3
5 or More Units.....	14.4	7.2	2,114	191	14.4	1.0	3.6	1,066	97	3.5
Heated Floorspace (square feet)										
Fewer than 1,000.....	30.5	9.0	2,650	223	30.4	1.0	4.1	1,209	104	2.0
1,000 to 1,999	39.1	16.0	4,678	383	39.1	1.1	5.5	1,621	135	1.7
2,000 to 2,999	16.9	19.9	5,844	494	16.8	1.3	6.4	1,870	161	2.5
3,000 or More	7.4	23.2	6,792	590	7.4	1.4	6.8	1,995	172	4.5
Ownership of Unit										
Owned.....	62.2	17.6	5,165	429	62.2	1.2	5.9	1,733	145	1.4
Rented.....	31.7	9.8	2,885	247	31.6	1.0	4.2	1,223	107	2.1
Public Housing.....	2.5	8.0	2,347	180	2.5	1.0	3.6	1,056	83	8.4
Not Public Housing...	29.2	10.0	2,930	252	29.1	1.0	4.2	1,237	109	2.2
Rent Subsidy.....	1.7	9.2	2,700	248	1.7	1.0	3.7	1,097	101	8.7
No Rent Subsidy...	27.5	10.0	2,945	253	27.4	1.0	4.3	1,246	110	2.2
Year of Construction										
1939 or Before.....	21.5	13.2	3,862	346	21.4	1.2	4.8	1,400	129	2.6
1940 to 1949.....	7.0	13.4	3,931	326	7.0	1.2	5.3	1,551	131	3.7
1950 to 1959.....	13.4	15.6	4,582	402	13.3	1.2	5.8	1,714	152	3.0
1960 to 1969.....	14.8	15.1	4,415	369	14.8	1.2	5.6	1,643	138	3.0
1970 to 1979.....	21.4	16.2	4,762	374	21.4	1.1	5.4	1,582	126	2.8
1980 to 1984.....	8.0	16.2	4,747	383	8.0	1.1	5.5	1,623	133	4.2
1985 to 1987.....	5.1	14.4	4,219	341	5.1	1.1	4.8	1,416	116	6.0
1988 to 19902/.....	2.8	17.7	5,178	412	2.8	1.3	5.5	1,600	126	10.4
Electricity Paid by Household										
Yes.....	89.0	15.4	4,508	377	88.9	1.2	5.4	1,589	135	1.4
No.....	5.0	8.1	2,383	195	4.9	1.0	3.7	1,073	90	4.8
1990 Family Income										
Less than $10,000.....	15.9	9.8	2,880	235	15.8	1.1	4.6	1,340	112	3.0
$10,000 to $19,999.....	19.8	11.8	3,446	282	19.8	1.1	4.8	1,393	117	2.2
$20,000 to $34,999.....	24.3	14.7	4,322	353	24.3	1.1	5.1	1,492	124	2.1
$35,000 to $49,999.....	16.7	17.3	5,067	421	16.7	1.2	5.6	1,629	138	2.2
$50,000 or More.....	17.3	21.6	6,333	557	17.3	1.3	6.8	1,990	176	3.1
Below Poverty Line										
100 Percent.....	13.1	11.3	3,300	271	13.0	1.1	4.5	1,326	112	3.3
125 Percent.....	18.2	11.7	3,432	281	18.0	1.1	4.6	1,356	113	2.8
Eligible for Federal Assistance3/.....	27.8	12.0	3,504	291	27.7	1.1	4.7	1,381	117	2.3
Age of Householder										
Less than 35 Years.....	27.5	13.1	3,849	325	27.4	1.1	4.4	1,304	113	2.2
35 to 44 Years.....	20.1	18.2	5,327	443	20.1	1.2	5.5	1,615	137	2.3
45 to 59 Years.....	19.7	17.9	5,240	437	19.7	1.2	6.2	1,815	152	2.4
60 Years and Over.....	26.6	12.4	3,632	303	26.6	1.2	5.5	1,599	135	1.9
Education of Householder										
Less than 13 Years.....	52.6	13.9	4,085	338	52.4	1.1	5.1	1,502	127	1.5
13 to 16 Years.....	31.6	15.9	4,671	391	31.6	1.2	5.5	1,607	136	2.1
17 Years or More.....	9.7	17.7	5,176	449	9.7	1.2	5.9	1,738	154	4.0

Table 44. Electricity Consumption and Expenditures for Appliances and Refrigerators, per U.S. Household, 1990

Characteristics	Electricity Used for Appliances				Electricity Used for Refrigerators					RSE Row Factors
		Consumed				Average	Consumed			
	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Households (million)	Number of Refrigerators	(million Btu)	(kWh)	Expenditures (dollars)	
RSE Column Factors:	1.6	NF	NF	NF	1.6	0.5	NF	NF	NF	
Race of Householder										
White	80.9	15.4	4,504	375	80.8	1.2	5.4	1,568	133	1.1
Black	10.6	12.8	3,753	320	10.5	1.1	5.3	1,548	133	3.7
Other	2.5	12.3	3,610	325	2.5	1.1	4.8	1,411	131	5.1
Householder of Hispanic Descent										
Yes	6.3	12.0	3,511	320	6.3	1.1	5.1	1,488	138	4.4
No	87.6	15.2	4,460	371	87.4	1.2	5.3	1,567	132	1.4
Average Electricity Expenditures (cents per kWh)										
Less than 6	10.7	18.8	5,498	285	--	--	--	--	--	5.1
6 to Less than 9	46.5	16.2	4,747	358	--	--	--	--	--	2.0
9 or More	36.7	12.4	3,627	403	--	--	--	--	--	2.3
Average Electric Refrigerator Expenditures (cents per kWh)										
Less than 6	--	--	--	--	10.6	1.2	5.9	1,739	92	5.2
6 to Less than 9	--	--	--	--	46.6	1.2	5.8	1,712	130	2.0
9 or More	--	--	--	--	36.6	1.1	4.5	1,319	148	2.3
Appliances Present in Household (more than one may apply)										
Separate Freezer	32.4	21.0	6,154	487	32.4	1.2	6.0	1,749	138	1.8
Dishwasher	42.7	18.5	5,430	452	42.7	1.2	6.0	1,767	148	2.0
Clothes Washer	71.7	17.5	5,134	426	71.6	1.2	5.8	1,690	142	1.3
Clothes Dryer	49.5	19.1	5,611	446	49.4	1.2	5.9	1,717	136	1.6
Waterbed Heater	13.7	20.6	6,037	479	13.6	1.2	5.4	1,590	126	2.8
Swimming-Pool Pump	5.0	28.7	8,406	748	5.0	1.3	7.2	2,118	190	4.2

See footnotes at end of table.

Table 44. Electricity Consumption and Expenditures for Appliances and Refrigerators, per U.S. Household, 1990 (Continued)

Characteristics	Electricity Used for Appliances				Electricity Used for Refrigerators					RSE Row Factors
		Consumed				Average	Consumed			
	Households (million)	(million Btu)	(kWh)	Expenditures (dollars)	Households (million)	Number of Refrigerators	(million Btu)	(kWh)	Expenditures (dollars)	
RSE Column Factors:	1.6	NF	NF	NF	1.6	0.5	NF	NF	NF	
Appliances Present in Household (more than one may apply)										
Hot-Tub or Spa Pump....	3.3	25.8	7,556	657	3.3	1.3	7.3	2,151	186	6.2
Hot-Tub or Spa Heater..	1.7	24.9	7,292	581	1.7	1.3	6.6	1,946	153	8.2
Well Pump.....	14.3	19.8	5,813	469	14.3	1.3	5.6	1,649	132	3.2
Appliance Combinations										
Dishwasher, Clothes Washer, and Clothes Dryer										
With.....	28.3	21.1	6,179	496	28.3	1.2	6.3	1,849	148	2.5
Without.....	16.6	6.6	1,925	175	16.5	1.0	3.9	1,144	105	3.0
Well Pump and Separate Freezer										
With.....	8.4	22.6	6,620	527	8.4	1.3	5.6	1,646	129	4.1
Without.....	55.6	11.4	3,341	296	55.5	1.1	4.9	1,443	129	1.5
Main Heating Fuel										
Natural Gas.....	51.7	14.6	4,282	372	51.6	1.2	5.4	1,585	139	1.9
Electricity.....	21.5	14.7	4,319	310	21.5	1.1	5.5	1,606	119	3.1
Fuel Oil or Kerosene...	11.5	15.5	4,533	431	11.5	1.2	4.8	1,393	136	3.7
Wood.....	3.9	19.7	5,761	425	3.9	1.2	5.1	1,487	109	5.6
LPG.....	4.4	16.1	4,725	378	4.4	1.2	5.3	1,567	126	6.9
Other.....	.3	15.9	4,663	391	.3	1.2	5.4	1,585	132	20.9
Number of Household Members										
Less than 3.....	53.9	11.4	3,337	278	53.8	1.1	5.0	1,480	126	1.4
3 to 4.....	29.7	19.0	5,559	464	29.7	1.2	5.7	1,657	140	1.7
5 to 6.....	9.0	22.4	6,569	555	9.0	1.2	5.9	1,718	148	3.3
More than 6.....	1.3	22.5	6,599	562	1.3	1.2	5.7	1,679	152	6.9
Number of Refrigerators										
1.....	79.4	14.0	4,101	344	79.4	1.0	4.6	1,359	116	1.4
2 or More.....	14.4	20.6	6,046	497	14.4	2.0	9.1	2,680	222	2.5

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, and E of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Table 45. Natural Gas and LPG Consumption and Expenditures for Appliances, per U.S. Household, 1990

Characteristics	Natural Gas				Liquefied Petroleum Gas				RSE Row Factors
		Consumed				Consumed			
	Households (million)	(million Btu)	(1000 cubic feet)	Expenditures (dollars)	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	
RSE Column Factors:	0.8	NF	NF	NF	2.1	NF	NF	NF	
Total U.S. Households....	40.0	8.2	7.9	51	6.0	5.7	62	80	4.5
Urban Status									
Urban.....	34.8	8.4	8.1	53	3.0	5.1	56	77	5.7
Central City.....	16.7	7.9	7.7	51	.4	6.6	73	101	10.3
Suburban.....	18.1	8.8	8.5	54	2.6	4.9	54	73	6.9
Rural.....	5.2	6.7	6.5	39	3.0	6.2	68	84	8.5
Climate Zone1/									
Under 2,000 CDD and Over 7,000 HDD.....	2.6	6.7	6.6	36	1.1	6.5	72	89	12.3
5,500 to 7,000 HDD...	12.6	8.3	8.0	46	1.3	5.1	56	80	6.5
4,000 to 5,499 HDD...	10.3	7.4	7.2	59	1.3	6.3	69	89	9.2
Under 4,000 HDD.....	8.1	9.2	8.9	53	1.1	4.7	52	66	10.6
2,000 CDD or More and Under 4,000 HDD.....	6.4	8.5	8.2	50	1.2	5.6	61	77	13.8
Number of Rooms									
1 to 3.....	4.1	5.2	5.0	42	.9	4.6	50	75	10.6
4 to 6.....	25.5	7.4	7.1	47	4.0	5.6	61	80	4.4
7 or More.....	10.4	11.2	10.9	63	1.1	6.8	74	88	10.6
Type of Housing Unit									
Single-Family.....	27.3	9.0	8.7	52	4.4	5.7	63	80	5.8
Detached.....	25.1	9.1	8.8	52	4.3	5.8	63	80	5.9
Attached.....	2.2	8.0	7.8	56	Q	Q	Q	Q	16.7
Mobile Home.....	1.8	6.9	6.7	37	1.3	5.3	58	77	10.0
Multifamily.....	10.9	6.2	6.1	49	.3	6.0	66	104	8.8
2 to 4 Units.....	5.7	6.8	6.6	50	.2	6.1	67	104	10.9
5 or More Units.....	5.2	5.6	5.4	48	Q	Q	Q	Q	7.4
Heated Floorspace (square feet)									
Fewer than 1,000.....	11.9	6.1	5.9	42	2.6	5.3	58	82	5.4
1,000 to 1,999	17.1	8.1	7.8	49	2.3	6.0	66	79	6.4
2,000 to 2,999	7.5	9.2	8.9	60	.8	5.7	63	88	7.8
3,000 or More	3.4	13.4	13.1	68	.3	5.6	62	58	18.0
Ownership of Unit									
Owned.....	26.2	9.0	8.7	54	4.7	5.5	60	77	5.4
Rented.....	13.8	6.6	6.4	45	1.3	6.3	69	93	6.9
Public Housing.....	1.0	7.2	6.9	52	Q	Q	Q	Q	20.1
Not Public Housing...	12.8	6.6	6.4	44	1.3	6.4	70	95	7.6
Rent Subsidy.....	.6	8.0	7.8	57	.1	8.2	90	142	17.3
No Rent Subsidy...	12.2	6.5	6.3	44	1.1	6.2	68	89	8.2
Year of Construction									
1939 or Before.....	12.3	7.2	7.0	50	1.4	6.4	70	90	7.8
1940 to 1949.....	3.8	7.2	7.0	47	.6	7.5	82	105	9.6
1950 to 1959.....	7.0	8.9	8.7	55	.8	4.7	51	65	10.2
1960 to 1969.....	6.9	9.3	9.1	53	.8	4.9	53	81	13.4
1970 to 1979.....	6.2	8.0	7.7	48	1.3	5.2	57	76	9.3
1980 to 1984.....	1.7	9.1	8.8	55	.6	5.7	63	74	21.7
1985 to 1987.....	1.1	7.2	7.0	38	.3	5.6	61	69	21.1
1988 to 19902/.....	.9	11.0	10.8	50	.3	5.1	56	75	25.2
Natural Gas Appliances Paid by Household									
Yes.....	35.0	8.5	8.2	53	—	—	—	—	5.1
No.....	4.9	5.9	5.7	37	—	—	—	—	7.1
Liquefied Petroleum Gas Appliances Paid by Household									
Yes.....	--	--	--	--	5.7	5.6	61	80	7.2
No.....	--	--	--	--	.3	7.4	81	100	16.4
1990 Family Income									
Less than $10,000.....	6.9	6.8	6.6	46	1.8	4.9	53	73	8.3
$10,000 to $19,999.....	8.3	6.6	6.4	43	1.5	5.9	64	77	6.9
$20,000 to $34,999.....	9.7	7.3	7.0	45	1.4	6.1	67	87	7.0
$35,000 to $49,999.....	7.1	8.1	7.9	52	.8	5.1	56	84	8.6
$50,000 or More.....	7.9	12.2	11.8	70	.6	7.0	77	90	13.2
Below Poverty Line									
100 Percent.....	5.8	7.4	7.2	51	1.6	5.8	64	82	8.1
125 Percent.....	7.8	7.4	7.1	50	2.1	5.7	63	81	7.1
Eligible for Federal Assistance3/.....	12.2	7.5	7.3	50	2.8	5.8	64	84	6.9

Table 45. Natural Gas and LPG Consumption and Expenditures for Appliances, per U.S. Household, 1990

Characteristics	Natural Gas				Liquefied Petroleum Gas				RSE Row Factors
		Consumed				Consumed			
	Households (million)	(million Btu)	(1000 cubic feet)	Expenditures (dollars)	Households (million)	(million Btu)	(gallons)	Expenditures (dollars)	
RSE Column Factors:	0.8	NF	NF	NF	2.1	NF	NF	NF	
Age of Householder									
Less than 35 Years	11.5	7.9	7.7	50	1.4	6.0	66	89	6.3
35 to 44 Years	8.7	8.9	8.7	54	1.3	7.2	79	95	9.7
45 to 59 Years	8.5	9.2	9.0	56	1.3	5.1	56	79	8.9
60 Years and Over	11.2	7.0	6.8	46	2.0	4.8	52	67	6.3
Education of Householder									
Less than 13 Years	22.7	7.9	7.6	51	4.6	5.7	62	81	4.9
13 to 16 Years	12.7	8.1	7.8	48	1.2	6.0	66	84	7.4
17 Years or More	4.6	9.8	9.6	56	.2	2.9	31	49	19.1
Race of Householder									
White	32.1	8.2	8.0	50	5.2	5.5	60	79	5.0
Black	6.8	8.0	7.7	53	.6	7.4	81	97	10.3
Other	1.0	8.4	8.1	49	.3	4.5	50	69	25.9
Householder of Hispanic Descent									
Yes	3.9	10.1	9.9	61	.2	5.1	56	95	23.5
No	36.1	7.9	7.7	50	5.8	5.7	62	80	4.4
Household Size									
1 Person	9.2	4.8	4.6	32	1.3	4.1	45	61	9.2
2 Persons	13.0	7.7	7.5	48	2.0	4.2	46	58	6.5
3 to 5 Persons	15.9	10.0	9.7	61	2.4	7.4	81	106	5.9
6 or More Persons	1.8	12.3	11.9	75	.4	7.8	85	106	13.3

1/ Climate zones are based on annual degree-days that are averaged over 30 years from 1951 to 1980.
2/ Does not include all new construction for 1990.
3/ Below 150 percent of poverty line or 60 percent of median State income.
Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.
NF = No applicable RSE row/column factor.
-- = Not applicable.
Notes: * To obtain the RSE percentage for any table cell, multiply the corresponding column and row factors. * Because of rounding, data may not sum to totals. * See "Glossary" for definition of terms used in this report.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, C, D, and F of the 1990 Residential Energy Consumption Survey (for specific titles of forms, see Appendix E).

Appendix A

How the Survey Was Conducted

Appendix A

How the Survey was Conducted

Introduction

The Residential Energy Consumption Survey (RECS) was designed by the Energy Information Administration (EIA) to provide information concerning energy consumption within the residential sector. The RECS is conducted in two major parts: the Household Survey and the Energy Suppliers Survey. The Household Survey collects information concerning the housing unit through personal interviews with a representative national sample of households. In the Energy Suppliers Survey, data concerning actual energy consumption are obtained from household billing records maintained by the energy suppliers. The data are collected by questionnaires mailed to all the suppliers for the households in the Household Survey. This report focuses on the results of the Energy Suppliers Survey. A prior report, *Housing Characteristics 1990*, focused on results of the Household Survey. Copies of the data collection forms for the Household Survey, the adjunct Rental Agent Survey, and the Energy Suppliers Survey are reproduced in Appendix E, "Survey Forms."

This appendix contains sections providing detailed information for the Sample Design, Household Survey, its adjunct Rental Agent Survey, Energy Suppliers Survey, Confidentiality of the Data, Data Preparation for the Report, Public Use Data File Preparation, and special data collection for the Administration for Children and Families.

Sample Design

The universe for the RECS includes all housing units occupied as a primary residence in the 50 States and the District of Columbia. The sample of households used as the basis for the 1990 estimates was selected by using a probability sampling design developed especially for the RECS. The current sample design was used for the first time for the 1980 RECS and was revised prior to the 1984 survey to reflect population figures from the 1980 Decennial Census; this revised design was then used for the 1984, 1987, and 1990 RECS.

Multistage Area Probability Sample

In the sample design used for the 1984, 1987, and 1990 RECS, the total land area of the 50 States and the District of Columbia was divided into 1,799 Primary Sampling Units (PSU's) on the basis of Metropolitan Statistical Areas (MSA's), county and independent city boundary lines, and population characteristics.[41] Three principal sources of information were used to update the sample frame in 1984 and are shown in the following text table.

[41]Boundary definitions for counties, independent cities, and equivalent units were generally those used by the Census of Population and Housing, 1980, for the revised design. There were 3,135 such units in the 1980 Census. Prior to 1983, MSA's were referred to as Standard Metropolitan Statistical Areas. Additional detail on RECS sample design can be found in "The 1990 RECS Sample Design Procedures Manual," prepared by the Response Analysis Corporation.

Data Components	Source of Data Used in 1984 RECS Sample Design
Population estimates for counties and equivalent units	1980 Census of Population
Metropolitan Statistical Area (MSA) definitions	OMB definitions published June 27, 1983
Main space-heating fuel	1980 Census of Housing

Stratification of PSU's was based on the nine geographically defined Census divisions, metropolitan or nonmetropolitan definitions of PSU's, and to the extent feasible, dominant space-heating fuel and weather conditions. PSU's were grouped into 129 strata.

Some PSU's comprising all or part of large metropolitan areas were large enough in population to be a stratum by themselves. PSU's of this type are called Self-Representing (SR) because the sample from each PSU represents only that PSU. In other strata, one PSU was selected from among two or more PSU's in the stratum. Each of the PSU's selected from these strata is called Nonself-Representing (NSR) because each PSU also represents the nonselected PSU's in its stratum. The design included 129 strata, of which 32 were Self-Representing PSU's and 97 were Nonself-Representing. From this point on, PSU refers to the PSU's selected to be used in the RECS sample design.

The "secondary stage" of sampling for the 1984-1990 RECS sample design consisted of a sequence of four sampling steps (Figure A1):

1. *Minor Civil Divisions* (MCD) such as cities, towns, and other Census units were selected from each RECS PSU. This step was used to stratify the SSU's into categories by the size and characteristic of the MCD in which the SSU is located. An average of 12 MCD's were selected in each RECS PSU. The MCD's were selected using probability proportionate to size sampling where population was used as a measure-of-size.

2. *Secondary Sampling Units* (SSU's), which are Census Tracts, Block Groups, and Enumeration Districts, were selected from each MCD that was selected in the first step. Usually only one SSU was selected, but in some cases multiple SSU's were selected. The SSU's were selected using probability proportionate to size sampling where population was used as a measure-of-size.

3. A single *listing segment* was selected from each SSU selected in step 2. Detailed field listings were created for the selected segments by field workers who visited the area and identified each housing unit by street address, apartment number, or other obvious features. The listing segments were selected using probability proportionate to size sampling where rough counts of the number of housing units were used as a measure-of-size.

4. A single *penultimate cluster* of 25 or fewer housing units was selected from each listing segment selected in step 3. The *ultimate cluster* to be contacted for interviews (averaging about five housing units for the 1990 RECS) was selected from the penultimate cluster, and these housing units constitute the assignments given to interviewers.

Because of the four-step procedure, it is not clear what we should call the sampling units for each step. We could have called the MCD's the "First Step-Second-Stage Sampling Units," the SSU's the "Second Step-Second-Stage Sampling Units," the segments the "Third Step-Second-Stage Sampling Units," and the penultimate clusters the "Fourth Step-Second-Stage Sampling Units."

Figure A1. Multistage Area Probability Sample Activities for the 1990 RECS

Source: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey.

An optimization criteria was used to determine the approximate number of penultimate clusters and the approximate number of strata for PSU's that should be used in the design. The actual number of strata for PSU's (129) reflected both the results of the optimization and the geographic constraints used in defining the strata (see above). The actual number of penultimate clusters (1,516) also reflected the optimization.

The number of penultimate clusters selected varied from PSU to PSU. For each SSU used in the design, only one listing segment was used and for each listing segment, only one penultimate cluster was used. Hence the number of SSU's used in the design equaled the number of listing segments used which in turn equaled the number of penultimate clusters used. If the cases where MCD's were selected more than once are ignored, then the number of MCD's equaled the number of penultimate clusters.

If a MCD exceeded a fixed size (the fixed size varied from PSU to PSU), then it was selected with certainty and there was a positive probability that the MCD could be selected more than once. This occurred frequently for large cities in metropolitan PSU's. The number of SSU's selected for a MCD equaled the number of times the MCD was selected.

If a SSU was judged to be small enough to economically list all housing units in the SSU, then the SSU was not divided into listing segments. In this case, there was only one listing segment for the SSU and it was selected with certainty. For SSU's divided into segments, one and only one segment was selected for listing.

If after listing, the selected listing segment contained too many housing units, a penultimate cluster (of approximately 25 housing units) was selected among the listed housing units in the segment. Otherwise, all housing units in the segment were in the penultimate cluster. The size of the penultimate clusters reflected the plan to use each penultimate cluster for two successive iterations of the RECS (using 10 out of the 25 housing units in the cluster) before the cluster was replaced.

Longitudinal Sample Design

A plan for rotation of sample units, used in the 1982, 1984, and 1987 RECS, was continued in 1990. The primary objective of this rotation plan (or longitudinal sample design) was to observe changes in a sample of the same housing units over the period between two RECS data-collection cycles. To accomplish this objective in an efficient way and to set the stage for continuity in the RECS series, systematic random procedures were used to divide the total set of 1,516 tracts and ED's into four subsamples, designated in Table A1 as C, D, E, and F.

Table A1. Overview of Sample Operations for the 1982, 1984, 1987, and 1990 RECS

Rotation Group	1982	1984	1987	1990
C	R	S[a]	R	N
D	R	N[a]	R	S
E	S	R	N[a]	R
F	N	R	S[a]	R

[a]Revised sample used for the first time for these rotation groups; new tracts/ED's were selected from PSU's.
R = Housing units return from preceding survey.
S = Selected housing units from the same penultimate clusters that had been used in the preceding survey.
N = Selected new listing segments from the same tracts/ED's used in preceding survey.
Source: Energy Information Administration, Office of Energy Markets and End Use, the 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys.

In the 1990 RECS, Groups E and F were the returning rotation groups in which procedures were designed to interview a sample of the same housing units that had been sampled in the preceding 1987 RECS. Groups C and D constitute the new rotation groups in which housing units were included in the RECS sample for the first time in 1990. Procedures for updating the sample for new construction and for other changes in the housing unit stock were incorporated in sampling operations so that each rotation group, as well as the total RECS sample, is a probability sample of the population covered by the survey.

Returning Rotation Groups E and F

The general plan for these sample units (758 out of the total of 1,516) was to conduct interviews in the same housing units that had been contacted 3 years earlier. These would include housing units that had been vacant, noninterviews (refusals, not-at-homes, etc.), and completed units.

Before contacting households for the 1990 RECS, interviewers made visits to sample segments in mid-1990 to check the 1987 housing unit listings for missed units and to update listings for new construction, demolition, and conversion of structures from one use to another. Newly constructed or converted units, and those missed in the 1987 listings, were sampled at the 1990 RECS sampling rate.

Rotation Groups C and D

Prior to selecting the 758 sample units for these groups, a new construction update procedure was used for the Census tract or ED. This would be based on a canvass, primarily by telephone, of local sources of information, such as building-permit-issuing agencies, zoning boards, and tax offices. The objective was to determine whether significant new construction--defined as groups of 25 or more housing units--had occurred within the tracts or ED's since 1984. In the canvass, significant new construction was found in Census tracts and ED's in 197 of the 758 units. New field counts were made and new segments were selected based on the new measures of size.

In Census tracts and ED's in which significant new construction (clusters of 25 or more new housing units) was not found, procedures diverged in Rotation Groups C and D. In Rotation Group D, 1987 RECS housing unit listings were checked and updated (for such things as missed units, new construction) before the start of field contacts for interviews. This step in Rotation Group D was identical to the listing checks carried out for Rotation Groups E and F. However, housing units for the 1990 RECS sample were selected from among those *not* selected in the earlier RECS. In Rotation Group C, a new listing segment was selected for the 1990 RECS.

Household Survey

Data Collection Procedures

Interviewers used Form EIA-457A, "Household Questionnaire," to conduct the personal interviews at the sampled housing unit. The original sample consisted of 6,757 units, of which 150 either were not used for dwelling purposes or were not habitable (Table A2). Of the 6,607 habitable housing units, 698 were ineligible

Table A2. Interviews Completed by Stage in the 1990 RECS

Units	Personal Interviews Attempted			Status After Third Wave	Mail Questionnaire Sent	Final Status
	First Wave	Second Wave	Third Wave			
Total Listed Units	6,757	1,847	1,173	6,757	1,081	6,757
Out of Scope Units						
Business, Other	34	0	0	34	--	34
Not Habitable	37	0	0	37	--	37
Nonhousing Unit	79	0	0	79	--	79
Subtotal Out of Scope	150	0	0	150	--	150
Housing Units	6,607	1,847	1,173	6,607	1,081	6,607
Ineligible Units						
Vacant	475	33	8	516	--	516
Seasonal Vacant	175	7	0	182	--	182
Subtotal Ineligible	650	40	8	698	--	698
Eligible Units (or yet to be contacted)	5,957	1,807	1,165	5,909	1,081	5,909
Not Completed--Personal Interview						
No One home	840	348	58	224	--	224
Eligible Respondent Not Home	44	16	5	15	--	15
Refused	781	435	57	[a]717	--	717
Illness	26	12	2	18	--	18
Language Barrier	37	8	1	19	--	19
Wrong Respondent or Unit	25	6	1	12	--	12
Not Contacted[b]	79	348	957	61	--	61
Other	15	0	0	15	--	15
Subtotal Not Completed (Personal Interview)	1,847	1,173	1,081	1,081	--	1,081
Not Completed--Mail Questionnaire						
Unusable Address	--	--	--	--	21	21
Postal Return	--	--	--	--	62	62
Returned Blank	--	--	--	--	23	23
Returned Unusable	--	--	--	--	6	6
Not Returned	--	--	--	--	641	641
Other Not Mailed	--	--	--	--	61	61
Subtotal Not Completed (Mailed Questionnaires)	--	--	--	--	814	814
Total Interviews Completed	4,110	634	84	4,828	267	5,095

[a]A household that refused an interview during any one of the three waves was classified as a "refusal" for the final status even though no one was at home in the second or third wave.

[b]Includes households that moved after initial contact.

-- Data not applicable.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457, A and B of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files and unreleased data.

for this study due to a current vacancy or seasonal occupancy (the units were not the primary residence for the occupants). Personal interviews were conducted at 4,828 of the 5,909 eligible units, for a response rate of 81.7 percent. A shortened version of the household questionnaire (Form EIA-457B, "Household Mail

Questionnaire") was sent to households where a personal interview was not completed. Mail questionnaires were sent to 1,031 of the 1,081 households that had not participated in personal interviews. Fifty households adamantly refused further contact or could not be reached by mail, and, therefore, were not included in the mail followup. Completed questionnaires were returned by 267 of these households, or 25.9 percent of those mailed. Of the total eligible households, responses were received from 86.2 percent (or 5,095 households).

Data Collection Dates

Approximately three-quarters of the personal interviews were completed in September and October 1990 and 99 percent were completed by the end of December 1990. In a few sample locations with low response rates, interviewing continued until January 1991. Most of the 267 completed mail questionnaires were received in January and February 1991. In keeping with past practice in the RECS survey, November was regarded as the rough midpoint for data-collection activity. Thus, November 1990 was the date for determining the independent estimates of the size of the universe of households used in the ratio adjustment of sampling weights.

The Interview

The average personal interview lasted 62 minutes, with 82 percent of the interviews lasting between 30 and 75 minutes. The interview with the householder (or spouse) covered structural features of the house related to energy, such as: insulation, doors, windows, the heating and cooling systems (with the fuels used in these systems), use of wood fuel, energy conservation improvements, household appliances, household vehicles, receipt of government assistance for the cost of heating, and demographic data on household members.

At the end of the interview, respondents were asked to sign an authorization form allowing the interviewing contractor to obtain records of energy consumption from the housing unit's energy supplier(s). At this time, the interviewer also measured the dimensions of the housing unit. (See "Estimates of Housing Unit Size" in Appendix B, "Quality of the Data.")

The Interviewers

A total of 279 interviewers completed one or more personal interviews for this study. One hundred and two interviewers (36 percent) had completed interviews on a prior RECS. The remainder were conducting their first RECS, but had interviewing experience either with other survey research organizations or with the U.S. Bureau of the Census.

Interviewer training was conducted by video cassette and guided self-study programs. This was a departure from previous RECS, which used a combination of in-person training, written materials, and telephone training. The training for interviewers covered general interviewing techniques, background of the Residential Energy Consumption Surveys, a question-by-question review of the household questionnaire, ways to measure the respondents' homes, the accurate recording of the Vehicle Identification Number (VIN), and administrative requirements (the schedule for returning completed questionnaires and procedures for submitting time and travel forms).

Interviewers were paid a fixed amount for their interview training time. All interviewers were required to complete two practice interviews (one before training and one after), training exercises during the training video, and a final quiz on the questionnaire after the training video had been completed. The practice interview, completed after the training, was carefully reviewed by the interviewer's supervisor. Extensive

feedback was provided to the interviewer on this practice interview and on the next one to five interviews completed by the interviewer.

The interviewers kept their video cassettes for review during the survey. In addition, there was a written, 132-page manual, *Instructions for Interviewers, 1990 Residential Energy Consumption Survey*.

Interviewers were paid on an hourly basis for their work on RECS, which included time for home study, review of completed interviews, actual interviewing time, and travel to and from sampled housing units. Interviewers were also reimbursed at standard mileage rates for use of personal vehicles and other travel expenses. Interviewers working in locations believed to present a hazard to their safety were compensated for the use of an escort. Interviewers conducted an average of 17 interviews. Twenty-six interviewers each completed fewer than six interviews; the average for this group of 26 interviewers was 3 completed interviews. Seven interviewers completed 50 or more interviews; the average for this group of interviewers was 66 completed interviews. Twenty percent of the personal interviews were verified by telephone or mail to ensure that interviews were conducted as intended.

Rental-Agent Survey

The Rental-Agent Survey is an adjunct to the Household Survey to verify information from household respondents in rental units on fuels and main space-heating equipment used. Telephone interviews were carried out using Form EIA-457C, "Rental Agent Questionnaire," with rental agents and landlords of RECS households living in multifamily dwellings whose occupants did not directly pay to utility companies or energy suppliers for one or more household fuels.

The interviews with rental agents or their representatives were conducted in the spring of 1991. Altogether, 281 rental agents were interviewed. These interviews covered 550 households in 513 buildings. The 550 households were 85.1 percent of the total of 646 households living in multiunit buildings who had one or more fuels included in their rent.

Comparisons were made between rental agents' and household respondents' reports on main space-heating fuel, main space-heating equipment, supplemental heating fuel, water-heating fuel, and air-conditioning fuel. Each discrepancy was individually examined. Changes were made in the household record whenever it was judged that the rental agent was more knowledgeable than the household respondent on specific fuels and/or equipment.

The rental agent was deemed the more knowledgeable person about landlord payments for the fuel; the use of the fuel as the main space-heating, water-heating, or air-conditioning fuel; and the main space-heating equipment. The respondent was generally considered the more knowledgeable person for the definition of supplemental heating fuel, as the supplemental heating fuel was more likely to be under the household's control, even in multifamily dwellings.

Minimizing Nonresponse

In an effort to minimize nonresponse and, therefore, maximize the validity of the survey data, a multiwave, multicontact approach was employed. Before the initial contacts, a letter was sent to each household with a street address. The letter from the Director of the Office of Energy Markets and End Use, briefly described the purposes and stressed the importance of the survey. Beginning in September 1990, interviewers made up to seven or more callbacks at different times of the day, throughout the week, in an effort to minimize the number of uncontacted households. The interviewers also queried neighbors regarding the most opportune times to contact the prospective respondent. By the end of the first wave, 150 addresses were found to be

nonresidential and an additional 650 were found to be ineligible (Table A2). Some 4,110 personal interviews were completed, leaving 1,847 nonrespondents in this wave.

A second wave was initiated in an effort to contact households that were not available during the first wave and to attempt to convince selected first-wave refusals to reconsider. A new set of letters preceded the renewed effort and, in most cases, the sampled housing units were assigned to a different interviewer. Again, up to seven or more attempts were made to contact the prospective respondents. At the end of this wave, an additional 40 addresses were found to be ineligible. As a result of the second wave, an additional 634 interviews were completed, leaving 1,173 nonrespondents.

A third wave was initiated in an effort to reach nonrespondents in a number of locations that had low completion rates. Eight addresses were found to be ineligible and an additional 84 personal interviews were completed in the third wave.

In a final attempt to reduce nonresponse, an abbreviated version of the questionnaire (adapted for self-administration) was mailed to most of the remaining nonrespondents. As a result of this effort, 267 additional households responded. After three waves of personal interview attempts and the mailed questionnaire, 814 households or 13.8 percent of all eligible housing units had not responded.

These efforts were successful in accomplishing the following improvements in response.

- Approximately 82 percent of the households were contacted and agreed to be interviewed personally. An additional 5 percent of the sampled households completed and returned mailed questionnaires.

- Of the 5,095 responses, 81.0 percent were obtained during the first wave of contacts; 12.4 percent were obtained during the second wave; and 1.6 percent resulted from third-wave contacts. Some 5.2 percent were responses to the mailed questionnaire.

- Of all households that participated in the personal interviews, 31.3 percent required only one visit in the first wave, and 75.8 percent were completed with no more than two first-wave callbacks.

- A total of 216 personal interviews were completed in the second and third waves with respondents who had previously refused to participate, representing 4.5 percent of all completed personal interviews. In addition, of the 267 mailed questionnaires that were completed and returned, 169 were from households that previously refused to participate.

Response Rates and Household Characteristics

This section of the report compares various response and nonresponse rates across Census region, location type, and housing structure type (Table A3). Several patterns are clear. First, personal interviews enjoyed the most success in the South Region (84.9 percent), in rural areas (87.2 percent), and among residents of buildings with two to four units (83.2 percent). Conversely, the interviewers had their lowest success rates in the Northeast Region (77.5 percent), urban areas (central city) (79.0 percent), and in buildings with five or more residential units (77.4 percent). When looking at the categories comprising these groupings, it is important to remember that their characteristics are not necessarily independent. Rather, they are very likely to overlap: for example, large apartment buildings are concentrated in urban areas.

The total response-rate patterns, with regard to highest and lowest rates, generally are not affected by adding the mailed-questionnaire responses; however, the overall range from highest to lowest decreases by one to two percentage points. The response to the mail questionnaire tended to be higher in areas where the refusal rate to the personal interview was the highest.

Table A3. Response Rates in the 1990 RECS by Region, Urban Status, Type of Structure, and Rotation Groups

(Percentage of Eligible Housing Units)

Housing Characteristic	Response Rates[a]			Personal Interview Nonresponse Rates	
	Personal Interviews	Mail Questionnaires	Total Responses	Refusals	Unable to Contact
Total	81.7	4.5	86.2	12.1	6.2
Census Region					
Northeast	77.5	5.9	83.4	13.8	8.7
Midwest	83.1	4.3	87.4	11.8	5.1
South	84.9	3.1	88.0	10.3	4.8
West	80.4	5.1	85.6	13.0	6.6
Urban Status					
Urban (Central City)	79.0	4.9	83.8	12.3	8.7
Suburban	80.6	5.2	85.9	13.7	5.7
Rural	87.2	2.8	89.9	9.3	3.5
Structure Type					
Single-Family or Mobile Home	82.3	4.4	86.7	12.8	4.9
Buildings with Two to Four Units	83.2	3.5	86.7	8.0	8.8
Buildings with Five or More Units	77.4	6.0	83.4	11.7	10.9
Sample Rotation Group					
Returning Rotation Group	79.4	4.5	83.9	13.9	6.7
New Rotation Group	84.0	4.5	88.5	10.4	5.6

[a]As a percent of the total eligible number of housing units.

Note: Because of rounding, data may not sum to totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457, A and B of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files and unreleased data.

Overall response rates are approximately 5 percent higher for new rotation groups (households not contacted for an earlier RECS) than for returning rotation groups. Conversely, refusal rates are approximately 4 percent higher for the returning rotation groups that had been contacted in an earlier RECS or in the companion survey, the Residential Transportation Energy Consumption Survey (RTECS). These findings replicate results for earlier RECS.

Data Editing

Completed interviews were mailed by the interviewers to the survey contractor headquarters. The first step in the review process was to verify the accuracy of the basic identifying information. Next, the questionnaires were manually reviewed to ensure completeness and the logical consistency of selected patterns of responses and to prepare the questionnaires for translation into machine-readable form. Keypunching of the data was 100 percent verified. Finally, the data were machine edited to further ensure completeness, logical consistency, and the legitimacy of coded values.

The contractor attempted to resolve inconsistencies or ambiguities in the data internally, by reference to other parts of the questionnaire. When these efforts failed to resolve an important problem, particularly those involving heating fuels or heating equipment and/or relationships between questionnaire responses, the contractor made a followup contact with the rental agent or a telephone contact with a member of the household in question. Telephone contacts with a household member were completed with approximately 4 percent of households during the course of data editing for this survey.

Survey Estimates

All the statistics published in this report are estimates of population values. These estimates are based on a randomly chosen subset of the entire population of households. The universe includes all households in the 50 States and the District of Columbia, including households on military installations. At the midpoint of this RECS, November 1990, the universe was estimated to contain 93,991,000 households, based on an extrapolation of the March 1990 and March 1991 Current Population Survey (CPS) estimates of the population. See Appendix B, "Quality of the Data," for details about the unit and item nonresponse imputations.

Energy Supplier Survey

The overall objective of the energy supplier survey was to provide data on which to estimate the annual energy consumption and expenditures of sample households. Five energy sources were covered in the supplier survey--electricity, natural gas, fuel oil, kerosene, and LPG.[42] For each of the energy sources, the goal was to obtain complete consumption records from January 1, 1990 through December 31, 1990.

Toward the end of the household interview, each household reported for each use of the energy source whether or not it was paid for by the household, included in rent, or paid another way. For the households that paid directly, the respondent was asked for the names, addresses, and telephone numbers of the energy suppliers; these respondents were also asked to sign a form, authorizing the contractor to collect consumption data from the suppliers. Altogether, the energy supplier survey included initial contact attempts with 892 companies (Table A4).

Data-Collection Procedures

Data-collection procedures for electricity and natural gas companies included at least the following steps:

- An initial letter from the Director of the Office of Energy Markets and End Use, addressed to the president or other official in the company, outlining the general nature of the request for participation. Enclosures in the letter included a printed statement, "About the Residential Energy Consumption Survey," specimen copies of reporting and authorization forms, and a postage-paid postcard with a checklist of available publications and data tapes.

- A telephone contact to determine the name of the person to whose attention the survey materials should be sent.

- The mailing of survey materials to the person named as contact person.

[42]Households using LPG only for outdoor cooking grills were not included in the LPG data collection; LPG used by these households is excluded from consumption and expenditures estimates. Data on usage of wood fuel were reported by the household, since it was not practical to collect these data from suppliers as is done with the major home fuels. Unless otherwise noted, consumption of wood is not included in the tables for this report.

- A followup-telephone contact a few days later to answer questions or discuss survey procedures as necessary.
- Completed forms or copies of records returned by mail.
- A letter from the survey contractor thanking the company for its effort.

Table A4. Companies in the Energy Supplier Survey and Number of Households Supplied

Energy Supplier	Number of Companies[a]	Number of Households with Companies Identified
Electricity	255	4,506
Natural Gas	140	2,619
Fuel Oil or Kerosene[b]	365	542
LPG	194	373

[a] The total number of companies in the survey was 892 -- 42 supplied both electricity and natural gas; 3 supplied natural gas and LPG, and 17 supplied fuel oil or kerosene and LPG.

[b] Households were asked for names of their "fuel-oil or kerosene" suppliers. Since most companies who have supplier records furnish both types and often supply both types of fuel to the same household, these companies are reported together. If a respondent reported only "cash and carry" purchases of a bulk fuel (fuel oil, LPG, or kerosene), they were not asked to furnish the name of the supplier.

Source: Energy Information Administration, Office of Energy Markets and End Use,Energy End Use Division, Forms EIA-457, A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

The personal contacts established at an early point largely precluded mailings of materials to an inappropriate person and the delays that might develop from such mailings.

Procedures for fuel oil or kerosene and LPG suppliers were the same as for electric and natural gas suppliers up through and including the mailing of survey materials to the company person named as the contact. These suppliers, however, most often had only one or two households for which information was to be supplied, and data collection was generally completed by telephone. A pretest of the procedure conducted earlier had indicated a somewhat greater likelihood that suppliers would respond by telephone than as a result of a request to complete and return the forms by mail.[43]

After the supplier returned the information, additional contact with the suppliers and the households was sometimes required to identify the correct record in the company files.

Data-Collection Dates

The first set of advance letters was mailed to the energy suppliers in January 1991. The cutoff date for receipt of usable information was July 31, 1991.

Data Processing

[43]The test is described in *RECS: Consumption and Expenditures - April 1980 Through March 1981, Part 1: National Data*, DOE/EIA-0321/1 (Washington, DC, September 1982), Appendix A, "How the Survey Was Conducted." Suppliers that chose to return the forms by mail, however, were not discouraged from doing so.

The energy consumption and expenditure statistics presented in this report are based on the individual annual consumption and expenditures amounts for each household. Individual consumption and expenditure amounts are calculated for each household for each of five energy sources (electricity, natural gas, fuel oil, kerosene, and LPG). None of the households that participated in the 1990 RECS used all five energy sources, but the majority of the households did use two or more energy sources. When possible, the annual consumption and expenditure amounts were calculated using data obtained from the Energy Supplier Survey.

The Energy Supplier Survey was conducted for households that paid their own fuel bills directly to the supplier and signed a form to authorize access to their billing records. These limitations meant that imputations of fuel consumption and expenditures were required for households whose fuel bills were included in the rent and for households that did not permit access to their records.

Imputations were also required for households when the supplier failed to produce usable billing records. The billing records for a given fuel and a given household were considered missing (and hence nonusable) if: (1) the supplier refused to participate, (2) the supplier did not keep records, (3) the supplier could not find the householder's records, (4) the information provided by the household was insufficient to locate the supplier, or (5) the supplier was no longer in business.

Available but nonusable billing records occurred when: (1) the household recently moved into the dwelling unit; (2) the amount of the bill that could be attributed to the housing unit was unknown; or (3) the billing records did not cover the entire amount used by the household.

For cash-and-carry purchases, households were asked to provide estimates of consumption and expenditures for kerosene only. In addition, if the household indicated that it had the ability to use LPG, fuel oil or kerosene but yet planned no purchases during 1990, they were assigned a consumption of zero. See "Annual Consumption and Expenditures" in Appendix B, "Quality of the Data," for more details on the annualization of monthly billing records and imputations for the energy supplier data.

Confidentiality of Information

The EIA does not receive nor take possession of the names or addresses of individual respondents or any other individually identifiable energy data that could be specifically linked with a household respondent. All names and addresses and identifiable information are maintained by the survey contractor for verification purposes only. The household records that are placed on the public use data file do not have any name or address information and additional measures have been taken to mask the data for further confidentiality protection. Unlike other EIA surveys, the consumption surveys pledge confidentiality to their respondents.

Public Use Data File Preparation

Housing Characteristics 1990 was produced with the survey data file received in January 1992. These data come from the Household Survey and the adjunct Rental Agent Survey. The Energy Suppliers Survey data were added and a later data file (April, 1992) was used to produce this report. Following this publication, a final data file will be prepared for release to the public containing both the housing characteristics and energy supplier data for the 1990 RECS. Measures, such as the removal of geographic identifiers except Census region and Census division, are taken to mask the data to insure that the identity of the individual respondents is kept confidential.

The public use data are released to the public through the National Technical Information Service (NTIS) and the Government Printing Office (GPO). (See Appendix G for information on how to order this data file from NTIS and the GPO.) The file is available both on magnetic tape for use with a main frame computer and on floppy diskettes for use with personal computers.

Special Data Collection for the Administration for Children and Families

The EIA collects supplemental data during the RECS interview for the Administration for Children and Families (ACF) for their use in program administration of the Low-Income Home Energy Assistance Program (LIHEAP). In the 1990 RECS, most of this information was in Section L of the Household Questionnaire (Form EIA-457A). Unlike past surveys, the ACF did not fund an "oversampling" of low-income households for the 1990 RECS.

In Section L of the Household Questionnaire, respondents with annual incomes under $35,000 were asked a series of questions about the receipt of home energy assistance and lack of heat during October 1989 through September 1990. The data were updated for the period from October 1990 to July 1991, through a telephone survey in August 1991. An annual report to Congress is produced by the LIHEAP. See "Assistance for Heating in Winter," in the Glossary for more information about the LIHEAP report.

Appendix B

Quality of the Data

Appendix B

Quality of the Data

Introduction

All the statistics published in this report are estimates of population values, such as the total amount of natural gas consumed in housing units that use natural gas. These estimates are based on observations from a randomly chosen subset of the entire population of occupied housing units. As a result, the estimates can differ from the true population values. This appendix deals with the nonsampling and sampling errors and other related factors affecting the quality of the data. The seven main sections of this appendix are: Nonsampling Error, Nonresponse, Annual Consumption and Expenditures, Estimation of Sampling Error, Data Analyses Background, Data Comparison, and Data Interpretation.

The differences between the estimated values and the actual population values are of two types, sampling errors and nonsampling errors. Nonsampling errors are also known as systematic errors or biases, and are presented in the section "Nonsampling Error."

Unlike the sampling error, the magnitude of the nonsampling error cannot be estimated from the sample data. For this reason, avoiding biases and systematic errors at the outset is a primary objective of all stages of survey design and field procedures. The wording and format of survey questionnaires; the procedures used to select and train interviewers; and the quality control built into the data collection, receipt, and processing operations were all designed to minimize these sources of error. For a discussion of these procedures, see Appendix A, "How the Survey Was Conducted."

In addition, response adjustments and ratio estimations were incorporated into the survey estimator to help reduce both sampling and nonsampling error. Nonresponse (both unit and item) adjustment procedures for the Household Survey are discussed in the "Nonresponse" section in this appendix. Procedures for adjusting the billing data collected in the Energy Supplier Survey are discussed in the "Annual Consumption and Expenditures" section of this appendix.

Sampling error is the random difference between a survey estimate and a population value that occurs because the survey estimate is calculated from a randomly chosen subset of the entire population. The sampling error averaged over all possible samples would be zero, but there is only one sample for the 1990 RECS. Therefore, the sampling error is nonzero and unknown for the particular sample chosen. However, the sample design permits sampling errors to be estimated. The section, "Estimation of Sampling Error," describes how the sampling error is estimated and presented for statistics given in this report.

Background information for three special analyses referenced in the text of this report, wood consumption, the energy efficiency of the equipment stock, and ratio adjustment of new homes, are presented in the "Data Analyses Background" section.

"Data Comparison" includes an example, which depicts the limitations of the RECS data to detect small changes or trends, and also information about a validation study of the RECS end use estimates. The section "Data Interpretation" presents an example illustrating the importance for data users to have a complete understanding of the RECS data prior to the use of the data for analytical studies.

Nonsampling Error

Nonsampling errors can occur for the following reasons:

- Differences between the target population (residential sector) and the population from which the sample is selected (occupied primary residential housing units)
- Interviewer errors, respondent misunderstandings, questionnaire design errors, and data processing errors
- Systematic nonresponse for certain segments of the population (unit nonresponse)
- Nonresponse on certain questions from the questionnaire for some respondents (item nonresponse).

The segments, "Completeness of Data" and "Quality of Specific Data Items," describe some of the sources of nonsampling error and how the survey is designed and conducted to minimize such errors. "Completeness of Data," describes the nonsampling errors that occur for the first reason in the list above.

"Quality of Specific Data Items," reviews some of the nonsampling errors that occur for the second, third, and fourth reasons in the list above. These errors would be expected to occur even if the survey attempted to contact the occupants of every occupied housing unit in the country. (For example, the results of the Decennial Census conducted by the Bureau of the Census are subject to these nonsampling errors.)

Completeness of Data: Noncovered Housing Units

Data are not collected for the following two types of housing units:

- ***Vacant housing units***. These units may use energy for minimal heating for protection from the weather and minimal lighting for security. The American Housing Survey (AHS) conducted by the Bureau of the Census estimated that there were 6.4 million vacant, year-round housing units (that were not held for "occasional" use) in 1989. Some vacant apartment units may be included in some statistics--a vacant upstairs or basement apartment for example. This space would be in the space measurements and in the energy consumption.
- ***Seasonal units or second homes for the owner's use***. The AHS estimates there were 2.7 million year-round homes held for "occasional" use and 2.9 million "seasonal" units in 1989.

These two types of units are not included in the RECS survey primarily because of the difficulty in acquiring data and limitations in the availability of funds for the RECS. The RECS data are collected by interviewing an occupant of the housing unit. By definition, a vacant housing unit is not occupied at the time RECS field workers attempt to interview the occupants of the unit. Hence, for vacant units, someone other than the occupants would need to be contacted. For many vacant units, this would add substantially to the cost of acquiring data for the unit. By definition, second homes are housing units that are not the primary residence of the occupants. Hence, for many second homes, the occupants may be living somewhere else at the time the interviewers are in the neighborhood of these second homes. As a result, contacting and interviewing the occupants of second homes may be costly and difficult.

Some effects of these omissions are an underestimation of the total number of residential housing units, the number of units in subcategories, and the amount of energy consumed in the residential sector.

Quality of Specific Data Items

Homes Built in 1990

The total number of new homes to have been built from 1988 through 1990, estimated from the 1990 RECS, is 2.8 million homes. However, RECS underrepresents the number of homes, primarily because of undercoverage of homes built in 1990. Since RECS data are collected before the end of 1990 from sample listings created in the late spring, some houses built later in 1990 may not be included. The RECS data show that 1.3 million occupied housing units were built in 1988, 1.2 million in 1989, and 0.4 million in 1990. New construction statistics for new privately owned housing units (single-family and multifamily) and mobile home placements show a 7 to 8 percent decline per year from 1988 to 1990.[44] This rate of decline suggests that a more accurate figure for RECS for 1990 would be 1.1 million occupied housing units, indicating that RECS may have covered only about one-third of the new homes built during 1990. For additional information on newly constructed homes, see "Ratio Adjustment Procedures for RECS New Homes Data" in the Data Analyses Background section of this appendix.

Family Income

Underreporting of family income is often a problem in surveys like the RECS. Underreporting may be exacerbated in the RECS, which measures family income by only one question. In comparison, the Current Population Survey (CPS) collected by the Bureau of Census measures family income by several questions; income questions are asked separately for each source of income and each family member.

The 1990 RECS underreported family income relative to the CPS. The underreporting of family income in the 1990 RECS relative to the CPS is most evident in the highest income category (Table B1). The RECS estimate for the number of households with family incomes over $50,000 fell 6 million short of the CPS estimate. Similarly, the RECS reported far more homes with low incomes than the CPS. In every lower income category, the RECS reported more households than the CPS.

Table B1. Estimates for 1990 U.S. Family Income from CPS and RECS
(Thousands of Households)

Family Income Category	Number of Households	
	1990 RECS	CPS Estimate
Total	93,999	94,312
Less than $5,000	5,219	4,901
$5,000 to $9,999	10,691	9,184
$10,000 to $14,999	11,384	8,925
$15,000 to $19,999	8,430	8,296
$20,000 to $24,999	9,015	8,427
$25,000 to $34,999	15,274	14,864
$35,000 to $49,999	16,727	16,469
$50,000 or More	17,251	23,327

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, Current Population Survey.

[44]U.S. Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC: U.S. Department of Commerce, 1991).

Poverty

The United States Bureau of the Census provides a threshold of poverty, which is based on family income and the number of household members (Table B2). Households with incomes below the poverty threshold are defined as "Below 100 Percent of Poverty." Households with income below 125 percent of the poverty threshold are defined as "Below 125 Percent of Poverty." Because the RECS income data were collected using categories of income, an exact match of Census thresholds could not be made. Table B2 provides a crosswalk between the Census thresholds and the RECS income categories. An additional source of error in the determination of poverty status is the nonsampling error in the reported family income.

Table B2. Definition of Poverty in the U.S. as Used in the 1990 RECS
(Dollars)

Number of Persons per Family	Below 100 Percent of Poverty		Below 125 Percent of Poverty	
	1990 RECS Income Range Less Than[a]	Census Threshold[b]	1990 RECS Income Range Less Than[a]	125 Percent Threshold[b]
1 and respondent is 64 or Younger	7,500	6,800	9,000	8,500
1 and respondent is 65 or Older	6,000	6,268	7,500	7,835
2 and householder is 64 or Younger	9,000	8,794	11,000	10,992
2 and householder is 65 or Older	7,500	7,905	10,000	9,881
3	10,000	10,419	12,500	13,024
4	14,000	13,359	17,500	16,699
5	15,000	15,792	20,000	19,740
6	17,500	17,839	22,500	22,299
7	20,000	20,241	25,000	25,301
8	22,500	22,582	27,500	28,228
9 or More	27,500	26,848	32,500	33,560

[a]The income category that contained the Census threshold was taken as the upper limit in defining poverty when the Census threshold was equal to or above the midpoint of the income category. For example, since the threshold of $6,268 was not above the midpoint of the category $6,000 to $7,499, the next lower income category was used.

[b]Data from Census Bureau (see Source).

Sources: • Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A and B of the 1990 Residential Energy Consumption Survey (RECS); RECS Public Use Data Files; • U.S. Bureau of the Census, *Poverty in the United States (Current Population Reports, Series P-60, Number 175, 1990)*, Table A2, p. 195.

Indoor Temperatures

The questionnaire asked respondents for indoor temperatures during sleeping hours and during the day when the home was occupied and unoccupied. The questionnaire did not ask for temperatures on a specific day, the implication was that typical temperatures during the winter were being requested. The self-reported temperatures, especially for some respondents, are impressions of typical temperatures and may not represent actual temperatures, or the averages of actual temperatures in the home. Studies do show that quite often self-reported temperature settings were significantly lower than observed settings.[45]

[45]For further discussion on setback behavior see Paul D. Luyben, "Prompting Thermostat Setting Behavior," *Environment and Behavior,* Vol. 14, No. 1, (January 1982), pp. 113-128.

Factors likely to make self-reported temperatures unreliable indicators of the actual temperatures include the following: respondents may not check temperatures or thermostat settings on a regular basis or may not have thermostats that are marked with degree settings; temperatures may differ from thermostat settings in cases where the thermostats may need to be recalibrated; and self-reported temperature settings may reflect the opinion of the respondent as to what the "correct" or "expected" temperature should be.

Cooled Floorspace

Two procedures may be used to calculate cooled floorspace. Procedure One uses only the measured heated floorspace. The heated floorspace (square feet) is multiplied by the number of rooms usually cooled, divided by the total number of rooms in the housing unit. Procedure Two uses total floorspace (heated and unheated) in the housing unit. The total floorspace is then, as in Procedure One, multiplied by the number of rooms usually cooled, divided by the number of rooms in the unit. Procedure One was used in Table 54, page 180 of *Housing Characteristics 1990*. In order to maintain consistency in the consumption estimates for air conditioning, Procedure Two was used in this report. This procedure was used in the nonlinear end-use equations. Procedure Two was also used in estimating cooled space in the publications based on the 1987 RECS. Table B3 shows that the estimated average cooled space is higher when Procedure Two is used. Additionally, the 1990 RECS asked respondents for the number of rooms that "usually" are cooled. In the 1987 RECS, the respondents were asked for the number of rooms that "can" be cooled.

Table B3. Electric Air Conditioning in U.S. Households, 1990

Housing Unit Characteristic	Average Cooled Floorspace (square feet)		Air-Conditioning Equipment Not Used (million households)				
	Procedure One	Procedure Two	Total	Census Region			
				Northeast	Midwest	South	West
All Air Conditioning	1,324	-	3.2	.7	1.0	1.0	.5
Central Air Conditioning	1,723	1,966	1.2	.2	.2	.5	.3
Room Air Conditioning	790	899	2.0	.5	.7	.5	.3

- = Data not calculated.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 A of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

Use of Air-Conditioning Equipment

Air-conditioning consumption and expenditure estimates are based only on those households that use air-conditioning equipment. Table 54, page 180 of *Housing Characteristics 1990* contains data for households that have air-conditioning equipment. Table B3 shows the number of households who did not use their air-conditioning equipment in 1990 and, therefore, were excluded from the air-conditioning statistics.

Gas Central Air Conditioning

Some respondents incorrectly report that they have gas air conditioners when in reality they have electric air conditioners. The majority of the households claiming to have natural gas or LPG central air conditioning may actually have electric systems. Three possible explanations for these errors are as follows: (1) Respondents may have confused the freon gas used within the air-conditioning equipment with the fuel running the compressor; (2) The housing unit is in an apartment building and the occupants do not know the fuel used in the central air-conditioning system; and (3) Households with gas central forced-air heating systems and electric central air-conditioning systems may have thought they were both gas systems. This may be especially true if one

thermostat controls both systems. In the 1990 RECS, an estimated 1.3 million households initially reported that they had gas air conditioners; but after checking back with the respondents, checking with the rental agents, or looking for a pattern in the natural gas utility bills that indicates increased usage during periods of demand for air conditioning, the estimated number of households that use gas air conditioners was reduced to 0.4 million. This estimate may still be too high.

Air-Conditioner Nameplate Data Collection

Short of measuring the actual efficiency of major home appliances, the only means of getting a measure of the rated efficiency of the equipment is from nameplate information affixed to the equipment. In 1990, an attempt was made for the first time, to collect central air-conditioner nameplate data. Interviewers recorded data on the make and model from the air-conditioning unit's nameplate. These units were located outside and were thus accessible to the interviewers. Following are the results of that effort.

In the 1990 RECS, 1,820 (35.7 percent) of the responding housing units had central air conditioning (CAC). Collection of nameplate data was not attempted for multiunit dwellings or for the households responding to the mail questionnaire (483 units). Nameplate data were obtained for the remaining 73.5 percent of the centrally air-conditioned, single-family households. An attempt was then made to match the reported nameplate data with information in the *Air-Conditioning and Refrigeration Institute Directory* to assign a Seasonal Energy Efficiency Ratio (SEER) rating. The SEER is a measure of the cooling output divided by the power consumption; a SEER was assigned to a total of 331 units. For the remaining units, there were several reasons why SEER's could not be obtained: (1) the air-conditioner nameplate data obtained was incomplete (597 cases); (2) a match could not be found for the air-conditioning nameplate data reported (283 cases); and (3) SEER's were not available for air-conditioning units manufactured before 1980 (126 cases).

Results of attempts to assign SEER's for single-family housing units or mobile homes with central air conditioning or heat pumps are summarized in Table B4.

Table B4. SEER Collection Results from the 1990 RECS

SEER Code	Frequency	Percent	Cumulative Percent
Valid SEER Located	331	18.2	18.2
No Match On Make	574	31.5	49.7
No Model Year	23	1.3	51.0
No Match On Model	283	15.5	66.5
No SEER Available	126	6.9	73.5
Total Obtained	**1,337**	**73.5**	**-**
Mail Questionnaire	99	5.4	78.9
Multifamily Unit	384	21.1	100.0
Total Not Obtained	**483**	**26.5**	**-**
Total CAC Units	**1,820**		**100.0**

- = Data not calculated.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 A of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

There are two ways of computing the response rate and assessing the success of this effort. The first is to note that SEER's for 331 of the total 1,820 cases that had central air conditioning were obtained. Thus, a response rate of 18.2 percent was achieved. The second is to take into account that no attempt was made to collect air-conditioner nameplate data from the 483 multifamily dwellings and mail-in questionnaire housing units with central air conditioning. Thus, SEER's for 331 of 1,337 possible cases were obtained, achieving a response rate of 25 percent.

The mean value of the 331 SEER's obtained was 8.74; the median was 8.70; and, the mode was 9.00. Table B5 illustrates the distribution of the 331 SEER's.

Table B5. Frequency Distribution of SEER's Collected in the 1990 RECS

SEER Code	Frequency	Percent	Cumulative Percent
Less than 6.51	7	2.1	2.1
6.51 to 7.00	22	6.6	8.8
7.01 to 7.50	15	4.5	13.3
7.51 to 8.00	33	10.0	23.3
8.01 to 8.50	63	19.0	42.3
8.51 to 9.00	79	23.9	66.2
9.01 to 9.50	50	15.1	81.3
9.51 to 10.00	27	8.2	89.4
10.01 to 10.50	14	4.2	93.7
10.51 to 11.00	13	3.9	97.6
11.01 and up	8	2.4	100.0

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 A of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

Trends in Heated Square Footage

Trend analysis shows an increase in the average heated floorspace from 1,499 square feet in 1980 to 1,569 square feet in 1990. A review of housing unit measurement procedures from 1980 and 1990 showed that the definition of heated square footage and the actual measurement recording procedures were consistent for the two surveys.

In both RECS, interviewers were instructed to measure "all parts of the respondent's household that are enclosed from the weather, including attached garages, basements, and attics (if heated or finished)." In both surveys, an area was considered to be heated if it was "a comfortable place to sit, work, or play during the winter months."

In both RECS, interviewers were equipped with a 50-foot tape measure, were asked to mark the measurements for each floor on a separate diagram, and were asked to shade those areas that were unheated. The format of the pages for recording measurements were somewhat different for the two surveys. In addition, a greater number of interviewer instructions were included in the questionnaire for the 1990 interview. (See "Estimates of Housing Unit Size" in this appendix for a more detailed discussion).

Weather (Degree-Days)

As in the 1987 RECS, degree-days were assigned to housing units for the 1990 RECS from individual weather stations. Previous RECS surveys assigned degree-days from clusters of weather stations contained within an individual National Oceanic and Atmospheric Administration (NOAA) weather division. This change in the methodology from the cluster method to the station method provides more accurate weather data for some households. The problem with using data from a cluster of weather stations is that some clusters contained a high variability in temperatures recorded among stations within the cluster. By selecting an appropriate, nearby weather station, it is believed that the difference between the temperatures actually experienced by a household could be minimized. In selecting an appropriate, nearby weather station, distance was the major consideration but intervening mountain ranges and the presence of bodies of water were taken into account.

This change has made it more difficult to assess trends in degree-days when comparing the 1987 or 1990 RECS with previous RECS. The reader may use degree-day data to make comparisons among the subgroups within the 1987 RECS or the 1990 RECS and between the 1987 and 1990 RECS, but should avoid comparing degree-day data from the 1987 RECS or the 1990 RECS with degree-day data from previous RECS.

Humidity

In the 1990 RECS, for the first time, a measure of relative humidity for the average of the months of June, July, and August was attached to each RECS household. The data were estimated from the average of the morning and afternoon relative humidity for each of the months. As an example, Birmingham, Alabama had 86 and 56 as measures of average relative humidity for the morning and afternoon, respectively, in June 1990. The average relative humidity for June would be 71, averaging morning and afternoon together. In the same manner the average relative humidity was calculated for July and August, yielding 74 and 75, respectively. Averaging over June, July, and August gives for the average relative humidity, 73. This would be attached to a RECS household if Birmingham was the closest city to the RECS household.

The measurements of average relative humidity did not come from the nearest NOAA weather station as did the measurement of the degree-days. The data were obtained from Using *Comparative Climatic Data for the United States Through 1990*, published by NOAA. In this publication, only measurements of relative humidity were available for major weather stations and not the weather station nearest the RECS household.

Number of Residential Buildings

The number of residential buildings was estimated by dividing the household weight by the number of housing units in the building (Table B6). Single-family and mobile homes were assumed to have one housing unit per building. A building was defined as a housing unit separated from another housing unit by walls that went from the basement to the roof, such that one household did not live over another. By this definition, single-family attached housing units were considered individual buildings. RECS does not collect information on the number of single-family attached housing units that are connected together to form what might be considered a building under a different definition. Therefore, the number of households in single-family attached housing units is the same as the number of single-family attached buildings.

Table B6. Relationship Between Number of U.S. Households and Number of Residential Buildings, 1990

Type of Housing Unit	Total Households (million)	Total Residential Buildings (million)	Number of Housing Units per Building
Single-Family	64.4	64.4	1.0
Detached	58.4	58.4	1.0
Attached	6.0	6.0	1.0
Mobile Home	5.2	5.2	1.0
Multifamily	24.4	4.6	5.3
2 to 4 units	10.0	3.6	[a]2.8
5 or More Units	14.4	1.0	[b]14.4

[a]Constant factor applied at the Census region level (Table B7).
[b]Each household record contained the number of housing units in the building and this number was used as the divisor.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1990 Residential Energy Consumption Survey (RECS). Table 18 and RECS Public Use Data Files.

For buildings with two to four housing units, a constant divisor was used in each Census region (Table B7). RECS does not distinguish between two-, three-, and four-unit buildings. For buildings with five or more units, the division was carried out at the individual record level, since RECS collects data on the number of units in buildings with five or more units.

Table B7. Derivation of Number of U.S. Households per Building for Buildings of Two to Four Units, 1990

Census Region	Number of Housing Units (occupied and unoccupied) in:		Number of Housing Units per Building with Two to Four Units[a]
	Two-Unit Buildings	Three- or Four-Unit Buildings	
Northeast	1,986,935	1,500,872	2.7
Midwest	1,313,094	1,081,091	2.7
South	1,054,433	1,295,003	2.8
West	593,656	1,051,323	3.0

[a]Assumes an even split between three- and four-unit buildings.
Source: U.S. Department of Commerce, Bureau of the Census, the 1990 Census of Housing and Population, Summary Tape File 1 (United States).

The number of residential buildings is likely to be underestimated for the reason that RECS interviews are not conducted in vacant housing units. Each vacant unit that was ineligible for a RECS interview represented, in general, the same number of buildings as did a unit where a RECS interview was conducted. The size of the underestimate is likely to be similar to the rate of vacancy, which was 9 percent in the 1989 American Housing Survey.

Nonresponse

There are two major types of nonresponse--for an entire sampled household (unit nonresponse), or for a particular item of interest from a responding household (item nonresponse). Most unit nonresponse is caused by a respondent's refusal to cooperate or by his unavailability. Item nonresponse results when the respondents do not know, or, less frequently, refuse to give the answer to a particular question or the interviewer does not ask the question or record the question during the interview.

The next two sections provide details on the procedures followed for each type of imputation. A third section deals with a special category of item nonresponse--the size of housing units in square feet.

Adjustments for Unit Nonresponse

Weight adjustment was the method used to reduce unit nonresponse bias in the survey statistics. Weights were calculated for each sample household. The household weight reflected the selection probability for that household and additional adjustments. These adjustments included correcting for potential biases arising from the failure to list all housing units in the sample area and to contact all sample housing units. Contacts were not successful with 13.8 percent of the eligible units.

The adjustment for these noninterviews (i.e., unit nonresponse) was designed to spread the effects of nonresponse over the interviewed sample of households in the final cluster. The noninterview weight adjustment is equal to the number of households in the ultimate cluster (interviews plus noninterviews) divided by the number of interviews. When the weight adjustment computed in this way was greater than 2.0, that part of the noninterview adjustment that exceeded 2.0 was spread over the remaining ultimate clusters in the PSU.

The failure to list all housing units in the field-listing task is a common problem in surveys of this type. The result is an undercount of housing units in the sample area and, hence, an underestimate of the number of households in the universe. The undercount in the 1990 RECS was in the range of 8 to 10 percent. This problem is treated in two ways in the RECS. One treatment occurs during the interviewing process. The second treatment occurs in the estimation process. During the interviewing stage, unlisted housing units or households are discovered by querying the household where interviews are conducted to determine if other households are present in the unit. In addition, the interviewer is instructed to conduct an interview at all housing units contained in the geographical area between the interviewed household and the next listed address. This method reduces the number of missed households, but does not completely eliminate the noncoverage problem.

The noncoverage problem is also treated by using ratio estimation to adjust selected estimates of household counts to official population values. Ratio adjustment took place in four stages for the 1990 RECS.

First Stage

The first-stage adjustment was computed from Census information for PSU's in NSR strata only. The purpose of this adjustment was to reduce the contribution of the variance arising from the sampling of PSU's. A separate factor was created for each of 20 cells (four Census regions classified by five space-heating fuel categories). The factors varied from 1.2020 for LPG in the South to 0.8947 for LPG in the Midwest. These factors were the same for the 1984, 1987, and 1990 RECS. The implementation of this factor reduced somewhat the amount of variance caused by the sampling of PSU's. The first-stage adjustment for Cell "c" is given by:

$$R_{1c} = N_c / M_c \qquad (1)$$

Where N_c is the total number of households (1980 Census population) in Cell c for all PSU's in RECS NSR strata (including those PSU's not selected for RECS). M_c is an estimate of N_c obtained from the 1980 Census data for the NSR PSU's that were selected for the 1990 RECS. In particular, M_c is given by the sum (over all NSR PSU's selected for RECS) of the product of the PSU sampling weight and the number of households in Cell c (1980 Census population) for the selected PSU's.

For all observations in NSR PSU's, the households' weights (adjusted for nonresponse) were multiplied by R_{1c} where c is the cell in which the observation falls.

Second Stage

The second-stage factor adjusted the weights (after the nonresponse adjustment and the first-stage adjustment) from the survey so that the sum of the weights in the 12 categories shown in Table B8 will equal the CPS estimates for the population in the 12 categories. The second-stage adjustment for Category k is given by:

$$R_{2k} = H_k / G_k \qquad (2)$$

Where H_k is the CPS estimate of the number of households in Category k, and G_k is the sum of the RECS households' weights before the second-stage ratio adjustment (after nonresponse adjustment and the first-stage adjustment) over all households in Category k. H_k is based on a linear extrapolation of values for each of the 12 cells, using CPS estimates for March 1990 and March 1991 to develop November 1990 estimates.

For all observations in Category k, the households' weights (adjusted for nonresponse and the first-stage adjustment) were multiplied by R_{2k}. This second-stage factor reduced both the between-PSU variance and the within-PSU variance.

Table B8. U.S. Population Estimates Used as Controls in Ratio Adjustment of Sampling Weights in the 1990 RECS

Census Region	Thousand Households			
	Urban			
	Central City	Suburban	Rural	Total
Northeast	6,470	10,485	2,268	19,223
Midwest	6,878	9,648	6,543	23,069
South	9,417	13,627	9,252	32,296
West	7,080	9,262	3,061	19,403
Total United States	29,845	43,022	21,124	93,991

Note: See "Glossary" for definition of urban, suburban, and rural.
Source: Estimates derived from the March 1990 and March 1991 Current Population Surveys, U.S. Bureau of the Census.

Third Stage

The third stage in the weight adjustments was similar to the second stage. The only difference was that instead of the 12 categories used in the second stage, the following three categories were used:

1. One-person households, male householder,
2. One-person households, female householder,
3. All other households.

The purpose of this third stage was to reduce possible bias in the RECS sample due to undercoverage of one-person households, particularly those comprised of a single male.

Fourth Stage

The fourth and final stage in the weight adjustments was exactly like the second stage. The final household weights will (for each of the categories in Table B8) sum to the control totals shown in that table.

Adjustments for Item Nonresponse--Household Survey

Item nonresponse occurs when respondents do not know the answer or refuse to answer a question or when an interviewer does not ask a question or does not record an answer. Imputations were made for nonresponse on about two-thirds of the items for which some nonresponse occurs, including most items to be used for making national estimates. Items for which national estimates are made, but for which imputations were not made, include questions on the presence, type, and amount of attic and floor insulation; indoor temperatures; and the presence of wall insulation. For these items, no variables existed where correlations with the missing item were strong enough upon which to base an imputation procedure.

"Hot-deck" imputation was the method used most frequently (Table B9). The hot-deck procedure requires sorting the file of households by variables related to the missing item. A household is then selected that has the same value for the related variables, and this "donor" household supplies the value for the variable that is missing in the "donee" household.

Table B9. Imputation Methods Used for the 1990 RECS

Imputation Method	Questionnaire Items Subject to Imputation	
	Number	Percent
Not Imputed	139	32
Imputed	290	68
Hot-Deck	179	42
Random	54	13
Deductive	34	8
Allocation	23	5
Total Items*	429	100

*There are an additional 74 questionnaire items for which missing values, if any, were determined by explicit editing rules in the initial stages of questionnaire editing.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

Less frequently used imputation methods included random selection from the known values of a variable and deductive and allocation procedures.

The random selection procedure was used primarily to impute for continuous numerical values and missing numbers that were conditional on other numbers (e.g., number of storm windows is conditional on total number of windows).

Deductive procedures were used primarily for missing information on fuels used for specific purposes and methods of payment for fuel uses. The amount of missing data on these items was generally quite small; other available information in the questionnaire, or from related data sources (utility bills and rental agent survey), provided reasonably conclusive assignments for the missing data.

Allocation procedures involved the use of explicit rules to assign values in place of missing information on relationship to householder, and age and sex of persons in household, based on the configuration of known information on these variables for other household members.

Table B10 lists the items most frequently imputed in the 1990 RECS. The amount of item imputations for the 267 households receiving mailed questionnaires was considerable since the mailed questionnaire contained only a small subset of questions from the household interview. For the mailed questionnaire, a modified hot-deck imputation method was used. A hot-deck matrix was created for both mailed-questionnaire and personal-interview households using Census region, type of housing unit structure, space-heating fuel, hot-water fuel, and presence and type of air conditioning. Whenever possible, a donor personal-interview household was chosen for each mailed-questionnaire household from the same cell of the hot-deck matrix. For 99 percent of the mailed questionnaires, donors matched on all hot-deck variables.

Because each cell of the matrix usually contained several possible donors, a donor was chosen from the cell on the basis of how closely it matched the mailed-questionnaire household on a number of additional variables. These variables were: income, number of household members, number of household vehicles, age of householder, tenure, number of rooms, model year of newest vehicle, and household structure (married couple, other). Except for information on household vehicles, which was taken directly from the mailed questionnaire, the entire set of

Table B10. Items Most Frequently Imputed in the 1990 RECS

Imputed Item	Cases Imputed	Percentage of Total Sample[a] (4,828)	Method of Imputing	Question Number on Questionnaire
Annual Family Income	693	14	Hot-deck	K-10
Number of Storm Doors	484	10	Random	N-2
Water Heater in Heated Area Status	281	6	Hot-deck	C-7
Availability of Natural Gas	279	6	Hot-deck	B-1
Household Able to Heat with Auxiliary Fuel	274	6	Hot-deck	B-8
Water Heater Size	269	6	Hot-deck	C-6
Water Heater Age	253	5	Hot-deck	C-5
Government Help Weatherizing	243	5	Hot-deck	L-6
Main Fuel Same as in November 1987	234	5	Hot-deck	B-3
Amount of Heat From Main Fuel	188	4	Hot-deck	B-7
Lower Rent Due to Government Aid	178	4	Hot-deck	L-13
Have Basement Insulation	159	3	Hot-deck	M-10
Household on Budget Plan	158	3	Hot-deck	I-1
Year House was Built	156	3	Hot-deck	A-6
Square Feet of Housing Unit	154	3	(b)	--
Type of Foundation	136	3	Hot-deck	P-11
Housing Project Status	117	2	Hot-deck	L-12
Number of Fluorescent Lights	108	2	Random	E-7
Number of Floodlights	107	2	Random	E-6
Year-Round Use of First Refrigerator	101	2	Hot-deck	F-7
Age of Central Air Conditioner	88	2	Hot-deck	D-7
Race of Householder	82	2	Hot-deck	K-7
Age of Other Household Members	80	2	Allocation	K-3
Basement or Crawl Space Heated	65	1	Hot-deck	P-12
Age of Householder	55	1	Allocation	K-3
Number of Rooms Cooled	55	1	Random	D-2
Marital Status of Householder	52	1	Hot-deck	K-6
Percent of Basement Insulated	50	1	Hot-deck	M-11

[a]Mailed questionnaires are not included in the percentage. To account for these, add five percentage points to the percentage points given.

[b]See section "Estimates of Housing Unit Size."

-- = Data not available.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

responses from the donor household was imputed to the mailed-questionnaire household. This means that all responses for mailed-questionnaire households are imputed except for weather data, fuel-consumption data acquired from the household's energy suppliers, the geographic location of the mailed-questionnaire household, information on household vehicles, and those items in the hot-deck imputation process for which an exact match was obtained.

Estimates of Housing Unit Size

Interviewers for the 1990 RECS were given a retractable 50-foot metal tape measure to ascertain the dimensions of housing units. The instructions were to measure the "area enclosed from the weather." This included garages attached to the house, attics either heated or finished, and basements enclosed from the weather (see "Floorspace" in "Glossary" for further definition). Interviewers indicated on a rough-drawn diagram of the floor plan which areas were heated and unheated and recorded the dimensions of the heated areas and the unheated areas. This finer

breakdown into heated and unheated areas more closely measures the floorspace of the housing unit that places the demand on the heating system and, therefore, is the figure that may prove to be more useful in analyzing residential energy consumption. All measurements were rounded to the nearest foot by the interviewer or in the editing process. Interviewers were given an option of measuring the home from the inside, taking into account the thickness of inside walls, or from the outside.

Interviewers attempted to measure the size of all 4,828 housing units where personal interviews were conducted. In 4,674 cases, usable measurements were acquired or were available from data collected during the 1990 RECS. In 154 cases, the measurements either were not usable or were not made. Although most cases contained the basic information, some imputations were required to produce a final set of 3-square footage amounts for each housing unit:

HOME AREA = total square footage of floorspace enclosed from the weather

HEATED = total square footage of heated floorspace

UNHEATED = HOME AREA - HEATED = total square footage of unheated floorspace.

Various pieces of information were missing and were imputed (Table B11). The imputations required standardizing all measurements to outside measurements when the measurement was made from inside the home, characterizing a measurement as inside or outside when this was unknown, apportioning the total space between heated and unheated when this proportion was unknown or partially known, and estimating the total square footage when the measurements were not made or not usable.

Table B11. Completeness of Data on Square Footage of Housing Units in the 1990 RECS

Amount of Information Collected	Number of Households	Percent
Complete Set of Dimensions	3,642	75
Outside Measurement of Home	2,515	52
Inside Measurements of Home	1,127	23
Some Data Missing	1,032	21
Information available on heated and unheated areas. Unknown whether dimensions are for inside or outside of home.	767	16
Total floorspace known but information on heated and unheated areas is missing. Also may be unknown whether dimensions are for inside or outside of home.	42	1
Basement dimensions missing.	78	2
Information available for all floors except basement. Basement total floorspace known, but information on heated and unheated areas for basement is missing.	69	1
Information on heated and unheated area were taken from the 1987 RECS data.	76	2
No Usable Measurements	154	3
Total	4,828	100

Notes: • The floorspace for the 267 households responding by mail was imputed through a hot-deck procedure. • These mail questionnaires are not included in this table. • Components may not sum to totals due to independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

The following three sections describe the procedures followed for each of the three major categories of data.

Treatment of Housing Units with Complete Measurements

As shown 3,642 homes had complete dimensions for all enclosed areas and information on which areas are heated and which areas are unheated (Table B11). The only adjustment required for these cases was to scale up the measurements for the 1,127 homes that were measured on the inside. The inside measurements were standardized to outside dimensions. The scaling factor was determined for each housing unit as a function of the floorspace of the first floor, the total floorspace of the home, and the housing unit type (Equation 3).

$$\begin{aligned} SCALE = {} & .984885 \\ & -.000010 \times FSFF \\ & +.000043 \times TFS \\ & -.08627 \times IMH \\ & -.032719 \times ISAH. \end{aligned} \qquad \textbf{(3)}$$

Where: FSFF is the floorspace of the first floor,
TFS is total floorspace of the home,
IMH is the indicator variable for the mobile home and,
ISAH is the indicator variable for the single-family attached home.

Equation 3 indicates that the scale factor varies by the floorspace of the first floor, the total floorspace, and the type of dwelling. In particular, the scale factor is reduced when the dwelling is a mobile home and when the dwelling is a single-family attached home. The scale factor increases as the floorspace of the remaining floors increases.

These scale factors, which increased the inside measurements, ranged from 1.001 to 1.245. Ninety-five percent of the scale factors were under 1.087. If the equation resulted in a scale factor of less than 1.0, the scale factor was set equal to 1.001. There was no upper bound placed on the scale factor.

Equation 3 was developed in the following manner: Regression prediction equations were developed independently for homes measured from the inside and homes measured from the outside. Both equations were used to generate estimates of floorspace for homes measured from the inside. The relationship between the ratio of predicted "outside" to "inside" floorspace, the actual inside floorspace for the first floor, the actual inside total floorspace for these homes, and the housing type were used in fitting the regression Equation 3 for the scale factor.

Treatment of Housing Units with Some Missing Data

The 767 cases lacking information as to whether the measurements were inside or outside, or a combination of inside and outside, were treated as though measurements were outside. This was because average predictions based on regression equations using homes measured outside matched average totals for this group very closely, while predictions based on regression equations using homes measured inside were seriously biased on the low side.

The 42 cases lacking information on the ratio of heated to unheated space borrowed that ratio from housing units with complete data, on a PSU-by-PSU basis. For most of these cases, information was also lacking as to whether the measurements were inside or outside, and measurements were again assumed to be outside. In 3 of these 42 cases, the measurements were known to be inside measurements and scale factors were used to increase the floorspace estimates.

For the 78 cases with missing basement dimensions, the basement floorspace was imputed by using a simple regression based on the floorspace of the first floor. The heated and unheated areas were determined or imputed and then added to known totals for the remaining floors. In 15 of these 78 cases, the measurements for the remaining floors were known to be inside measurements and scale factors were used to increase the floorspace estimates.

There were 69 cases in which the ratio of heated to unheated space for the basement was unknown. This ratio was imputed by using an appropriate empirical distribution of heated to unheated ratios. Three such distributions were used: one for single-family homes with basements only; one for homes with a basement plus crawl space and/or slab; and one for basements of homes in buildings with two to four units. In 10 of these 69 cases, the measurements were known to be inside measurements and scale factors were used to increase the floorspace estimates.

Treatment of Housing Units with No Usable Measurements

A regression equation was used for the 154 cases with no usable data. After HOME AREA had been imputed by using the regression equation, the ratio of heated to unheated space was imputed using the same procedures described above for housing units for which that ratio was missing.

The prediction equations for outside dimensions were used in the imputations because regression equations based on cases with inside measurements did not yield fits that were substantially better. This procedure eliminated the need to scale up these estimates to outside dimensions.

Annual Consumption and Expenditures

The consumption and expenditure data that were obtained from the suppliers did not list the annual amounts. Instead, the supplier provided the monthly billing records for the 14-month period from December 1989 through January 1991 (when available). These records listed the amount purchased, the cost of the purchase, and the date of purchase. For natural gas and electricity, the amount purchased was usually equivalent to the amount consumed. The major exception occurred when the supplier had estimated the bill for the billing period. For fuel oil, kerosene, and LPG, the fuel purchased in 1990 may be consumed in 1991 instead of 1990. Conversely, the fuel consumed in 1990 may have been purchased in 1989. The procedures that were used to calculate the annual consumption and expenditure amounts for electricity and natural gas were designed to avoid estimated bills when possible. The annual consumption and expenditure amounts for fuel oil, kerosene, and LPG reflected the amounts purchased. No attempt was made to distinguish between the amount purchased and the amount consumed for fuel oil, kerosene, and LPG.

Nonresponse Statistics

The proportion of households that did not sign authorization forms for suppliers to release billing data was in the range of 1 to 6 percent for the five fuels. Overall the proportion was 5 percent. Most households that signed authorization forms did so at the time of the personal interview or at the time of completing the mailed questionnaire. To maximize the number of households with records, however, a followup request was mailed to those who did not sign a form at the time of the personal interview. About 23 percent of this group returned signed forms in response to the mail request and, therefore, were included in the energy supplier survey.

Factors affecting nonresponse are somewhat different for fuel oil, kerosene, and LPG than they are for electricity and natural gas (Table B12). The most frequent reasons for nonresponse for households using fuel oil, kerosene, or LPG were that the company was unknown or not contacted and that the dealer could not identify the customer.

A number of factors contribute to this nonresponse. First, many customers purchase fuel from a number of dealers on a cash-and-carry basis. Second, some customers use several different energy suppliers and pay cash for deliveries. In both cases, few records are kept and efforts to get consumption records for households rarely are successful.

Table B12. Energy Consumption Records and Missing Data for Survey Households Using Electricity, Natural Gas, Fuel Oil, Kerosene, or LPG
(Percentage of Households Using the Energy Source)

Survey Households	Electricity	Natural Gas	Fuel Oil	Kerosene	LPG
Total Households Using the Energy Source Number	5,094	3,255	700	278	461
Percent	100.0	100.0	100.0	100.0	100.0
Usable Records Received from Supplier[a]	85.1	76.6	58.1	10.1	65.3
Quantity Estimated by Household[b]	(d)	(d)	0.2	62.2	(d)
Nonusable Records Received from Supplier	1.6	2.2	9.6	2.5	8.9
Household Pays Supplier Directly--No Record Available for the Household	7.3	7.0	13.2	24.8	21.0
Household Not Identified in Company Records	1.9	2.1	3.0	1.1	4.7
Company Refused to Participate	(d)	(d)	0.3	(d)	(d)
Company Unknown or Not Contacted	(d)	(d)	3.8	22.6	10.2
Authorization Form Not Signed	5.4	4.9	6.1	1.1	6.1
Fuel Used Included in Rent or Paid in Other Way[c]	6.0	14.2	18.9	0.4	4.8

[a]Data were unusable for electricity and natural gas if the records covered less than 5 months and included seasonal use (heating or cooling) or if the records covered less than 2 months. Data were unusable for fuel oil, kerosene, and LPG if the record covered less than 1 year.
[b]Households in this group are those that purchased kerosene primarily on a cash-and-carry basis. These households supplied estimated purchases of kerosene during the household interview. In addition, if a household indicated that it had the ability to use LPG, fuel oil, or kerosene—but planned no purchases during 1990—the household was assigned a zero consumption.
[c]These data exclude households that paid for some, but not all, uses of fuel.
[d]Represents or rounds to zero.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

Refusal of companies to participate in the survey was not a significant factor.

Some additional factors related to the quality of fuel records are discussed in the following section on data processing and imputations.

Usable Records

Of a total of 5,095 households that participated in the 1990 RECS, 5,094 used electricity (Table B12). For 85.2 percent of these cases, the electric utilities provided usable billing records. On the other hand, 278 sample households used kerosene, but the kerosene suppliers provided usable kerosene billing data for only 10.1 percent of these.

Households lacking consumption records because they do not pay fuel bills directly to fuel suppliers occur most frequently among users of natural gas and fuel oil (see Table B12). These households represent 14.2 percent of the users of natural gas and 18.9 percent of the users of fuel oil.

Imputations

Not all the fuel records that were collected in the energy supplier survey could be used. For example, some records covered too few months and other records were incomplete (Table B12). The problem of nonusable records is small for the metered fuels (electricity and natural gas) since the partial-year records of electricity and natural gas were considered usable. For fuel oil, kerosene, and LPG, the problem of nonusable records was more serious, since 9.6 percent of fuel oil, 2.5 percent of kerosene, and 8.9 percent of LPG records were nonusable. Partial-year records for these fuels were not acceptable.[46]

A variety of information from household respondents as well as from suppliers was reviewed and used as a basis for declaring a fuel oil, kerosene, or LPG record complete or incomplete. Questionnaire information from respondents include the number of suppliers and an estimate of the annual number of deliveries. Suppliers provided dates of onset and termination of service to the household.

Consumption

Households with nonusable records, as described earlier, and households with no records had their annual energy consumption imputed using nonlinear regression techniques. The equations were developed using RECS sample households that had approximately a full year of acceptable data. Separate regression equations were developed for the five fuels: electricity, natural gas, fuel oil, kerosene, and LPG. These equations are described in Appendix D, "End-Use Estimation Methodology."

The strategy for imputing consumption varied across fuels for two reasons. First, fuels differ in the number of ways they can be used. Electricity, for example, is used for a large number of appliances, water heating, space heating, and space cooling. Kerosene, on the other hand, is used almost exclusively for space heating. As a result, the equation for electricity includes a larger number of terms to represent all of the possible end uses. Second, the number of sample cases also influenced the analysis strategy. For the electric and natural gas equations, there were a large number of sample cases, allowing for the inclusion of a greater number of factors. For example, the electricity equations included a variable for the price of electricity.

A final adjustment was made to all imputed fuel quantities. To maintain the variance structure of the unimputed fuel-consumption data, an error term was added to the predicted fuel consumption rather than imputing a single value for all households with equivalent values for all independent variables in the regression equation. This allowed estimates for sampling error to be calculated without separating imputed from unimputed data.

Expenditures

Missing energy expenditures data were imputed by applying a cost factor to the imputed consumption. The cost factor for electricity and natural gas was derived from the energy consumption records of households in the same neighborhood or geographic area as the household that had missing data. The cost factor for fuel oil and kerosene and LPG was based on regression fits for cost versus quantity for all fuel users.

[46]The number of households with partial-year records, as a proportion of total households using the fuel, is 9.3 percent for electricity and 8.5 percent for natural gas.

Estimation of Sampling Error

Sampling error is the random difference between a survey estimate and a population value that occurs because the survey estimate is calculated from a randomly chosen subset of the entire population. The sampling error averaged over all possible samples would be zero, but there is only one sample for the 1990 RECS. Therefore, the sampling error is nonzero and unknown for the particular sample chosen. However, the sample design permits sampling errors to be estimated. This section describes how the sampling error is estimated and presented for statistics given in this report.

Throughout this report, standard errors are given as percents of their estimated values; that is, as relative standard errors (RSE). The RSE is also known as the coefficient of variation. Computations of standard errors are more conveniently described, however, in terms of the estimation variance, which is the square of the standard error.

For a given population parameter Y that is estimated by the survey statistic Y', the relative standard error of Y', $RSE_{Y'}$, is given by:

$$\mathrm{RSE}_{Y'} = \left(\frac{S_{Y'}}{Y'}\right) \times 100 \ . \qquad \textbf{(4)}$$

Thus the standard error of Y', is given by:

$$S_{Y'} = \left(\frac{\mathrm{RSE}_{Y'}}{100}\right) \times Y' \ . \qquad \textbf{(5)}$$

This section provides an explanation and example of the procedures used to calculate approximate RSE's for each statistic shown in Tables 18 through 45 in the "Detailed Tables" section. This section also includes a discussion of the derivation of the procedures used to calculate the approximate RSE's and explanations of the procedures used to calculate the RSE for percentages and for ratios.

For some surveys, a convenient algebraic formula for computing variances can be obtained. However, the RECS used a multistage area sample design of such complexity (see Appendix A, "How the Survey Was Conducted") that it is virtually impossible to construct an exact algebraic expression for estimating variances. In particular, convenient formulas based on an assumption of simple random sampling, typical of most standard statistical packages, are entirely inappropriate for the RECS estimates. Such formulas tend to give severely understated standard errors, making the estimates appear much more accurate than is the case. Instead, the method used to estimate sampling variances for this survey was balanced half-sample replication.
The balanced half-sample replication method involves calculating the value for a statistic using the full sample and calculating the value for each of a systematic set of half samples. (Each half sample contains approximately one-half of the observations contained in the full sample.) The variance is estimated using the differences between the value of the statistic calculated using the full sample and the values of the statistic calculated using each of the half samples.

The half samples are determined by first collapsing the 129 strata used in the sample design into 85 "super" strata to achieve a pairing of the sampling strata. The observations in each of the "super" strata were divided into two sets to form a pair, where each set in the pair contained approximately one-half of the observations in the "super" strata. The 85 "super" strata can be divided into the following groups:

- Forty-four of the "super" strata consisted of two nonself-representing Primary Sampling Units (PSU's) belonging to the same Census divisions, with the observations from one PSU constituting one set in the pair and the observations from the other PSU constituting the other set.

- Thirty-two of the "super" strata consisted of single, large metropolitan areas that came into the sample with certainty. The pairs for these "super" strata were formed by dividing the Secondary Sampling Units (SSU) selected for the PSU's into two groups. The observations in one of the groups of SSU's constitute one set in the pair. The observations in the other group of SSU's constitute the other set. There was no between-PSU component of variance for self-representing PSU's.

- The nine remaining "super" strata consisted of a single nonself-representing PSU that was treated as a self-representing PSU. These nine unmatched nonself-representing PSU's were not matched due to a desire to: (1) match PSU's with other PSU's that are in the same Census division, (2) match PSU's consisting of MSA's with PSU's consisting of other MSA's, (3) match PSU's consisting of non-MSA counties with other non-MSA PSU's, and (4) treat Alaska and Hawaii as two separate and unique strata.

Half-sample replication involved repeatedly drawing pair members from the 85 "super" strata. Each replication was called a "half sample" because only one member of the pair within each of the 85 "super" strata was selected. For each half sample, the sampling weights were ratio adjusted upward. The result of the adjustment is that the sum of the weights for each of the 12 cells (four Census regions by three types of Metropolitan Statistical Area (MSA)) equals the appropriate control total (See Table B8). In this way, each half sample can produce unbiased survey statistics based on roughly one-half of the data. Using different combinations of members from the 85 pairs, it is possible to produce a total of $2^{85} = 3.9 \times 10^{25}$ unique half samples. Although desirable for good variance estimation, such an extremely large number of half samples would be computationally infeasible. However, the method of balanced half-sample replication allows a small number of half samples (approximately equal to the number of "super" strata) to produce estimates of variance that are identical to estimates based on all possible unique half samples for linear survey statistics. The use of ratio adjustments in RECS means that even a statistic giving the number of households in a category is not a linear statistic. For nonlinear survey statistics, the variance estimate computed using the method of balanced half samples is approximately equal to the variance estimate computed using all possible half samples. With this balancing method, each half sample is constructed by using an orthogonal matrix to control the selection of pair members from the "super" strata. For the 1990 RECS, 128 balanced half samples were used in variance estimation.

The variances are estimated using the balanced half-sample replication method in the following way. Let Y' be an estimate of the population characteristic Y (for example, total number of households in the West Census region whose main space-heating fuel is natural gas). Then, the estimated variance of Y' is given by:

$$S_{Y'}^2 = \left(\frac{1}{128}\right) \sum_{k=1}^{128} (Y_k' - Y')^2 \quad . \qquad \textbf{(6)}$$

Where Y_k' is the k^{th} half-sample estimate of Y. The standard error of Y' is given by:

$$S_{Y'} = \sqrt{S_{Y'}^2} \quad . \qquad \textbf{(7)}$$

As mentioned above and in Appendix A, "How the Survey Was Conducted," the national total number of households is not estimated from the survey results. The household weights are ratio adjusted so that the total weighted number of households equals the number obtained from the CPS. The same is true for the total number of households in the 12 cells mentioned above (four Census regions by three types of MSA designations). The balanced half-sample replicate procedure used for RECS assumes that the CPS numbers are exact and are not subject to error. Any error in the CPS results can be considered as a bias in the RECS results and not as part of the sampling error for RECS. The weights for each half sample are also constructed such that the national total and the total for the 12 cells match the CPS numbers. As a result, the half-sample estimate for the RSE of the national total number of households and

the RSE's for the totals in the 12 cells will always be zero. Also, the half-sample estimate of the RSE will be close to zero whenever the statistic involved is a household count that is close to a control total. Examples of this are the national total for the number of households that use electricity and the number of households that have a refrigerator.

Generalized Variances

For every estimate in this report, the RSE was computed by the balanced half-sample replication methods described above. This was the RSE used for any statistical tests or confidence intervals given in the text, or to determine if the estimate was too inaccurate to publish (RSE greater than 50 percent).

Space limitations prevent publishing the complete set of RSE's with this document. Instead, a generalized variance technique is provided, by which the reader can compute an approximate RSE for each of the estimates in the detailed tables. For the statistic in the i^{th} row and j^{th} column of a particular table, the approximate RSE is given by:

$$RSE_{i,j} = R_i \times C_j, \quad \textbf{(8)}$$

where R_i is the RSE row factor given in the last column of row i, and C_j is the RSE column factor given at the top of column j. This value for the relative standard error can be used to construct confidence intervals and to perform hypothesis tests by standard statistical methods. However, because the generalized variance procedure gives only approximate RSE's, such confidence intervals and statistical tests must also be regarded as only approximate.

Derivation of Row and Column Factors

The row and column factors are determined from a two-factor analysis of the table of RSE's on the basis of the model

$$\log(RSE_{i,j}) = m + a_i + b_j \, . \quad \textbf{(9)}$$

The least-squares estimates for this model are given by:

$$m = \overline{\log(RSE)}$$

$$a_i = \overline{\log(RSE_{i.})} - \overline{\log(RSE)} \quad \textbf{(10)}$$

$$b_j = \overline{\log(RSE_{.j})} - \overline{\log(RSE)}$$

where $\overline{\log(RSE)}$ is the mean of $\log(RSE_{i,j})$ over all rows i and columns j, $\overline{\log(RSE_{i.})}$ is the mean over all columns j for a particular row i, and $\overline{\log(RSE_{.j})}$ is the mean over all rows i for a particular column j. The row and column RSE factors are then computed as

$$R_i = \log^{-1}(m + a_i)$$

$$= \log^{-1}\left(\overline{\log(RSE_{i.})} \right)$$

(11)

$$C_j = \log^{-1}(b_j)$$

$$= \log^{-1}\left(\overline{\log(RSE_{.j})} - \overline{\log(RSE)} \right) .$$

The RSE row factor, R_i, is thus the geometric mean of the RSE's in row i, and the RSE column factor, C_j, is an adjustment factor with geometric mean equal to 1.0.

For a few table cells, there were no sample cases, hence no estimate and no RSE. As a result, some of the arrays of directly estimated RSE's had a few missing values. In such cases, the formulas given above for row and column factors still apply, but only after appropriate estimates have been substituted for the missing values.

The estimation procedure used to obtain the row and column factors does not use RSE's that are less than 1.0 percent or greater than 50.0 percent. In addition, if the statistic for a cell is not listed for any reason (high RSE, small cell sample size, or missing data), the RSE for that cell is not used in the procedure. The RSE for this cell is treated as if there was a missing value for this cell. This convention is used because the product of the row and column factors frequently is an inaccurate estimate for these RSE's. Using these cells in the calculation of the row and column factors may result in factors that give inaccurate RSE estimates for other cells.

Whenever a household count is a control total, its RSE is zero. Hence, RSE's of control totals are not used in the row column factor calculations. Rows that contain only control totals have a row factor that was set to equal zero. Rows that only contain household counts that are close to control totals do not have a listed row factor. A footnote is given that tells the reader that the RSE's for all statistics in these rows are less than 1.0 percent. This occurs because the half-sample estimates for the RSE's for all statistics in the row are less than 1.0 percent. The row factors for these rows should be a positive number but the number will be small.

For detailed discussions of the accuracy of the RSE approximation, the procedure for estimating confidence intervals, and the statistical tests of hypotheses, see Nonresidential *Buildings Energy Consumption Survey: Commercial Buildings Consumption and Expenditures 1983, DOE/EIA-0318(83)* (Washington, DC, September 1986).

Determination of Relative Standard Error for Percentages Based on Household Counts

The following procedure can be used when the population of the numerator is a subset of the population of the denominator. Let X be an estimate of the number of households that have both characteristic C_1 and characteristic C_2. Let Z be an estimate of the number of households that have characteristic C_1 but do not have characteristic C_2. Set Y = X + Z. Then Y is an estimate of the number of households that have characteristic C_1. Set p = 100 X/Y. Then p is an estimate of the percentage of households that have characteristic C_2 among all households that have characteristic C_1. The RSE of p can be approximated using:

$$RSE(p) = \sqrt{[RSE(X)]^2 - [RSE(Y)]^2} .$$

(12)

The following example illustrates this equation. Among the 51.7 million households that used natural gas as their main space-heating fuel, 34.9 million or 68 percent used a central warm-air furnace as the main space-heating equipment (Table 34). The approximate RSE for 51.7 million households that use natural gas as their main space-heating fuel was 3.40 percent. The approximate RSE of the 34.9 million households that used a natural gas central warm-air furnace as their main space-heating equipment was 3.91 percent.

Using the above equation the RSE of the percent is:

$$RSE(p) = \sqrt{3.91^2 - 3.40^2}$$
$$RSE(p) = 1.93. \quad \textbf{(13)}$$

This approximation works best when RSE(X) and RSE(Y) are estimated using the row column procedure or a generalized variance equation. The approximation may differ greatly from the correct value if RSE(X) and RSE(Y) are half-sample estimates. This equation may also produce inaccurate approximations when it is applied to percentages that are not based on household counts or are based on ratios of household counts that cannot be characterized as described above.

Determination of the Relative Standard Error for Ratios

This procedure can be used when the population of the numerator is not a subset of the denominator, but instead is one estimate divided by another. The following equation provides an approximate RSE for ratios not presented in the tables.

$$RSE\left(\frac{X}{Y}\right) = \sqrt{[RSE(X)]^2 + [RSE(Y)]^2}\,. \quad \textbf{(14)}$$

The following example illustrates this equation. The number of households in the urban areas of the country where the main space-heating fuel is natural gas was 43.1 million. The approximate RSE (as determined by the row-column method) was 3.72 percent (Table 34). The number in the rural areas where the main space-heating fuel is natural gas was 8.7 million households, with an approximate RSE of 8.00 percent. The ratio of these estimates shows that 4.95 times as many households in the urban areas use natural gas as their main space-heating fuel as in the rural areas. The RSE of this ratio is:

$$RSE\left(\frac{X}{Y}\right) = \sqrt{3.72^2 + 8.00^2}$$
$$RSE\left(\frac{X}{Y}\right) = 8.82. \quad \textbf{(15)}$$

The standard error of the ratio is:

4.95 x (8.82/100) = 0.44

The half-width for the 95 percent confidence interval is:

1.96 x 0.44 = 0.86

The confidence interval for the ratio is 4.95 ($\pm$ 0.86).

Determination of the Standard Error of the Difference Between Two Statistics

The procedure used to compute the standard error of the difference between two statistics follows:

$$S_{X_1-X_2} = \sqrt{[S_{X_1}]^2 + [S_{X_2}]^2}. \quad \textbf{(16)}$$

This procedure assumes the two statistics are not correlated. Using the above example, the standard error of the 43.1 million households in the urban areas that heat with natural gas is 1.60 million households (Table 34). (The RSE is 3.72 percent.) The standard error of the 8.7 million households in the rural areas that heat with natural gas is 0.70 million households. (The RSE is 8.00 percent.) The difference between the number of households in the urban areas and the rural areas was 34.4 million households. The standard error of this difference is:

$$S_{X_1-X_2} = \sqrt{1.60^2 + 0.70^2} \quad \textbf{(17)}$$

$$S_{X_1-X_2} = 1.75.$$

If 1.96 times the standard error is greater than the difference between the statistics, the difference is not statistically significant. In this example, 1.96 times the standard error equals 6.0 million households, while the difference is 34.4 million households. Therefore, it can be said that there is a statistically significant difference between the number of households that heat with natural gas in the urban areas and the number in the rural areas of the country.

Data Analyses Background

Wood Consumption

The following is a detailed explanation of all calculations used in the study of declining wood consumption mentioned in the first section of this report. All of the calculations used in the study are provided. Data used in the calculations were provided by the RECS surveys.

Increased Efficiency of New Wood Stoves:

The efficiency of new wood stoves was estimated from RECS data by comparing the intensity of wood consumption (cords burned per square foot of heated floorspace per heating degree-day) for new wood stoves to wood stoves purchased before 1987.

$$\frac{C_n / (HDD_n \times SF_n)}{C_o / (HDD_o \times SF_o)} = \text{increased efficiency of new wood stoves} \quad \textbf{(18)}$$

$$\frac{3.1 / (4{,}660 \times 1{,}450)}{4.1 / (4{,}841 \times 1{,}534)} = 15.2 \text{ percent} \sim 15 \text{ percent.}$$

Where:

SF_n = square feet of heated floorspace per household purchasing a wood stove between 1987-1990,
SF_o = square feet of heated floorspace per household with wood stove purchased before 1987,
C = cords burned, and
HDD = heating degree-days (base 65 degrees Fahrenheit).

Savings Due to Increased Efficiency of New Wood Stoves:

$$\begin{aligned} x - .15x &= \text{total cords burned by new stoves} \\ x - .15x &= 5{,}020{,}000 \\ .85x &= 5{,}020{,}000 \\ x &= 5{,}905{,}882. \end{aligned} \quad \textbf{(19)}$$

Where:

x = total number of cords that would have been burned if new stoves had not been 15 percent more efficient and
.15x = total number of cords saved due to the 15-percent increase in the efficiency of new stoves.

Therefore:

number of cords saved = x - number of cords actually burned and
5,905,882 - 5,020,000 = 885,882 or ~ 1 million cords saved.

Savings Due to Reduced Consumption of Wood as an Energy Source for Main Space Heating:

$$\begin{aligned} S &= N87 - N90 \\ S &= (3{,}900{,}000 \times 4.7) - (3{,}900{,}000 \times 3.9) \\ S &= 18{,}330{,}000 - 15{,}210{,}000 \\ S &= 3{,}120{,}000 = \text{cords saved.} \end{aligned} \quad \textbf{(20)}$$

Where:

S = number of cords saved due to reduced average consumption for homes using wood as main space-heating energy source,
N87 = 1990 number of households times 1987 rate of consumption,
N90 = 1990 number of households times 1990 rate of consumption.

Savings Due to Fewer Homes Using Wood as an Energy Source for Main Space Heating:

$$\begin{aligned} S &= N87 - N90 \\ S &= (5{,}000{,}000 \times 3.9) - (3{,}900{,}000 \times 3.9) \\ S &= 19{,}500{,}000 - 15{,}210{,}000 \\ S &= 4{,}290{,}000 = \text{cords saved.} \end{aligned} \quad \textbf{(21)}$$

Where:

S = number of cords saved due to reduced number of homes using wood as main space-heating energy source,
N87 = 1987 number of households times 1990 rate of consumption,
N90 = 1990 number of households times 1990 rate of consumption.

Percent of Decline Attributable to Given Factor

Dividing the cords saved for each factor by the total decline in cords provided the percentage of the decline which could be attributed to a given factor. Savings due to the reduced rate of wood consumption was 29 percent and savings due to fewer homes using wood as the main space-heating energy source was 34 percent. The 1 million cords saved by the improved efficiency of new wood stoves was 7 percent of the 13.5 million-cord decline in wood consumption from 1987 to 1990. These wood stoves were used for both main and secondary space heating.

The remaining 37 percent was attributable to change in the use of wood as a secondary space-heating energy source.

Calculation of Stock Efficiencies

Available efficiency data on new model appliances cover the period from 1972 to 1990 (*Energy Conservation Trends*, DOE/PE-0092, Table 18; J. McMahon, written communication). The units of measure for the mandated standards vary according to type of appliance. For example, the freezer standard is in kilowatthours per year (kWh/yr), while the heat pump standard is a seasonal energy efficiency ratio (SEER). Appliance efficiency data were normalized to a 1972 base efficiency of 100, in order to show the relative efficiency improvement for a given appliance over time. These normalized values should not be used to directly compare different types of appliances.

Table 7 in *Housing Characteristics 1990* provides information on the age distribution of the existing stock of appliances in 1990. These age data are also listed in Table B13. The age distribution for an appliance is given as percentages (of all households) for age ranges, rather than percentages for each age year. For example, Table 7 of *Housing Characteristics 1990* indicates that 20.9 percent of freezers were between 5 and 9 years old in 1990. These data provided the information that was used to calculate the stock efficiencies for individual appliances for the year 1990.

The time frame that was selected for analysis was the years 1960 to 1990. Because efficiency data were unavailable for years prior to 1972, it was necessary to extrapolate the 1972 to 1990 efficiency data to earlier years. All of the appliances, with the exception of natural gas furnaces, showed a linear or nearly linear efficiency-age relationship for the entire 1972-1990 range. The relationship for natural gas furnaces was distinctly nonlinear across its entire age range. For this appliance, linear extrapolation of data from 1972 to 1978 was applied to the pre-1972 data.

An alternative approach to the extrapolation would have been to assume the 1972 base level of 100 for years prior to 1972. In most cases the difference in the calculated stock efficiency when using both assumptions is very small since the relative share of appliances that are at least 20 years old is small--i.e., most appliances were replaced before they got that old. The two exceptions were freezers and natural gas furnaces, both of which had a significant proportion in the 20-years-or-older category (19.7 percent for freezers and 26.2 percent for furnaces; see Table B13). However, the difference between the two assumptions yielded relatively small differences in stock efficiencies, less than 1 percent for the furnaces and less than 13 percent for the freezers.

Once all of the yearly new unit efficiencies were derived, the 1990 stock efficiency for each appliance was calculated. Table B13 shows the age distributions and average efficiencies for each of the RECS age categories. For each age category, the average efficiency is calculated by: (1) calculating the inverse of the efficiency for each year in the age category, (2) calculating the average of the inverses over all years in the age category, and (3) setting the average efficiency for the age category equal to the inverse of the average. The 1990 stock efficiency is calculated by: (1) calculating the inverse of the average efficiency for each age category, (2) calculating the

Table B13. 1990 Stock and New Model Energy Efficiencies and Age Category Information by Appliance Type

Appliance	Age Category[y] (percent of households)					1990 Stock Efficiency (1972=100)	1990 New Unit Efficiency (1972=100)
	Fewer Than 2 Years	2 to 4 Years	5 to 9 Years	10 to 19 Years	20 Years or More		
Room Air Conditioner						**117.2**	**146.0**
Age Distribution (% of households)	12.4	23.0	30.1	27.5	7.0		
Average Efficiency (1972=100)	143.9	134.2	122.5	105.5	78.3		
Central Air Conditioner						**115.0**	**139.8**
Age Distribution (% of households)	12.0	20.1	26.9	32.3	8.7		
Average Efficiency (1972=100)	139.4	134.9	125.9	104.4	77.9		
Refrigerator						**127.6**	**212.2**
Age Distribution (% of households)	13.9	19.4	28.5	29.8	8.4		
Average Efficiency (1972=100)	207.3	189.5	165.9	116.0	45.2		
Freezer						**114.5**	**194.7**
Age Distribution (% of households)	6.9	11.7	20.9	40.9	19.7		
Average Efficiency (1972=100)	192.6	173.2	156.1	119.5	67.0		

See footnotes at end of table.

Table B13. 1990 Stock and New Model Energy Efficiencies and Age Category Information by Appliance Type (Continued)

Appliance	Age Category[y] (percent of households)					1990 Stock Efficiency (1972=100)	1990 New Unit Efficiency (1972=100)
	Fewer Than 2 Years	2 to 4 Years	5 to 9 Years	10 to 19 Years	20 Years or More		
Natural Gas Warm-Air Furnace						**106.1**	**121.1**
Age Distribution (% of households)	8.1	14.2	19.9	31.7	26.2		
Average Efficiency (1972=100)	120.6	119.6	112.1	101.3	98.4		
Heat Pump						**121.2**	**145.1**
Age Distribution (% of households)	11.9	22.9	39.3	22.4	3.5		
Average Efficiency (1972=100)	143.5	136.6	124.7	104.4	78.1		

[y]Data exclude households with missing data and those that did not know the age of their equipment.

Sources: Energy Information Administration, Office of Energy Markets and End Use, *Housing Characteristics 1990,* DOE/EIA-0314(90), Table 7; U.S. Department of Energy, Office of Policy, Planning and Analysis and Office of Conservation and Renewable Energy, *Energy Conservation Trends,* DOE/PE-0092; J. McMahon, Lawrence Berkeley Laboratory, unpublished data.

weighted average of the inverses using the age distribution as the weights, and (3) setting the 1990 stock efficiency equal to the inverse of the weighted average. This procedure was used because the inverse of the efficiency is proportional to the annual energy consumption. Therefore, using the average of the inverses is equivalent to using the average annual energy consumption. In order to estimate the amount of energy saved, we need to estimate the decrease in the average annual energy consumption. Inspection of the data in Table B13 for a given appliance illustrates how the efficiency improvement over time (shown by the average efficiency for each age category) and the age distribution of units in the 1990 stock combine to give the 1990 stock efficiency.

In each case, the 1990 new unit efficiency is greater than the 1990 stock efficiency (Table 13 and Table B13). The 1990 stock efficiencies range from 106.1 for natural gas furnaces to 127.6 for refrigerators. These stock efficiencies vary widely because they are functions of both the particular mix of ages within the stock and the rate of efficiency improvements for the particular appliance.

All of the preceding calculations are subject to several uncertainties and assumptions. First of all, it was assumed that the respondents accurately recalled the age of their appliances. The oldest age range in the RECS questionnaire, 20 years or greater, is open-ended, while the averaging calculation was arbitrarily extended back to 1960. The impact of the weighted efficiencies of appliances older than 1960 is uncertain, but this impact should be minor as few pre-1960 appliances were still in use in 1990. The use of average efficiencies for the RECS age ranges, rather than yearly efficiencies, added unavoidable uncertainties to the calculations because the energy efficiency changed within these ranges.

Ratio Adjustment Procedures for RECS New Homes Data

The RECS sample of new homes can be ratio adjusted to take advantage of more precise estimates of some characteristics of new homes collected by the Bureau of the Census' Survey of Construction and the Survey of New Mobile Home Placements.[47] These characteristics were the location of new homes by Census region and the increase in floorspace. Since the Census surveys are annual, one can compare to the RECS time periods by cumulating years of Census survey data. This means that for the RECS new homes built from 1988 to 1990, one cumulates the Census surveys for 1988, 1989, and 1990.

There are some major points of difference when comparing these sets of data that may have unknown effects on the results. They include:

- RECS measured the characteristics of all homes at one point in time. This means that the size of homes built from 1985 to 1987 were measured by RECS in November 1990 but by the Census Bureau at the time they were originally constructed. Changes to the size of those homes since they were built were reflected in the RECS measurements, but not in the Census data. This would not have affected the location of homes by Census region, since homes were not likely to have been moved from one region to another.

- Census data included second homes and vacant housing that are excluded from RECS and Census data may include housing that is later used for commercial or industrial purposes. For example, the RECS estimate for number of homes built from 1985 to 1987 is 5.1 million compared to 5.9 million Census estimated were constructed during that period of time.

- Census defines floorspace as areas that are completely finished including space in basements and attics with finished walls, floors, and ceilings. RECS defines floorspace more expansively to include areas that are heated whether or not they are finished. RECS estimates of floorspace are, therefore, larger than Census estimates. For example, the 1990 RECS estimate for heated floorspace for homes built from 1985 to 1987 was 1,581 square feet; the Census estimate at the time of construction was 1,466 square feet.

Location Adjustment

The regional distributions from the Census data were different from those in the RECS sample (Table B14). For example, new homes in the Midwest Census Region were overrepresented in the RECS sample (31 percent of new homes compared with only 19 percent in the Census survey), and those in the West Census Region were underrepresented (13 percent of new homes compared with 26 percent in the Census survey). Readjusting the RECS sample of new homes to match Census distributions affected a number of other statistics for new homes (Table 11). Because RECS included a larger proportion of new homes from the relatively colder Midwest Census Region, the resulting number of annual heating degree-days for new homes[48] was affected. So, too, was the total consumption of energy in new homes. By adjusting the location of RECS homes to match more closely with Census data, the estimate of energy consumption in new homes was reduced from 103.1 million Btu to 94.0 million Btu per household. In homes built from 1985 to 1987, consumption per household increased from 67.6 million Btu to 70.5 million Btu.

[47]See U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing 1990* (Washington, DC, 1991) and earlier volumes.

[48]The higher-than-expected proportion of new homes in the Midwest Census Region and lower-than-expected proportion in the West Census Region inflates the number of annual heating-degree days (6,510 is normal for the Midwest compared to 3,516 for the West Census Region).

Table B14. Regional Distribution Adjustment for U.S. New Homes, 1990

Census Region	RECS Distribution (percent)		Census Distribution (percent)		Adjustment Factors Applied to RECS	
	Homes Built 1988-1990 (A)	Homes Built 1985-1987 (B)	Homes Built 1988-1990 (C)	Homes Built 1985-1987 (D)	Homes Built 1988-1990 (C/A)	Homes Built 1985-1987 (D/B)
United States	100.0	100.0	100.0	100.0		
Northeast	14.3	12.0	14.1	13.4	0.986	1.117
Midwest	30.5	14.4	19.0	15.5	0.623	1.076
South	41.9	54.6	41.1	46.2	0.981	0.846
West	13.3	19.1	25.8	24.8	1.940	1.298

Sources: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1985 data.

Floorspace Adjustment

RECS results indicated new homes built in 1988-1990 had 37 percent more floorspace than homes built in 1985-1987 (Table 21). Census data, however, indicated the increase in floorspace was only 14 percent,[49] which is the lower confidence bound of the RECS estimate (14 to 60 percent). By adjusting the size of new homes to match more closely with Census data after the location adjustment, the estimate of energy consumption in new homes is reduced further to 90.3 million Btu.

The adjustment for floorspace was carried out separately within each region. Sample households with less than the average size were given a weight adjustment different from that for households above the average size (Table B15). The adjustment was less than one or more than one depending on whether the target was an increase or a decrease in floorspace.

[49]Census data indicate that floorspace in new homes (single-family, multifamily, and mobile homes) increased from 1,466 square feet for homes built from 1985 to 1987, to 1,676 square feet for homes built from 1988 to 1990, a 14-percent increase. See U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing 1990* (Washington, DC, 1991) and earlier volumes.

Table B15. Floorspace Adjustment for New U.S. Homes, 1990

Adjustment Steps	Census Region			
	Northeast	Midwest	South	West
Heated Floorspace for RECS Homes Built from 1985-1987 (square feet)(A)	1,741	2,055	1,468	1,450
Increase in Floorspace from 1985-1987 to 1988-1990 (Census data)(B)	1.05	1.11	1.15	1.20
Target Heated Floorspace for RECS 1988-1990 Homes (square feet) (C=A*B)	1,833	2,281	1,688	1,740
Heated Floorspace of RECS 1988-1990 Homes (square feet) (D)	1,593	2,868	2,091	1,242
Theoretical Adjustment Factor (C/D)	1.17	0.80	0.81	1.40
Adjustment Factors[a]				
Homes Below Average Size	0.66	1.40	1.38	0.50
Homes Above Average Size	1.34	0.60	0.62	1.50

[a]These factors were derived from the theoretical factors, so that D will equal C. Except for the West, the factors were about twice the size of the theoretical factors.

Sources: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1985 data.

Post Stratification Procedures for RECS New Homes Data

This section describes the use of poststratification estimation procedures to estimate the mean energy consumption for housing units built from 1980 through 1984, from 1985 through 1987, and from 1988 through 1990. The poststratification results are compared to the 1990 RECS estimates.

Let $\bar{y}$ be the 1990 RECS estimate of the mean amount of energy consumed in housing units built from 1988 through 1990. The following procedure is used to estimate $\bar{y}$. Let y_i be the total annual energy consumption for observation i from the 1990 RECS data set and let w_i be the weight for observation i. Then

$$\bar{y} = [\sum (y_i \times w_i)] / [\sum w_i] \quad \textbf{(22)}$$

where the summation is over all housing units in the 1990 RECS data set that were built from 1988 through 1990.

If outside data can be found that give accurate estimates of the number of housing units by year built and by other categories that are related to energy consumption, then using poststratification estimation procedures may produce more accurate estimates of the mean energy consumption by year built than just using the mean estimated from the 1990 RECS data.

The Bureau of Census' publications *Characteristics of New Housing: 1990, Current Construction Reports* can be used to get the number of housing units by the year of construction, the Census region, main space-heating fuel, and by the housing type.

Suppose that the sample has been divided into H strata, let N_h be the Census' *Characteristics of New Housing: 1990* estimate of the number of housing units in strata h for housing units built from 1988 through 1990. Let N be the Census' *Characteristics of New Housing: 1990* estimate of the total number of housing units built from 1988 through

1990, and let $\bar{y}_h$ be the 1990 RECS estimate of the mean amount of energy used in housing units in strata h that were built from 1988 through 1990.

Then the poststratification estimate of the mean amount of energy used in housing units built from 1988 through 1990 is

$$\bar{y}_{post} = [\sum_{h=1}^{H} (N_h \times \bar{y}_h)] \; / \; N \qquad \textbf{(23)}$$

where the summation is over the H strata.

The poststratification estimation procedures should have a lower variance than the normal RECS estimate if:

1. The Census' *Characteristics of New Housing: 1990* estimate of the number of households in each strata is an accurate estimate. (Hence, the effect of the errors in N_h and N can be ignored.)

2. The strata are chosen so that the households in the same strata are relatively homogeneous with respect to energy consumption, while the strata are relatively heterogeneous.

3. The strata are chosen such that the number of 1990 RECS observations in each strata is reasonable. The larger the value of N_h/N, the larger the number of 1990 RECS observations needs to be.

Condition 2 and 3 imply that the strata need to be defined carefully.

The mean energy consumption is estimated for the following three categories of housing units:

1. Units built from 1980 through 1984

2. Units built from 1985 through 1987

3. Units built from 1988 through 1990

Initially, It was decided to define the strata by

1. Census region

    1.1. Northeast
    1.2. Midwest
    1.3. South
    1.4. West

2. Type of home

    2.1. Single-family homes (attached or detached)
    2.2. Units in multifamily buildings
    2.3. Mobile homes

3. Type of main space-heating fuel

    3.1. Gas (natural gas and LPG)
    3.2. Electric
    3.3. Oil
    3.4. Other and none

This would yield 48 strata from each year-built category. Census new construction data are available for each of the 48 categories in the *Characteristics of New Housing: 1990* reports. (The data on mobile homes are not contained in the reports that cover the period from 1980 through 1984.)

Among the 1990 RECS observations that correspond to homes built from 1988 through 1990, the number of 1990 RECS observations is zero or very small, for some of the 48 combinations of the above characteristics. As a result, the number of strata was reduced to nine.

Table B16 contains the definition of the nine strata that were used along with the number of 1990 RECS observations in each strata and each year-built category.

Table B16. Number of 1990 RECS Observations by Strata and Year-Built Category

Strata Number	Housing Type	Main Space-Heating Fuel	Census Region	Number of Observations		
				Year-Built Category		
				1980-1984	1985-1987	1988-1990
1	Single-Family Home (attached or detached)	Gas or Oil	East	11	13	9
2	Single-Family Home (attached or detached)	Gas or Oil	Midwest	22	23	26
3	Single-Family Home (attached or detached)	Gas or Oil	South	25	8	16
4	Single-Family Home (attached or detached)	Gas or Oil	West	59	32	8
5	Single-Family Home (attached or detached)	Electric	All	99	61	18
6	Units in Multifamily Buildings	Gas or Oil	All	41	10	9
7	Units in Multifamily Buildings	Electric	All	52	32	13
8	Single-Family Homes (attached or detached) and Units in Multi-family Buildings	Other/None	All	25	17	12
9	Mobile Homes	All	All	46	29	27
Total				380	225	138

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1980-1985 data.

In forming these nine strata, the first consideration was given to grouping housing units together according to characteristics that were most related to the mean annual energy consumption of housing units. All three factors (housing type, main space-heating fuel, and Census region) are related to the amount of energy consumption.

The housing units that heated with oil were always grouped with the housing units that heated with gas. This was done because the 1990 RECS sample for new housing units that were heated with oil was very small and the annual energy consumption of homes that heat with oil is similar to that for homes that heat with gas.

For single-family homes (attached and detached) and units in multifamily buildings, the housing units that were heated with electricity were separated from those that were heated with gas or oil. This was done primarily because of the big difference between energy consumption of homes that heat with gas or oil and the energy consumption of homes that heat with electricity.

Because of the small 1990 RECS sample size, all mobile homes were placed into one strata. Similarly, all single-family homes and units in multifamily buildings that were not heated or where the main space-heating fuel was not gas, electricity, or oil, were placed into one strata.

The only case where there was enough 1990 RECS observations to use the Census regions in forming the strata was that of single-family homes that heated with gas or oil. For all other cases, the number of observations of housing units built from 1988 through 1990 was too small for at least one of the Census regions.

Table B17 contains the data that are needed for the poststratification estimation for the year-built category. In particular, the table contains for each strata the Census *Characteristics of New Housing: 1990* estimate of the number of housing units and the 1990 RECS estimate of the average energy consumption.

Table B17. Stratum Estimates of Number of Homes Built and Average Energy Consumption

	Census Estimates of the Number of Housing Units (thousands)			RECS Estimate of Average Energy Consumption (million Btu)		
	Year-Built Category			Year-Built Category		
Strata Number	1980-1984	1985-1987	1988-1990	1980-1984	1985-1987	1988-1990
1	267	363	368	103.4	117.3	121.8
2	459	416	497	120.1	139.5	176.1
3	720	461	492	95.8	121.0	136.2
4	508	482	559	107.7	111.0	129.3
5	2,144	1,470	1,072	63.6	50.5	53.0
6	744	657	525	64.0	80.1	75.2
7	1,689	1,132	635	31.1	32.5	31.1
8	285	149	116	52.0	38.0	42.8
9	[1]812	778	622	77.9	78.6	73.3
All Strata	7,628	5,908	4,886	71.9	67.6	103.1

[1]Because of the lack of data in the Characteristics of New Housing reports, this number was set equal to the 1990 RECS results.

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1980-1985 data.

Table B18 lists the resulting poststratification estimates and the original 1990 RECS estimates of the average annual energy consumption for the year-built category.

Table B18. Poststratification Estimates and 1990 RECS Estimates of Average Annual Energy Consumption
(Million Btu)

Year-Built Category	Poststratification Estimate	RECS Estimate
1980-1984	68.3	71.9
1985-1987	74.5	67.6
1988-1990	89.7	103.1

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey.

Tables B19, B20, and B21 show both the Census *Characteristics of New Housing: 1990* estimates and 1990 RECS estimates of the number of households by strata and year-built category. In addition, the tables also contain the ratio of the RECS estimate to the Census *Characteristics of New Housing: 1990* estimate. This ratio and the average consumption, also shown in the tables, can be used to explain why the poststratification estimate differs from the original RECS estimate.

Table B19. Stratum Estimates for Homes Built from 1980 Through 1984

Strata Number	Number of Housing Units (thousands)		Ratio of RECS Estimate to Census Estimate	RECS Estimate of Average Energy Consumption (million Btu)
	Census	1990 RECS		
1	267	164	0.61	103.4
2	459	432	0.94	120.1
3	720	778	1.08	95.8
4	508	1,087	2.14	107.7
5	2,144	2,289	1.07	63.6
6	744	716	0.96	64.0
7	1,689	1,367	0.81	31.1
8	285	382	1.34	52.0
9	[1]812	812	1.00	77.9
Total	7,628	8,027	1.05	71.9

[1]Because of the lack of data in the Characteristics of New Housing reports, this number was set equal to the 1990 RECS results.

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1980-1985 data.

Table B20. Stratum Estimates for Homes Built from 1985 Through 1987

Strata Number	Number of Housing Units (thousands)		Ratio of RECS Estimate to Census Estimate	RECS Estimate of Average Energy Consumption (million Btu)
	Census	1990 RECS		
1	363	171	0.47	117.3
2	416	403	0.97	139.5
3	461	183	0.40	121.0
4	482	488	1.01	111.0
5	1,470	1,739	1.18	50.5
6	657	114	0.17	80.1
7	1,132	1,116	0.99	32.5
8	149	257	1.72	38.0
9	778	610	0.78	78.6
Total	5,908	5,081	0.86	67.6

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1980-1985 data.

Table B21. Stratum Estimates for Homes Built from 1988 Through 1990

Strata Number	Number of Housing Units (thousands)		Ratio of RECS Estimate to Census Estimate	RECS Estimate of Average Energy Consumption (million Btu)
	Census	1990 RECS		
1	368	170	0.46	121.8
2	497	609	1.23	176.1
3	492	444	0.90	136.2
4	559	104	0.19	129.3
5	1,072	440	0.41	53.0
6	525	148	0.28	75.2
7	635	176	0.28	31.1
8	116	201	1.73	42.8
9	622	475	0.76	73.3
Total	4,886	2,767	0.57	103.1

Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 1990 Residential Energy Consumption Survey; U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1980-1985 data.

The small sample sizes (see Table B16) imply that the RECS estimates of the number of households in many of the strata will not be very accurate. This is seen in Tables B19, B20, and B21. If the estimation of the amount of energy consumed in new homes is an important result of RECS, then the RECS design should include an oversample of new homes.

The following points should be made concerning the above example.

1. The error in the N_h values cannot be completely ignored. N_h is the Census *Characteristics of New Housing: 1990* estimate of the number of housing units in strata that were built.

    1.1. N_h includes vacation homes, second homes, and seasonal rentals. This implies that, for many strata, N_h should overestimate the actual number that are in scope for RECS.

    1.2. Units that were constructed may have been demolished or converted to some other use by the time of the 1990 RECS.

    1.3. The values for N_h reflect the main space-heating fuel as originally placed in the unit. The household may have changed the main space-heating fuel since the unit was first built. Note that in Tables B19, B20, and B21 the RECS estimate of the number of households in Strata 8 (no space-heating or main space-heating fuel is not gas, oil, or electricity) is always higher than the Census *Characteristics of New Housing: 1990* estimate.

    1.4. The 1990 RECS does not cover many of the homes that were first occupied in the later half of 1990. Also the new construction update procedures for the RECS may have a hard time adequately covering new homes built in entirely new subdivisions. This is reflected in the tendency for the Census *Characteristics of New Housing: 1990* estimates to vary considerably from the RECS estimates in Table B21. This fact can be used as an additional justification for the need to periodically update completely the RECS sample design. The estimates are closer in Tables B19 and B20.

    1.5. The Census *Characteristics of New Housing: 1990* estimates for the period from 1980 through 1984 may be seriously out of date by 1990. The errors in the values for N_h for the 1980 through 1984 year-built category may be too large. Consequently, the use of poststratification procedures for the 1980 through 1984 year-built category may not be a reasonable thing to do.

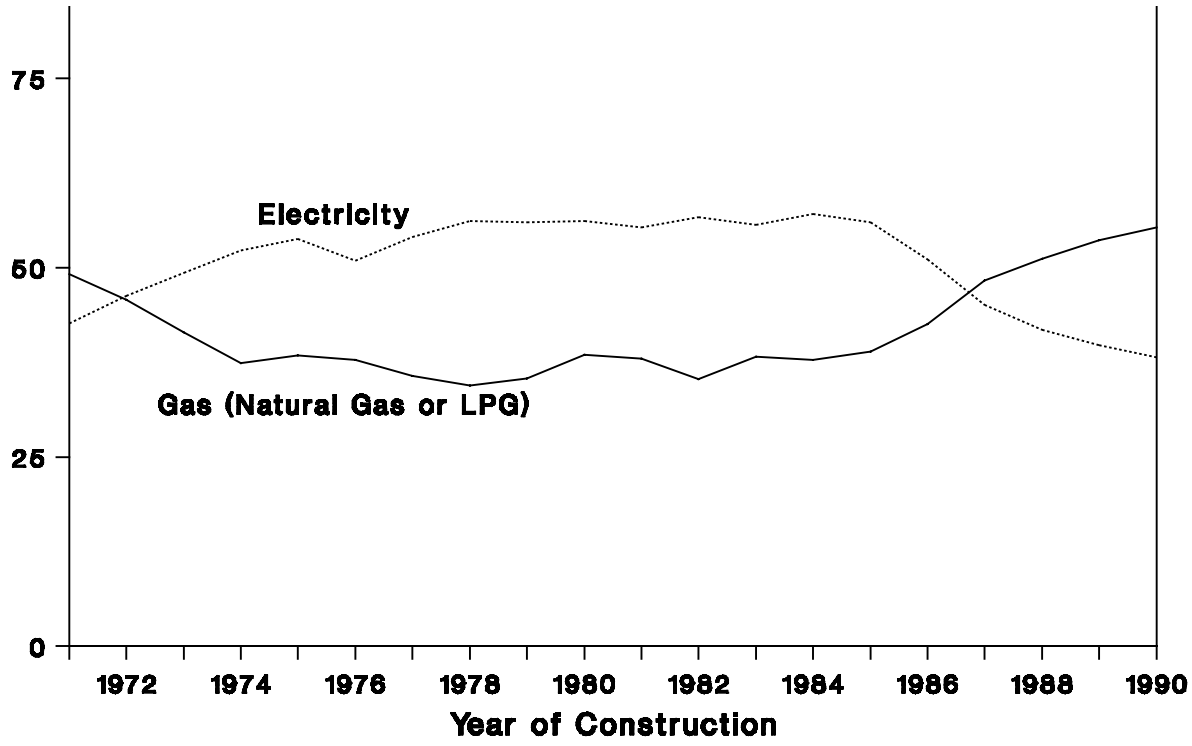
2. One of the reasons the poststratification estimate for homes built from 1988 through 1990 is lower than the RECS estimate is that the ratio of the Census *Characteristics of New Housing: 1990* estimate to the RECS estimate (see Table B21) tends to be higher than 0.57 (the overall ratio) for strata with high consumption (single-family units heated with gas or oil) and lower than 0.57 for strata with low consumption (single family units that heat with electricity and multifamily units in general).

Data Comparison

The RECS is limited in its ability to detect small changes or trends due to (1) its relatively small sample size which leads to higher standard errors that can mask or confound small changes and (2) the fact that it is fielded only once every 3 years, which means that a trend can be as much as 3 years old before RECS identifies it. Therefore, other data series may be used to help augment the RECS data by providing more detailed estimates.

An example of such detail is the year-by-year history of the fuel chosen for new housing constructed from 1971 to 1990. This annual history shows the end of a 14-year dominance by electricity over gas (natural gas and LPG) as the main space-heating fuel in new single-family and multifamily homes (Figure B1). The annual data available from surveys of new housing indicate that the dominance of electricity began in 1973 and ended in 1987. Data not shown in Figure B1 indicate that for privately owned single-family units, the crossover point was 1986. There was no crossover point for privately owned multifamily units that favored electric (53 percent in 1990) over gas heat (44 percent in 1990) throughout the period from 1971 to 1990.

Figure B1. Main Space-Heating Fuel in U.S. Single-Family and Multifamily Homes Constructed from 1971 to 1990



Source: U.S. Department of Commerce, Bureau of the Census, *Current Construction Reports--Series C25, Characteristics of New Housing: 1990* (Washington, DC, 1991). See earlier volumes for 1971-1985 data.

End-Use Estimates Validation Study

At the present time, EIA is conducting a study to test the accuracy of the 1990 RECS electricity end-use estimates. These statistically-derived estimates will be compared to submetered estimates from the same households. This comparison is the first direct test of the accuracy of the statistically-derived end-use estimates from the RECS.

Data Interpretation

The 1990 RECS is a rich source of data for analysis of residential energy issues. In undertaking such analyses, it is important for data users to have a complete understanding of the RECS data and to clearly state analytic assumptions in reports. The following illustrates alternative approaches to the estimation of a statistic of interest.

Short-Term Petroleum Fuel-Switching: Estimates of Household Potential Under Different Assumptions

Estimates of the potential to switch from petroleum to other energy sources have been undertaken in the past to analyze and mitigate the impact of supply disruptions in all sectors of the economy including the residential sector.[50] The supply of petroleum is not as predictable today as it has been in the past. The Middle East Gulf crisis of 1990-1991 was a prime example of a potential in supply disruption that may occur at any time.

Recent studies using RECS data to identify one group of households with fuel switching capability have made an assumption based on the type of secondary space-heating equipment used by households. That assumption is that only households using built-in electric units or heating stoves as secondary equipment could rely on that equipment to heat the housing unit to the same level of comfort as the petroleum main space-heating fuel. The 1990 RECS tested this assumption by asking households whether they could switch to a secondary source of heat and still maintain a level of comfort comparable to that provided by the main space-heating equipment. This additional piece of data collected in the 1990 RECS is important information since the household's perception of comfort would be a major factor in a household's decision to switch to the secondary source of heat in a time of crisis.

Of the 7.7 million single-family and mobile homes using fuel oil as the main space-heating fuel (Table 35), approximately 1.7 million households used heating stoves or built-in electric units as secondary equipment (Table B22). These households were assumed to be able to heat their home comfortably with this secondary equipment. However, when asked if this were true, only 0.8 million households replied that it was true. Surprisingly, another 0.6 million households using a fireplace or other type of equipment reported that the secondary equipment they used could be relied on to heat their home comfortably. The net result is that about one-half of those assumed to be able to rely on their secondary space-heating equipment reported they could not rely on their equipment. And another group of about equal size, dismissed as not having fuel switching capability, reported they did have such capability.

Table B22. Secondary Space-Heating Equipment Used in U.S. Households with Fuel Oil-Switching Potential Under Different Assumptions, 1990
(Million Households)

Secondary Space-Heating Equipment	Secondary Space-Heating Equipment Can Comfortably Heat the Home	
	Comfort Assumed Based on Presence of Secondary Space-Heating Equipment	Comfort Assumed Based on Respondent Report
Fuel Oil	1.7	1.4
Heating Stove	1.4	.7
Built-in Electric Unit	.3	.1
Fireplace	NA	.5
Other	NA	.1

NA = Not Applicable.
Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A, B, and C of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data Files.

[50]Recent studies include: (1) Energy Information Administration, *Estimates of Short-Term Petroleum Fuel-Switching Capability*, DOE/EIA-0526 (Washington, DC, May 1989) and (2) International Association of Energy Economics, "Estimates of Short-Term Petroleum Fuel-Switching Potential in Residential Households in the United States" in the *Proceedings of the 13th North American Conference* (November 1991).

This analysis points up the difficulty of inferring fuel-switching capability from knowledge of the heating equipment. RECS collects limited information about heating equipment. For example, RECS does not collect data on whether the fireplace has efficiency enhancements such as an outdoor air intake, glass doors, or forced-air circulation. Additional equipment information may still not be helpful since comfort tolerances probably differ among households with similar equipment.

This analysis demonstrates that the number of fuel-oil heated households with fuel-switching capability is 1.4 million households based on the household's perception and 1.7 million households based on an assumed effectiveness of their secondary space-heating equipment. This difference may be small considering the tentative conclusions that can be drawn about what people can do under hypothetical conditions. Of greater importance in considering the results from these two approaches to assessing fuel-switching capability is the fact that the mix of households is different. One half of the households (0.6 million households) with self-reported fuel-switching capability were not included in the analyses based on the presence of certain secondary space-heating equipment.

Appendix C

RECS Coverage Related to EIA Supply Surveys

Appendix C

RECS Coverage Related to EIA Supply Surveys

Introduction

The primary purpose of the Residential Energy Consumption Survey (RECS), which is conducted triennially, is to collect accurate data on residential energy consumption along with detailed characteristics of the household and the housing unit. The data are collected by first contacting the household and then later contacting the energy supplier of that household.

The surveys that EIA conducts can be divided into two broad groups. The first group, supply surveys, obtain information from the producers, suppliers, and marketers of specific energy sources. From these surveys, data are obtained about the amount of product supplied, sold, or delivered to consumers classified by the company as residential, commercial, or industrial. These data, with some adjustments, are summarized for each state, for each energy source, and for each end-use sector in the annual report, *State Energy Data Report 1960-1990*, DOE/EIA-0214(90).

The second group of surveys conducted by EIA gathers information on the types of energy consumed by the end users along with the characteristics of those end users that can be associated with the energy consumed. This group is referred to as consumption surveys and include the RECS. Data from the consumption surveys are published at the Census region and Census division level.

There are important differences between the supply and consumption surveys which need to be taken into account in any analysis that uses both data sources.[51] In comparing the RECS with the supply surveys, discrepancies can be attributed largely to differences in the units that are identified as residential units in the surveys.[52]

Survey Coverage and Data Comparisons

The RECS is designed to sample all year-round, occupied, residential housing units that are primary residences. Included are multifamily units, mobile homes, farm homes, and single-family homes on and off military bases. The RECS definition specifically excludes seasonal units, vacant units, and second homes which numbered 12 million seasonal and vacant housing units in 1989.[53] If these units were a part of the covered households in the RECS, they would represent about 11 percent of residential housing units in 1990; they may represent proportionately less of the total energy consumption. The exclusion of these units from RECS should lower RECS estimates of the consumption of energy sources relative to estimates from supply surveys, which do cover these types of units.

[51]For a discussion of differences between the supply and consumption surveys for the commercial and manufacturing sectors of the United States, refer to the publications *Commercial Buildings Energy Consumption and Expenditures 1989*, DOE/EIA-0318(89) and *Manufacturing Energy Consumption Survey: Consumption of Energy 1988*, DOE/EIA-0512(88).

[52]The survey "unit coverage" factors discussed in this appendix are the major cause of differences between RECS and supply estimates. An additional, less important contributor is the varying treatment of mixed-use consumption between the surveys. The RECS asks householders approximately how much of their consumption of each fuel used is consumed for nonhousehold purposes. Total household consumption is then scaled back by this amount. The supply survey estimates rely upon rate classifications provided by energy suppliers and lack information about the portion of the mixed-use bill that is used for nonhousehold purposes. The account is classified based upon quantity of fuel used as well as intended purpose or mix of purposes. For all fuel types combined, RECS found that 3.3 million or 3.5 percent of RECS households reported that one or more of their utility bills included some consumption for nonhousehold purposes.

[53]U.S. Department of Commerce, Bureau of the Census, *American Housing Survey for the United States in 1989*, H150/89, (July 1991).

Because the RECS collects information directly from each sampled unit, it is possible for the RECS to be explicit about which residential units are included or excluded from the RECS. EIA supply surveys collect residential sector data from the suppliers of energy to households. These data depend upon how accounts serving these household customers are classified in the sales reporting systems of individual utility companies and fuel suppliers. Suppliers may classify accounts as commercial if annual use exceeds some limit. Farm homes, military housing, and master-metered multifamily housing units are types of residential units in the RECS which may be classified as commercial by some fuel suppliers, due to the size of their consumption or the special characteristics of these units. The 1990 RECS collected additional information from utilities as to whether the household for which fuel data were being requested were charged on a residential, commercial, or industrial rate schedule. Analysis of these rate schedule data showed that only a few RECS households (.2 percent) were not classified by their electric utility companies as residential (Table C1). This information, however, was not obtained for all households. The percentage of households for which rate schedule information was not obtained varied by fuel type, ranging from 13 percent for electricity to 89 percent for kerosene (Table C1).[54]

Table C1. Energy Supplier Account Classification by Energy Source Used by RECS Households (Million Households)

Account Classification	Electricity	Natural Gas	Fuel Oil	Kerosene	Liquefied Petroleum Gas
Residential	81.8 (87%)	45.2 (78%)	7.6 (65%)	.6 (11%)	6.1 (74%)
Commercial/ Other	0.2 (.2%)	0.0	0.0	0.0	0.0
Fuel Used, Classification Not Obtained	12.0 (13%)	12.6 (22%)	4.1 (35%)	4.7 (89%)	2.0 (24%)

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457, A-G of the 1990 Residential Energy Consumption Survey (RECS). RECS Public Use Data File.

Over all energy sources, the principal type of household for which these data were not obtained were households for which fuel records were not obtained from energy suppliers because the householder's cost of energy was included in the rent.[55] Multifamily units in buildings whose utility bills are included in the householder's rent are a prime example of RECS households for which fuel and rate schedule information were not obtained from their energy suppliers, although energy consumption is imputed for these RECS households. They are also a prime example of accounts, which may be classified under commercial rate schedules by some utility companies, due to master-metered building energy consumption.[56] Classification of multifamily units under commercial accounts will lower supply residential consumption estimates relative to RECS since the energy consumed in these units will be allocated to the commercial sector.

Electricity

Annual electricity sales data are currently collected on Form EIA-861, *Annual Electric Utility Report*, which is completed by all electric utilities in the United States. Utilities are requested to classify electricity sold as residential

[54]Although fuel records were not obtained from suppliers for 89 percent of kerosene households, 62 percent of kerosene households made cash-and-carry purchases for which they provided estimates of their consumption. (See Appendix B, "Quality of the Data.")

[55]See Appendix B, "Quality of the Data," for a discussion of problems with fuel records for households using kerosene and LPG.

[56]Natural gas transported for the account of another is a potential example of residential consumption amounts large enough to be under commercial rate classification. While this is a large and growing factor in nonresidential natural gas markets for 1990, it represented less than 1 percent of residential gas sales. Energy Information Administration, *Natural Gas Annual, DOE/EIA-0131(90)/1, p. 52*.

if "supplied to private household establishments, which consume energy primarily for space heating, water heating, air conditioning, etc. Apartment houses are included." Where use is mixed, the utility is requested to classify sales by principal use. Included within this definition of the residential sector are seasonal and vacant units (including second homes).

The RECS estimate of 1990 residential electricity consumption was 3.03 quadrillion Btu (Table C2). The supply survey (Form EIA-861) estimates 3.15 quadrillion Btu for the residential sector. The RECS estimate was lower than the supply estimate by 4 percent (5 percent in 1987), a difference, which is not statistically significant. The factors, discussed below, which contribute to differences between the survey estimates work in both directions and may cancel each other out.

Table C2. Comparison of U.S. Residential Energy Consumption Estimates from the Consumption Survey and Supply Surveys, 1990
(Quadrillion Btu)

Energy Source	Consumption Survey	Supply Surveys	Percent Difference Between Consumption and Supply Data
	1990	1990	1990
Electricity	3.03	3.15	[a]-4
Natural Gas	4.86	4.52	8
Fuel Oil	.98	.84	17
Kerosene	.06	.06	0
Liquefied Petroleum Gas[b]	.28	.36	-22

[a]Difference is not statistically significant at the 95 percent confidence level.
[b]The liquefied petroleum gas (LPG) data, presented in the *State Energy Data Report* (see Sources) and shown here for comparison are not collected by EIA.
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457, A-G of the 1990 Residential Energy Consumption Survey; *State Energy Data Report 1960-1990*, DOE/EIA-0214(90).

Seasonal and vacant housing units are by definition excluded from the RECS. In 1989, there were 4 million[57] seasonal and vacant housing units that had electricity as a main heating fuel; many other seasonal or vacant units probably use some electricity for lights, air conditioning and appliances, for some part of the year. If these units were included in RECS they would represent about 4 percent of electricity-using housing units. These units are covered in the supply survey (Form EIA-861).[58]

Offsetting the exclusion of vacant and seasonal units from the RECS are residential housing units that are classified as commercial customers in supply data (Table C1). Out of 82 million electricity-using households, for which data were obtained from electric utilities, only 0.2 million were classified as other than residential in the utility company records. For another 12 million households, rate schedule data were not obtained. Of these 12 million, 4.7 million RECS households live in multifamily units and do not pay directly to utility companies for their fuel. To the extent that these are master-metered buildings and are large enough to be under commercial rate schedules, RECS consumption estimates will be higher than corresponding supply estimates.

[57]U.S. Department of Commerce, Bureau of the Census, *American Housing Survey for the United States in 1989*, H150/89 (July 1991).

[58]Some large apartment buildings among these units may be classified as commercial in utility company records, and therefore, not be included in the residential Supply estimate of consumption.

Natural Gas

Supply survey data for natural gas are collected on Form EIA-176, *Annual Report of Natural and Supplemental Gas Supply and Disposition*. Form EIA-176 must be submitted by all gas pipeline companies and other plant operators that deliver gas directly to consumers. Form EIA-176 requests companies to classify as residential use, sales to "single and multifamily dwellings and apartments." The RECS estimates that 4.86 quadrillion Btu of natural gas were consumed by residential units in 1990. This was 8 percent (9 percent in 1987) more than that estimated by the supply survey (EIA-176) (Table C2).

RECS excludes seasonal and vacant units; natural gas Form EIA-176 supply data include these units. About 4 million of the seasonal or vacant units heat with natural gas.[59] These units would represent about 6 percent of the natural gas using households in RECS if vacant and seasonal units were covered in RECS.

Analysis of rate classification data obtained from gas utility companies indicated that none of the RECS households for which data were obtained were classified in the utility company records other than as residential. However, out of 12.6 million households that use natural gas and for which rate schedule data were not obtained, there were 9.8 million RECS households that live in multifamily unit buildings, and do not pay directly for all their natural gas. To the extent that these units are in master-metered buildings they may be under commercial rate schedules and not included in supply estimates of residential energy consumption.

Fuel Oil

EIA conducts a supply survey for fuel oil and kerosene collected with a sample of fuel oil distributors who submit Form EIA-821, *Annual Fuel Oil and Kerosene Sales Report*. The 1990 RECS estimates residential consumption of fuel oil as 0.98 quadrillion Btu; supply data estimate 0.84 quadrillion Btu. This represents a difference of 17 percent (10 percent in 1987). There are a number of factors which work in opposite directions, which are likely to cause differences between the survey estimates.

Unlike the electricity and natural gas supply surveys, residential sector sales are defined for the EIA-176 as "private" sales. Fuel oil dealers are specifically requested to exclude apartments and farm homes from their residential sector data. RECS includes the consumption of farm homes and multifamily units. The 1990 RECS households included 2.7 million households that live in multifamily buildings and do not pay a fuel oil dealer directly for their fuel oil. RECS also includes 0.5 million farm homes that use fuel oil. Therefore, RECS covers a total of 3.2 million homes, which are specifically excluded from the supply survey. Partially offsetting these 3.2 million farm and multifamily units are seasonal and vacant homes that are covered in the supply surveys but are not covered in the RECS. In 1989, there were 1.3 million seasonal and vacant homes that were heated by fuel oil.[60]

Subtracting seasonal and vacant homes from the 3.2 million households leaves 1.9 million households that use fuel oil, live in multifamily units, and do not pay their fuel bill directly. These units are by definition excluded from the Form EIA-176. While a seemingly small number of households, they represent 16 percent of all fuel oil using households in the RECS (11.7 million households use fuel oil).

[59]U.S. Department of Commerce, Bureau of the Census, *American Housing Survey for the United States in 1989*, H150/89, (July 1991).

[60]ibid.

Kerosene

For kerosene, there is no difference between the 1990 RECS consumption estimates and the EIA supply estimates (2.5 percent difference in 1987).[61] The observation that there is no difference between the consumption and supply data series is consistent with an examination of factors which were examined for the other energy sources. Seasonal and vacant housing unit use of kerosene is very small as is the use of kerosene in master-metered multifamily units.

Conclusion

The RECS defines the "residential sector" differently from the EIA supply surveys. Differences in the estimates of residential consumption are thought to be attributed largely to the differences in coverage of residential units between the RECS and the supply surveys. These coverage differences are: (1) RECS excludes seasonal and vacant units, which are included in the EIA supply surveys; (2) RECS includes housing units that may sometimes be classified as commercial or industrial in energy supplier records, namely, farms, military housing and master-metered multifamily units.

More complete information on classification of accounts by energy suppliers is still needed. The new data collected on the classification of accounts by utility companies showed that most all households in RECS for which data were obtained from utilities were classified by their utility companies as residential. However, the master-metered units are more likely to be classified as commercial rather than as residential. These are precisely the units for which RECS does not obtain fuel records from suppliers of energy. Future RECS will try to acquire more information about the classification of these types of households from building managers and rental agents.

[61]Beginning in 1990, kerosene supply estimates taken from the *State Energy Data Report* are based upon a revised methodology for 1985 through 1990.

Appendix D

End-Use Estimation Methodology

Appendix D

End-Use Estimation Methodology

Introduction

For each household that responded to the 1990 RECS, the annual amount of energy used for five end-use categories (space heating, water heating, air conditioning, refrigerators, and general appliance usage) was estimated. The end-use estimates were produced for each of the five main energy sources: electricity, natural gas, fuel oil, kerosene, and liquefied petroleum gas (LPG). The end-use amounts were not based on data produced by placing meters on individual appliances, rather the end-use amounts were obtained by estimating for each household how much of the total annual consumption for each energy source can be attributed to each of the end-use categories by using a regression technique.

For each energy source, the annual consumption attributed to each of the end-use categories can be estimated by use of regression equations. The regression equations are also used to impute energy consumption when the billing data are missing or inadequate. A separate equation was developed for each of the five main energy sources. In each equation, the dependent variable was the annual energy consumption for the 1990 calendar year. The set of independent variables varied according to energy source type. Violation of the assumptions associated with linear least-squares regression led to consumption being estimated using nonlinear regression techniques.

This appendix documents the methodology used for the 1990 RECS end-use estimation. First, a description of the basic equation used to estimate total consumption for each energy source and a general discussion of the nonlinear regression technique are presented. This is followed by a discussion of the specific nonlinear regression equations used by each of the five sources (in order presented): natural gas, electricity, fuel oil, LPG, and kerosene. The last section of this appendix is an alphabetical listing of, and definitions for, the variables used in the end-use estimation equations.

General Consumption Equations

Basic Equation

For electricity, the basic equation is:

Total Consumption = Space-Heating Component
+ Water-Heating Component
+ Air-Conditioning Component
+ Refrigerator Component
+ Appliance Component

The basic equation was the same for natural gas, fuel oil, kerosene, and LPG except (1) the refrigerator component existed only for electricity and (2) the air-conditioning component existed only for electricity and natural gas. Table D1 shows which end uses were estimated for each fuel source. The components of the general consumption equation will be discussed prior to a discussion on the nonlinear regression technique.

Table D1. 1990 RECS End-Use Estimation Equations by Fuel Source

	Space Heat	Water Heat	Air Conditioners	Refrigerators	Appliances
Natural Gas	X	X	X		X
Electricity	X	X	X	X	[1]X
Fuel Oil	X	X			X
LPG	X	X			X
Kerosene	X	X			X

X = End use was estimated for this energy source.
[1] Separate estimate for freezer and appliance subcomponents.
Source: Energy Information Administration, Office of Energy Markets and End Use, the 1990 Residential Energy Consumption Survey.

General Space-Heating Component

For all energy sources, the space-heating component was defined as all energy used to generate heat by space-heating equipment. The equipment could be the main space-heating equipment or secondary space-heating equipment. Hence, for all energy sources, a household could have had a positive amount of energy assigned to the space-heating component even if the energy source was not used as the main space-heating energy source.

For electricity in the 1987 and 1990 RECS, the electricity associated with the operation of fans in any central forced-air heating equipment was assigned to the electricity appliance component and not to the space-heating component. This differed from the 1984 RECS where the electricity used to run fans for central forced-air heating systems was assigned to the space-heating component. The change was implemented so that the households that did not use electricity as a space-heating energy source (main energy source or a secondary energy source), by definition, did not have positive amounts of electricity assigned to the space-heating component.

General Water-Heating Component

The component for water heating was defined as all energy used to heat water for hot running water, as well as water heated at point sources (such as stoves or auxiliary water-heating equipment) for bathing, cleaning and other noncooking applications of hot water. Energy used at point sources to heat water for cooking and hot drinks was considered part of the general appliance component. Energy used to heat water for a swimming pool, hot tub, spa, or jacuzzi was also considered as part of the general appliance component.

General Air-Conditioning Component

The electricity air-conditioning component was defined as all electricity associated with (1) electric air-conditioning equipment and (2) fans in any central air-conditioning equipment including natural gas air-conditioning equipment. The regression equations used with the 1987 and 1990 RECS for electricity did not contain specific terms for whole-house fans, ceiling fans, window fans, and evaporative (swamp) coolers, because the terms were only marginally significant. Hence, the consumption of electricity to operate these fans and evaporative coolers was not

assigned to the air-conditioning component; it was included in the appliance component. This differs from the previous RECS (prior to 1987) where the regression equation for electricity included in the air-conditioning component a term for evaporative coolers, whole-house fans, ceiling fans, and window fans. The consumption of electricity to operate these types of coolers and fans was assigned to the air-conditioning component. Consequently, in RECS prior to 1987, there existed households that did not have air-conditioning equipment, yet these households had positive amounts assigned to their air-conditioning component.

In the 1990 RECS, the households that reported that they had air-conditioning equipment but did not use the equipment, were assigned a value of zero for their electricity air-conditioning component. In RECS prior to 1987, these households were assigned positive values for their electricity air-conditioning component.

The natural gas air-conditioning component was defined as all natural gas used to operate natural gas air-conditioning equipment. There was no air-conditioning component for fuel oil, kerosene, or LPG.

General Refrigerator Component

The refrigerator component for electricity consisted of all electricity used to operate refrigerators. The electricity used to operate freezers that are not part of a refrigerator was assigned to a separate component under General Appliance. There was no refrigerator component for natural gas, LPG, fuel oil, and kerosene.

General Appliance Component

The general appliance component consisted of the following two components: (1) Appliance Subcomponent and (2) Freezer Subcomponent. A discussion of these two components follows.

Appliance Subcomponent

The general appliance component consisted of all energy not used specifically for any of the other end uses. This component included energy associated with lights, clothes dryers, cooking equipment, fans (including fans for forced-air, space-heating systems), evaporative coolers, and home entertainment equipment such as televisions, stereos, video cassette recorders, electronic games, and computers.

The appliance component for fuel oil was zero except for five households that used fuel oil for some end use other than space heating and water heating. Of these five households, two households used fuel oil for heating a hot tub. Similarly, the appliance component for kerosene was zero except for seven households that used kerosene for some end use other than space heating and water heating.

Energy used in general appliances during the winter will frequently help heat the housing unit. This secondary effect of the appliance consumption was not included in the estimation of the space-heating component. In addition, during the summer, energy used in general appliances may add to the load on the air-conditioning system. This was not included in the air-conditioning component.

Freezer Subcomponent

This component was only estimated for electricity; there was no freezer component for natural gas, LPG, fuel oil, and kerosene. The freezer component for electricity consisted of all electricity used to operate freezers that were not part of a refrigerator.

Nonlinear Regression Technique

The nonlinear regression technique was used to produce end-use estimates for each household and each energy source. The end-use estimates were normalized so that the sum of the end-use estimates was equal to the actual or imputed yearly consumption for each energy source used by the household. The individual household end-use estimates were used to estimate averages and totals for end-use consumption over selected household categories. The results are presented in the text and in the tables in the "Detailed Statistics" section of this report.

The nonlinear equations that were used in the end-use estimation procedure are described below. As with any large regression, care should be taken in interpreting the individual coefficients in the equations. The variables that are used in the equations may be highly correlated with variables, which are not used in the equations. Thus, the value of the coefficients will reflect both the impact of the included variables and the impact of any correlated excluded variables. For instance, the natural gas equations did not contain variables that used the type and R-value of insulation directly, but the impact of the type and amount of insulation is included through variables which indicate the presence of insulation.[62]

An example of this type of positive correlation was the presence of a swimming pool and higher income. The coefficients in the electricity regression equation corresponding to variables involving swimming pools may have reflected the consumption of other appliances that were not contained in the equation and that were highly correlated with income (particularly for higher income households with swimming pools).

The regression equation for each fuel splits estimated consumption into its end-use components. The result is:

$$YCOM = SPHTCOM + WTHTCOM + AIRCCOM + RFRGCOM + FZZRCOM + APPLCOM,$$

where:

YCOM is the estimated annual consumption,
SPHTCOM is the estimated space-heating component,
WTHTCOM is the estimated water-heating component,
AIRCCOM is the estimated air-conditioning component,
RFRGCOM is the estimated refrigerator component,
FZZRCOM is the estimated freezer component, and
APPLCOM is the estimated appliance component.

The actual annual consumption is called Y. The unit of measure for Y and YCOM is thousands of Btu. This unit of measure is used for all energy sources.

The typical regression error term is as follows:

$$e_1 = Y - YCOM .$$

[62]For a more detailed discussion of the end-use estimation procedures and the correlation of variables, see the *National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption,* DOE/EIA-072 (Washington, DC, July 1981); the *National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption - A Supplement* DOE/EIA-0272/S (Washington, DC, October 1981); and *Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use,* DOE/EIA-0431 (Washington, DC, October 1983).

Unfortunately, the variance of e_1 tends to increase as YCOM increases. Furthermore, the distribution of e_1 is skewed in the positive direction. These two facts violate the assumptions associated with linear least-squares regression. On the other hand, the distribution of

$$e_2 = (Y)^{1/4} - (YCOM)^{1/4}$$

is closer to being normally distributed with a constant variance. Hence, a nonlinear least-squares regression procedure that minimizes the sum of squares of e_2 was used.

For each energy source, the dependent variable was the household's consumption as reported on the RECS Suppliers Survey in thousands of Btu. The specific set of independent variables was not the same for all energy sources. Most of the independent variables are derived from information reported by the household on the Household Survey. The end-use components consisted of sums or products of terms that themselves may have been sums or products of the independent variables. The overall methodology may seem complex at first glance, but there was a common structure. In general, the components consisted of an overall term multiplied by various adjustments. This format allowed the components to be adjusted by many factors. The relative size of the adjustments was easy to determine.

The disadvantage of the format was that it yields a basic equation that is intrinsically nonlinear. As a result, standard multivariate linear regression techniques could not be used to estimate the parameters. A nonlinear technique was used. The parameters were estimated by using the nonlinear regression procedure (PROC NLIN) contained in the statistical computer package, SAS.[63]

The equations are discussed below. All coefficients were obtained from the nonlinear regression equation unless otherwise noted. Natural gas is discussed first because the results of the natural gas nonlinear regression procedure were used to formulate independent variables for the other energy sources.[64]

Natural Gas Regression Equations

The regression equations estimated for natural gas is:

$$Y = SPHTCOM + WTHTCOM + AIRCCOM + APPLCOM + e,$$

where Y is the annual natural gas consumption for the household. The individual components are complicated nonlinear functions of independent household variables, which are available from RECS and a description of each component follows.

Space-Heating Component (SPHTCOM)

The space-heating component of natural gas consumption can be written

$$SPHTCOM = (NGMAINHT + NGSECHEAT) \times NGTOTADJ.$$

In this equation, NGMAINHT represents the use of natural gas as the main space-heating fuel and NGSECHEAT represents the use of natural gas as a secondary space-heating fuel. The adjustment term NGTOTADJ is also

[63]Statistical Analysis System (SAS) Institute (Cary, North Carolina).

[64]The terms used in the regression equations for all fuels are described in "Definitions of End-Use Variables" at the end of this appendix.

applied to other natural gas end-use components. This term adjusts for various demographic characteristics of the household and the price of natural gas.

The use of natural gas as a **main space-heating fuel** is given by:

NGMAINHT = NGMHEAT × NGMHHDD × NGMHSZ × NGSHDJDX.

The terms in NGMAINHT can be described as follows. NGMHEAT was an indicator variable that equaled one if natural gas was used as the main space-heating energy source, and equaled zero, otherwise. NGMHHDD was a function of heating degree-days. NGMHSZ was a function of the size of the housing unit. NGSHDJDX adjusted the space-heating component for the presence of a heated basement (NGMHADJ1), the type of main space-heating equipment (NGMHADJ2), the insulation characteristics and energy efficiency of the housing unit (NGMHADJ3), the amount of secondary space heating (NGMHADJ4), the age of the housing unit (NGMHADJ5), the thermostat setting (NGMHADJ6), the occupants evaluation of the quality of the insulation (NGMHADJ7), and the type of the housing unit (NGMHADJ8).

The resulting expressions and their estimated coefficients are given below. Specific definitions of the independent variables are given at the end of this appendix.

NGMHHDD = (0.01975 × HDD65) + (2.45834 × SQRTHD65),

NGMHSZ = (0.05965 × HEATED) + (40 × LOGHTSF) + (4.84516 × NDRSAWS),

NGSHDJDX = NGMHADJ1 × NGMHADJ2 × NGMHADJ3 × NGMHADJ4
x NGMHADJ5 × NGMHADJ6 × NGMHADJ7 × NGMHADJ8,

NGMHADJ1 = 1 - (0.20766 × BASEHTDX),

NGMHADJ2 = 1 + (0.13372 × RADEQUIP)
- (0.14689 × (SPHEATER + COOKSTVH)),

NGMHADJ3 = 1 - (0.02304 × RECI × (1-APTUNIT)),

NGMHADJ4 = 1 - (0.28586 × MHTC66MN × SECHTCAP),

NGMHADJ5 = 1 + ((.18816 × MD39MNUS) × (1 - WHRZONE1))
+ ((.07500 × MD40TO49) × (1 - WHRZONE1))
- (.07868 × MD70TO79)
- (.21278 × MD80PLUS),

NGMHADJ6 = 1 + (0.05585 × TEMPINDX),

NGMHADJ7 = 1 + (0.08302 × POORINSL),

and

NGMHADJ8 = 1 - (0.52785 × LRGAPTBD)
- (.28794 × SMLAPTBD).

The use of natural gas as a **secondary heating fuel** is given by:

$$NGSECHEAT = (3.33993 \times NGSHEAT \times HDD65) + (4849.59 \times NGSHEAT \times NUMHSMEM).$$

The terms in the secondary space-heating component, NGSECHEAT, can be described as follows. NGSHEAT was an indicator variable that equaled one if natural gas was a secondary, but not the main space-heating energy source. HDD65 was the number of heating degree-days. NUMHSMEM was the number of household members.

Adjustment Factors

The term NGTOTADJ represents a total adjustment that was applied to all of the natural gas components. NGTOTADJ consisted of six components that adjusted for various demographic characteristics of the household and the price of natural gas. NGTOTADJ, its six components, and the estimated coefficients are defined as follows:

$$NGTOTADJ = NGTOTADJ1 \times NGTOTADJ2 \times NGTOTADJ3 \times NGTOTADJ4 \times NGTOTADJ5 \times NGTOTADJ6$$

$$NGTOTADJ1 = 1 + (0.20045 \times BLACK)$$

$$NGTOTADJ2 = 1 - (0.35327 \times OFTNGONE)$$

$$NGTOTADJ3 = 1 + (0.04232 \times HHFEMALE)$$

$$NGTOTADJ4 = 1 - (0.26494 \times LOGRNGPC)$$

$$NGTOTADJ5 = 1 + (0.13391 \times HIGHINCM)$$

and

$$NGTOTADJ6 = 1 + (0.15975 \times HH66PLUS).$$

Water-Heating Component (WTHTCOM)

The water-heating component of the natural gas consumption is given by:

$$WTHTCOM = NGWATERHT \times NGTOTADJ$$

Here the first term represents the use of natural gas for water heating. The adjustment term is described above.

Natural gas used for water heating is given by:

$$NGWATERHT = NGWATRHT \times NGWHTADJ1 \times NGWHTADJ2 \times NGWHTADJ3.$$

The terms in NGWATERHT can be described as follows. NGWATRHT expressed the consumption of energy for water heating as a function of the square root of the number of household members and the square root of the number of household members between 13 and 65 years of age. NGWHTADJ1 was a term that adjusted NGWATERHT for the situation in which natural gas was only a secondary water-heating energy source or the household did not have hot running water. NGWHTADJ2 was a term that adjusted NGWATERHT for the climate. NGWHTADJ2 decreases as the number of cooling degree-days increases. Households in warmer climates should use less energy for water heating because the ground water should be warmer. NGWHTADJ3 adjusted

NGWATERHT for water heater size. NGWATRHT, NGWHTADJ1, NGWHTADJ2, and NGWHTADJ3 were given by:

$$\begin{aligned} NGWATRHT &= (4{,}178 \times SQRTNHMM) \\ &\quad + (3{,}650 \times SQR13T65), \end{aligned}$$

$$\begin{aligned} NGWHTADJ1 &= (NGWTHT \times HVHTRUNW) \\ &\quad + (0.39216 \times (NGSWTHT + (NGWTHT \times (1 - HVHTRUNW)))), \end{aligned}$$

$$NGWHTADJ2 = 1 + (0.01459 \times SQRTHD65),$$

and

$$NGWHTADJ3 = 1 + (.11665 \times (LRGWHTER - SMLWHTER)).$$

Air-Conditioning Component (AIRCCOM)

The natural gas consumption for air conditioning is given by:

$$AIRCCOM = NGAIRCON \times NGTOTADJ$$

The first term is a measure of the natural gas consumption for air-conditioning. The adjustment factor is described above.

Relatively few households use natural gas to operate air-conditioning equipment. Hence, the natural gas air-conditioning component was non-zero for only a few observations in the 1990 RECS. The natural gas consumption for air conditioning is estimated by:

$$NGAIRCON = 1.94759 \times SQRTCD65 \times ACINDEX.$$

It is a function of the square root of the number of cooling degree-days and an index that reflects the use of the air-conditioning system.

$$\begin{aligned} ACINDEX &= (1 - USEACNOT + (.7 \times UCNACQBT + UCNACASL)) \\ &\quad \times (1 + .3 \times SQR13T65) \\ &\quad \times ((.04 \times COOLED) + (50 \times LOGCOOL)). \end{aligned}$$

The experience gained in fitting the electricity air-conditioning component was used in determining the variable ACINDEX. It is similar to the product of the terms ELACADJ2, ELACNHMM, and ELACSIZE in the electricity air-conditioning component.

Appliance Component (APPLCOM)

The appliance component for natural gas consumption is given by:

$$APPLCOM = NGAPPL \times NGTOTADJ.$$

The first term reflects consumption of natural gas for cooking, outdoor lights, pool heating, clothes drying, outdoor grills, and other minor uses. The adjustment factor is described above. Consumption of natural gas for cooking is presented as a function of the square root of the number of household members and indicators, which equal 1 only if natural gas is used for cooking. The consumption for the remaining appliances use indicator variables for their

presence. Consumption for clothes dryers is also presented as a function of the square root of the number of household members.

$$\begin{aligned} NGAPPL &= (3{,}344 \times SQRTNHMM \times (NGCOOK + NGSCOOK)) \\ &+ (19{,}180 \times NGOUTLT) \\ &+ (33{,}595 \times NGPLHT) \\ &+ (1{,}168 \times NGTUB) \\ &+ (2{,}132 \times NGCLSDY \times SQRTNHMM) \\ &+ (135 \times NGOUTGR) \\ &+ (135 \times NGOTHER). \end{aligned}$$

Electricity Regression Equations

The regression equation that was developed for predicting the amount of electricity consumed for space heating, water heating, air conditioning, refrigerator, freezer, and appliance usage is:

$$Y = SPHTCOM + WTHTCOM + AIRCCOM + RFRGCOM + FZZRCOM + APPLCOM + e,$$

where Y is the annual electricity consumption for the household. The individual components are complicated nonlinear functions of independent household variables, which are available from RECS and a description of each component follows.

Space-Heating Component (SPHTCOM)

The space-heating component of electricity consumption can be written as:

$$SPHTCOM = (ELMAINHT + ELSECHEAT) \times ELTOTADJ.$$

In this equation, ELMAINHT represents the consumption of electricity for space heating when electricity was the main space-heating energy source. ELSECHEAT represents the consumption of electricity for space heating when electricity was only a secondary space-heating energy source. ELMAINHT involves terms defined in the natural gas space-heating component. This was done for consistency and to take advantage of the results found while developing the natural gas equation. The number of observations where the main space-heating energy source was natural gas was much larger than the number where the main space-heating energy source was electricity. The coefficients in the electricity equations were less accurate because of the smaller number of observations. It was decided to use the coefficients that were estimated using the natural gas data to calculate some of the independent variables used in the electricity space-heating component. The variables borrowed from natural gas adjust for demographics or housing structure. Adjustments for such characteristics should be the same regardless of energy source.

The use of electricity as a **main heating fuel**, is given by:

$$ELMAINHT = MHHDDSZ \times ELMSHADJ.$$

The terms in ELMAINHT can be described as follows. MHHDDSZ represents the consumption of electricity as the main heating fuel. ELMSHADJ adjusted for the presence of a heat pump. The resulting expressions and their estimated coefficients are given below.

$$MHHDDSZ = .3632 \times ELMHEAT \times NGMHHDD \times NGMHSZ \times NGSHDJDX \times NGTOTIDXEL$$

$$ELMSHADJ = 1 - (.1233 \times HEATPUMP).$$

ELMHEAT was an indicator variable that equaled one if electricity was the main space-heating energy source. NGMHHDD, NGMHSZ, and NGSHDJDX are defined in the natural gas heating section, as are the adjustment factors that comprise NGTOTIDXEL.

$$NGTOTIDXEL = NGTOTADJ3 \times NGTOTADJ6.$$

The use of electricity as a **secondary heating fuel** is given by:

$$ELSECHEAT = (1073 \times ELSHEAT \times SQRTNHMM) \times (1 + 4.23917 \times MAJELSEC)$$

ELSHEAT is an indicator variable that equals one if the household indicated that electricity was a secondary but not a primary fuel. SQRTNHMM represents the square root of the number of household members and MAJELSEC adjusts for auxiliary equipment.

Adjustment Factors

The term ELTOTADJ was an adjustment that was applied to all electricity components. It adjusted all electricity components for the price of electricity, climate, demographic characteristics of the household, and type of housing structure. ELTOTADJ was given by:

$$ELTOTADJ = ELTOTADJ1 \times ELTOTADJ2 \times ELTOTADJ3 \times ELTOTADJ4 \times ELTOTADJ5 \times ELTOTADJ6 \times ELTOTADJ7 \times ELTOTADJ8$$

where:

$$ELTOTADJ1 = 1 - (.51624 \times LOGRELPC)$$

$$ELTOTADJ2 = 1 - (.19486 \times OFTNGONE)$$

$$ELTOTADJ3 = 1 - (.05416 \times WHRZONE1) - (.13968 \times WARMPACF) - (.14392 \times HOTSOALT)$$

$$ELTOTADJ4 = 1 + (.146441 \times HIGHINCM) + (.04278 \times MDHHINCM)$$

$$ELTOTADJ5 = 1 - (.08197 \times MD85PLUS)$$

$$ELTOTADJ6 = 1 + (.06195 \times MIDDLEHH)$$

$$ELTOTADJ7 = 1 + (.09094 \times BLACK)$$

and

$$ELTOTADJ8 = 1 - (.07406 \times (APTUNIT + SFATTACH)) - (.20232 \times (MOBILEHM \times (1 - OWNER))).$$

Water-Heating Component (WTHTCOM)

The water-heating component of electricity consumption is given by:

$$WTHTCOM = ELWATERHT \times ELTOTADJ.$$

The term ELWATERHT represents the use of electricity for water heating. ELTOTADJ was defined above.

Electricity used for water heating is given by:

$$ELWATERHT = (0.45320 \times NGWHIDX \times NGTOTIDXEL \times ELWATADJ1).$$

The first two terms in ELWATERHT use components estimated for natural gas. The third term (ELWATADJ1) adjusted ELWATERHT for the situation in which electricity was only a secondary water-heating energy source or the household did not have hot running water. NGWHIDX and ELWATADJ1 were given by:

$$NGWHIDX = NGWATRHT \times NGWHTADJ2 \times NGWHTADJ3$$

and

$$ELWATADJ1 = ELWHEAT \times HVHTRUNW + (0.41090 \times (ELSWHEAT + (ELWHEAT \times (1 - HVHTRUNW)))).$$

NGTOTIDXEL was defined in the space-heating section.

Air-Conditioning Component (AIRCCOM)

The electricity consumption for air conditioning is given by:

$$AIRCCOM = ELAIRCON \times ELTOTADJ$$

The term ELAIRCON represented the use of electricity for air conditioning and ELTOTADJ was defined earlier. The electricity consumption for air conditioning is estimated by:

$$ELAIRCON = ELACCDD \times ELACSIZE \times ELACNHMM \times ELACADJ1 \times ELACADJ2 \times ELACADJ3 \times ELACADJ4 \times ELACADJ5.$$

The term ELACCDD was a function of cooling degree-days and the average humidity during the summer months. The term ELACSIZE was a function of the amount of floorspace that could be cooled and ELACNHMM was a function of the number of household members. The terms ELACADJ1, ELACADJ2, ELACADJ3, ELACADJ4, and ELACADJ5 were terms that adjusted the air-conditioning component for the type of equipment (ELACADJ1 and ELACADJ4), the pattern of use of the equipment (ELACADJ2 and ELACADJ3), and the housing type (ELACADJ5).

ELACCDD, ELACSIZE, ELACNHMM, ELACADJ1, ELACADJ2, ELACADJ3, ELACADJ4, and ELACADJ5 were given by:

$$ELACCDD = (1 - USEACNOT) \times ((.235007 \times SQRTCD65) + (.06638 \times SRC65T20 \times SQRTHM58))$$

$$ELACSIZE = (0.04 \times COOLED) + (42.02794 \times LOGCOOL),$$

$$ELACNHMM = 1 + (.24546 \times SQR13T65),$$

$$ELACADJ1 = 1 + (1.53180 \times HVCENTAC),$$

$$ELACADJ2 = 1 + (.66035 \times UCNACQBT \times (1\text{-}UWWACASL)) + (.87069 \times UCNACASL),$$

$$ELACADJ3 = 1 + (1.69508 \times UWWACQBT \times (1 - UCNACQBT - UCNACASL)) + (3.06674 \times UWWACASL \times (1 - UCNACASL),$$

$$ELACADJ4 = 1 - (0.09153 \times SQRTARAC),$$

and

$$ELACADJ5 = 1 + (0.43263 \times MOBILEHM).$$

The terms describing the pattern of use of equipment in the electricity air-conditioning component were defined as follows. The term (1 - USEACNOT) equaled zero when the household reported that they did not use their air-conditioning equipment. In this case, the air-conditioning component was zero. The term (1-USEACNOT) equaled one when the household reported that they used their air-conditioning equipment. The variable UCNACASL is an indicator variable that equals one when the households reported that the central air-conditioning equipment was used all summer long. The variable UCNACQBT is an indicator variable that equals one when the households reported that the central air-conditioning equipment was used quite a bit. The variable UWWACASL is an indicator variable that equals one when the households reported that the window air-conditioning units were used all summer long. The variable UWWACQBT is an indicator variable that equals one when the households reported that the window air-conditioning units were used quite a bit.

Refrigerator Component

The refrigerator component for electricity consumption is given by:

$$RFRGCOM = ELRFGCON \times ELTOTADJ$$

The refrigerator component for electricity consisted of all electricity used to operate refrigerators. The electricity used to operate freezers that are not part of a refrigerator was assigned to a separate component. ELTOTADJ was defined earlier and ELRFGCON is defined as follows:

$$ELRFGCON = REFRIG \times RZADJ.$$

The term RZADJ adjusted REFRIG for cooling degree-days because refrigerators located in dwellings in warmer areas were projected to consume more electricity than refrigerators in dwellings in colder areas.

$$RZADJ = 1 + (0.03047 \times SQRTCD65).$$

REFRIG was given by:

$$REFRIG = REFRIG1 + REFRIG2 + REFRIG3$$

Where:

$$EFRIG1 = RFRBASE1 \times RFR1ADJ \times RFR1BDJ \times RFR1CDJ \times RFR1DDJ \times RFR1EDJ$$
$$REFRIG2 = RFRBASE2 \times RFR2ADJ \times RFR2BDJ \times RFR2CDJ \times RFR2DDJ \times RFR2EDJ$$
$$REFRIG3 = RFRBASE3 \times RFR3ADJ \times RFR3BDJ \times RFR3CDJ \times RFR3DDJ \times RFR3EDJ$$

and

$$RFRBASE1 = 2462 \times HVREFRG1$$
$$RFRBASE2 = 2462 \times HVREFRG2$$
$$RFRBASE3 = 2462 \times HVREFRG3$$

$$RFR1ADJ = 1 - .31240 \times AFRMANU1$$
$$RFR2ADJ = 1 - .31240 \times AFRMANU2$$
$$RFR3ADJ = 1 - .31240 \times AFRMANU3$$

RFR1BDJ = 1 + .46337 × RFRDD1
RFR2BDJ = 1 + .46337 × RFRDD2
RFR3BDJ = 1 + .46337 × RFRDD3

RFR1CDJ = 1 - .32296 × RFRNEW1
RFR2CDJ = 1 - .32296 × RFRNEW2
RFR3CDJ = 1 - .32296 × RFRNEW3

RFR1DDJ = 1 - RFRLTU1
RFR2DDJ = 1 - RFRLTU2
RFR3DDJ = 1 - RFRLTU3

RFR1EDJ = 1 - (.50484 × RFRSML1) + (.36202 × RFRLRG1)
RFR2EDJ = 1 - (.50484 × RFRSML2) + (.36202 × RFRLRG2)
RFR3EDJ = 1 - (.50484 × RFRSML3) + (.36202 × RFRLRG3)

The adjustment term RFR1ADJ decreases the estimated consumption for the first refrigerator if it is a manual defrost refrigerator. The adjustment term RFR1BDJ increases the estimated consumption for the first refrigerator if it is a double door refrigerator. The adjustment term RFR1CDJ decreases the estimated consumption for the first refrigerator if it is a new refrigerator. The adjustment term RFR1DDJ decreases the estimated consumption for the first refrigerator if it is used less than 12 months per year. The adjustment term RFR1EDJ decreases the estimated consumption for the first refrigerator if it is a small refrigerator and increases the estimated consumption if it is a large refrigerator.

General Appliance Component

Freezer Subcomponent (FZZRCOM)

The freezer component for electricity consumption is given by:

FZZRCOM = ELFZZCON × ELTOTADJ

The freezer component for electricity consisted of all electricity used to operate freezers that were not part of a refrigerator. There was no freezer component for natural gas, LPG, fuel oil, and kerosene. ELTOTADJ was defined earlier and ELFZZCON is given by:

ELFZZCON = FREZZR × RZADJ.

The term RZADJ adjusted FREZZR for cooling degree-days as described above under the refrigerator component.

FREZZR was given by:

FREZZR = FRZRBASE × FRZRADJ × FRZRBDJ × FRZRCDJ

Where:

FRZRBASE = 1961 × HVFRZR
FRZRADJ = 1 + (-0.32925 × MANUFZZ)
FRZRBDJ = 1 + (0.50692 × UPRTFZZ)
FRZRCDJ = 1 + (0.46049 × OLDFZZ)
+ (-0.28183 × NEWFZZ).

Appliance Subcomponent (APPLCOM)

The appliance component for electricity consumption is given by:

$$APPLCOM = ELAPPLTOT \times ELTOTADJ$$

ELTOTADJ was defined earlier. The term ELAPPLTOT represented the use of electricity for all end uses except space heating, water heating, refrigerators, freezers, and air conditioning. This term specifically accounted for electricity use in TV's, pools, waterbeds, cooking, washers, electric dryers, dishwashers, electric well pumps and the length of time lights were turned on. Lighting and small appliances such as room fans, toasters, and VCR's were included by using as proxy variables the number of household members and the heated floorspace.

ELAPPLTOT was given by:

$$\begin{aligned} ELAPPLTOT = {} & (1158 \times NUMTVCLC) \\ & + (5749 \times HVPOOL) \\ & + (8080 \times HVHTPOOL) \\ & + (5140 \times ELPLHEAT) \\ & + (2512 \times ELHTTUB) \\ & + (3021 \times NUMWTBED) \\ & + (868.5 \times ELCOOK \times SQRTNHMM) \\ & + (830.8 \times CLSWASHR \times SQRTNHMM) \\ & + (2035 \times ELCLSDRY \times SQRTNHMM) \\ & + (1037 \times DSHWASHR \times SQRTNHMM) \\ & + (1106 \times NUMHSMEM) \\ & + (0.44192 \times HEATED) \\ & + (938.8 \times WTWELLPP \times SQRTNHMM) \\ & + (1120 \times SQRTFLLT) \\ & + (550.9 \times NUMLGT4) \\ & + (1211 \times SQRTNL12). \end{aligned}$$

Fuel Oil Regression Equations

Two sets of equations were used for fuel oil. The first set was developed using the respondents' estimates for the amount of fuel oil consumed by the households for a 12-month period and the estimates of the number of fuel oil deliveries for a 12-month period. The second set was developed without these estimates. Most of the respondents that paid for fuel oil directly gave estimates for these two quantities. If the housing unit was rented and the rent covered the fuel oil bills, then the respondents were not asked to estimate these quantities. The respondents' estimates were used to determine the value of three indicator variables. These variables were used in the first set of equations.

For both fuel oil equations, the general form of the regression equations was as follows:

$$Y = SPHTCOM + WTHTCOM + APPLCOM + e,$$

where Y is the annual fuel oil consumption for the household. A description of each component follows.

The use of fuel oil in air-conditioning equipment was extremely rare or nonexistent. No household sampled for the 1990 RECS used fuel oil to operate air-conditioning equipment. Therefore, no provision was made for a fuel oil air-conditioning component.

Space-Heating Component (SPHTCOM)

The space-heating component of fuel oil consumption can be written

$$SPHTCOM = (FOMAINHT + FOSECHEAT) \times FOSHWHADJ.$$

FOMAINHT represented the consumption of fuel oil for space heating when fuel oil was the main space-heating energy source. FOSECHEAT represented the consumption of fuel oil for space heating when fuel oil was a secondary space-heating energy source and was not used as the main space-heating energy source. Both FOMAINHT and FOSECHEAT used terms that were developed using the natural gas data. The natural gas terms were used in the fuel oil space-heating component for the same reasons that natural gas terms were used in the electricity space-heating component. (See section on "Electricity Regression Equations, Space-Heating Component" in this appendix for details.)

$$FOMAINHT = .80823 \times FOMHEAT \times NGMHHDD \times NGMHSZ \times NGSHDJDX \times NGTOTIDX$$

and

$$FOSECHEAT = 177.82537 \times FOSHEAT \times NGMHSZ.$$

NGTOTIDX is a product of adjustment factors that were also used in the natural gas space-heating component.

$$NGTOTIDX = NGTOTADJ1 \times NGTOTADJ2 \times NGTOTADJ3 \times NGTOTADJ5 \times NGTOTADJ6.$$

Adjustment Factors

The term FOSHWHADJ adjusted the space-heating and water-heating components. If the respondent estimates were available, then FOSHWHADJ adjusted the two components for the value of the estimates and for the type of the space-heating equipment. If the respondents' estimates were not available, then FOSHWHADJ adjusted the two components only for the type of space-heating equipment.

$$FOSHWHADJ = FOTTADJ \times FOTTBDJ \times FOTTCDJ$$

Where:

$$FOTTADJ = 1 + (.01251 \times FOMHEAT \times RADEQUIP)$$

$$FOTTBDJ^{65} = 1 + (.30686 \times LOGFODLS)$$

$$FOTTCDJ^{66} = 1 - (.42161 \times VSLQUNFO) - (.23046 \times SMLQUNFO) + (.08992 \times LRGQUNFO).$$

[65]When the household member does not provide for an answer for the number of fuel oil deliveries and the amount of fuel oil used in a year, the adjustment terms FOTTBDJ and FOTTCDJ are set equal to one in the fuel oil regression equations and the remaining coefficients are recomputed. This results in the coefficient for the FOMAINHT term changing from .80823 to .86814. Similarly, the coefficients for the FOSECHEAT term changes from 177.82537 to 148.88705, the FOTTADJ term changes from .01251 to .15624, and the FOWATERHT term changes from .72141 to .81079.

[66]Ibid.

Water-Heating Component (WTHTCOM)

The water-heating component of the fuel oil consumption is given by:

$$WTHTCOM = FOWATERHT \times FOWHTADJ \times FOSHWHADJ.$$

FOWATERHT and FOWHTADJ were given by:

$$FOWATERHT = (.72141 \times NGWHIDX \times NGTOTIDX).$$

$$FOWHTADJ = (FOWTHT \times HVHTRUNW) + (0.39216 \times (FOSWTHT + (FOWTHT \times (1 - HVHTRUNW)))),$$

Some terms in FOWATERHT and FOWHTADJ were adapted from the natural gas results. See the electricity section for a discussion of NGWHIDX. FOSHWHADJ was defined in the fuel oil adjustment factor section.

Appliance Component (APPLCOM)

The appliance component for fuel oil consumption is given by:

$$APPLCOM = (1{,}000 \times FOTUB) + (135 \times FOAPLOTH).$$

Only five households sampled for the 1990 RECS used fuel oil for some end use other than space heating or water heating. In two of the five observations, fuel oil was used to heat a hot tub. Because of the small number of observations, the coefficients in the equation for the fuel oil appliances component were not estimated using the fuel oil data. Instead, the coefficient for FOTUB was obtained from the natural gas results by rounding to the nearest thousand. The coefficient for FOAPLOTH represented the use of one gallon per year. FOTUB and FOAPLOTH are defined at the end of this appendix in the definition of end-use variables.

LPG Regression Equations

The regression equations for LPG were as follows:

$$Y = SPHTCOM + WTHTCOM + APPLCOM + e$$

where Y is the annual LPG consumption for the household.

The use of LPG in air-conditioning equipment is rare. None of the households sampled for the 1990 RECS had LPG air-conditioning equipment. Therefore, no provision was made for a LPG air-conditioning component. On a national scale, the small amount of LPG that was used in air-conditioning equipment can be considered part of the LPG appliance component.

Space-Heating Component (SPHTCOM)

The space-heating component for LPG consumption is given by:

$$SPHTCOM = (LPGMAINHT \times LPGMHADJ) + (LPGSECHT \times LPGSHADJ).$$

LPGMAINHT represented the consumption of LPG for space heating when LPG was the main space-heating energy source. LPGSECHT represented the consumption of LPG for space heating when LPG was a secondary space-heating energy source but not the main space-heating energy source. The results of the natural gas regression were used to calculate the independent variable used in LPGMAINHT. LPGMAINHT and LPGSECHT were given by:

$$\begin{aligned} \text{LPGMAINHT} &= (0.85493 \times \text{LPGMHEAT} \times \text{NGMHHDD} \times \text{NGMHSZ} \times \text{NGSHDJDX} \\ &\quad \times \text{NGTOTIDX} \end{aligned}$$

$$\text{LPGMHADJ} = 1 - (.23685 \times \text{HVAUXHT})$$

$$\text{LPGSECHT} = (7640.3 \times \text{LPGSHEAT} \times \text{SQRTNHMM})$$

and

$$\begin{aligned} \text{LPGSHADJ} &= 1 - (1.0 \times \text{LPRANGE}) \\ &\quad + (2.5036 \times \text{MHTC66MN} \times \text{SECHTCAP}). \end{aligned}$$

In the equation for LPGMAINHT, the term LPGMHEAT was an indicator variable that equaled one if LPG was the main space-heating energy source. See natural gas equations for a definition of NGSHDJDX and the fuel oil equations for the definition of NGTOTIDX. In the equation for LPGSECHT, the term LPGSHEAT was an indicator variable that equaled one if LPG was a secondary, but not the main space-heating energy source.

Water-Heating Component (WTHTCOM)

The water-heating component for LPG is given by:

$$\text{WTHTCOM} = \text{LPGWATHT} \times \text{LPGWHTADJ}$$

The terms in the LPG water-heating component were given by:

$$\text{LPGWATHT} = (0.79789 \times \text{NGWHIDX} \times \text{NGTOTIDX})$$

and

$$\begin{aligned} \text{LPGWHTADJ} &= (\text{LPGWTHT} \times \text{HVHTRUNW}) \\ &\quad + (0.39216 \times (\text{LPGSWTHT} + (\text{LPGWTHT} \times (1 - \text{HVHTRUNW})))), \end{aligned}$$

where NGWHIDX was defined earlier in the electricity section and NGTOTIDX was defined earlier in the fuel oil section.

Appliance Component (APPLCOM)

The appliance component for LPG is given by:

$$\text{APPLCOM} = \text{LPGAPPL} + \text{LPGCK}.$$

The appliance component for LPG contained terms that accounted for the use of LPG for cooking, clothes drying, outdoor lights, and pool heating.

LPGAPPL and LPGCK were given by:

$$\begin{aligned} LPGAPPL &= (2160 \times LPGCLSDY \times SQRTNHMM) \\ &\quad + (9149 \times LPGOUTLT) \\ &\quad + (26546 \times LPGPLHT) \\ &\quad + (1000 \times LPGTUB) \\ &\quad + (135 \times LPGUSEOT) \end{aligned}$$

$$LPGCK = (2974 \times SQRTNHMM \times (LPGCOOK + LPGSCOOK)).$$

Kerosene Regression Equations

The regression equations for kerosene were as follows:

$$Y = SPHTCOM + WTHTCOM + APPLCOM + e.$$

The use of kerosene in air-conditioning equipment was nonexistent. No household sampled for the 1990 RECS used kerosene to operate air-conditioning equipment. Therefore, no provision was made for a kerosene air-conditioning component.

Space-Heating Component (SPHTCOM)

The space-heating component for kerosene is given by:

$$SPHTCOM = (KRMAINSH + KRSECSH) \times KERTTADJ.$$

KRMAINSH represented consumption of kerosene for space heating when kerosene was the main space-heating energy source and kerosene was used in portable kerosene heaters. KRSECSH represented the consumption of kerosene for space heating when kerosene was a secondary space-heating fuel but not the main space-heating fuel. KERTTADJ is the adjustment factor for kerosene.

The use of kerosene as a main heating fuel is given by:

$$\begin{aligned} KRMAINSH &= (.54136 \times KERMHEAT \times NGMHHDD \times NGMHSZ \times NGSHDJDX \\ &\quad \times NGTOTIDX). \end{aligned}$$

KERMHEAT was an indicator variable that equaled one if kerosene was the main space-heating energy source. The terms beginning with NG were defined in the natural gas section. They represent adjustments for heating degree-days, amount of area heated, and variables concerning the housing structure and energy conservation characteristics.

The use of kerosene as a secondary heating fuel is given by:

$$KRSECSH = (1019 \times KERSHEAT \times NUMHSMEM \times KRSHADJ \times KRSHBDJ)$$

KERSHEAT was an indicator variable that equaled one if kerosene was a secondary but not the main space-heating energy source. NUMHSMEM was the number of household members, and KRSHADJ and KRSHBDJ were defined as:

$$\begin{aligned} KRSHADJ &= 1 + (2.01884 \times MHTC66MN) \\ &\quad + (.85667 \times MHTC9467) \end{aligned}$$

$$KRSHBDJ = 1 + (.54605 \times WDSECHT).$$

The kerosene adjustment factor is given by:

KERTTADJ = 1 + (.53353 × KERODELV).

It adjusts the kerosene space-heating component upward when kerosene is delivered to the housing unit.

Water-Heating Component (WTHTCOM)

The water-heating component for kerosene is given by:

WTHTCOM = KRWATRH × KERWHTADJ × KERTTADJ.

Only two households that responded to the 1990 RECS, indicated that kerosene was used to heat water. One of these households indicated that kerosene was the main water-heating energy source; the other household indicated that kerosene was a secondary water-heating energy source. The value of KRWATRH and KERWHTADJ were given by:

KRWATRH = (.54136 × NGWHIDX × NGTOTIDX)

and

KERWHTADJ = (KERWTHT × HVHTRUNW)
+ (0.39216 × (KERSWTHT + (KERWTHT × (1 - HVHTRUNW)))),

KERWTHT was an indicator variable that equaled one if the main water-heating energy source was kerosene. KERSWTHT was an indicator variable that equaled one if the secondary water-heating energy source was kerosene. NGWHIDX was defined in the electricity equations and NGTOTIDX was defined earlier in the fuel oil section. The value of the coefficient in the above equation was constrained to equal the coefficient in KRMAINSH, the kerosene main space-heating component.

Appliance Component (APPLCOM)

The appliance component was defined by:

APPLCOM = (135 × KERAPPL).

The term KERAPPL in the appliance component is an indicator variable that equaled one if kerosene was used for some end use other than space heating or water heating.

Definition of End-Use Variables

Many of the independent variables used in the regression equations were indicator variables. By definition, an indicator variable is set equal to one when a certain condition is met. Otherwise, the variable is set equal to zero. Typically, the end-use components are defined in the text as the product of a general consumption measure (referred to as the midlevel term in the glossary in this appendix) and factors, which adjust consumption. Typically, the adjustments account for differences between households because of demographic or housing characteristics. The midlevel terms are generally functions of several RECS variables. Their specific definitions are given in equations presented in the text. The definition of the variables used in the end-use regression equations follows in alphabetical order by variable name.

ACINDEX: Index used in natural gas air-conditioning component representing air-conditioning usage, number of household members that are 13 to 65 years old, and cooled floorspace. The index was given by

$$\begin{aligned} ACINDEX = {} & (1 - USEACNOT + (.7 \times UCNACQBT) + UCNACASL) \\ & \times (1 + (.3 \times SQR13T65)) \\ & \times ((.04 \times COOLED) + (50 \times LOGCOOL)). \end{aligned}$$

AIRCCOM: Energy used for air-conditioning component.

APPLCOM: Energy used for appliance component which consists of freezer and general appliance.

APTUNIT: An indicator variable that equaled one if the housing unit was in a building that contained two or more housing units.

ARAC (Apparatus to Reduce Air Conditioning): A number derived for the purpose of characterizing the presence of different apparatus that may contribute to lower consumption of energy for air conditioning. Each item in the index is weighted according to its importance as a conservation activity. The ARAC lies between 0 and 21. The table below describes the items that are included in the ARAC and the weights for the ARAC.

Item	Weight
Evaporative Cooler	4.0
Whole-House Fan	2.5
Ceiling or Window Fan	1.5
Portable Fan	1.0
Exhaust Fan	1.0
Shade Trees for the Windows	1.0
Shade Trees for the Roof	1.0
Shutters or Blinds	1.0
Thermal Drapes	1.0
Reflective Film on Windows	1.0
Adequate Insulation	3.0
Dehumidifier	3.0
Total (Maximum ARAC)	21.0

BASEHEAT: Variable describing the amount of heated floorspace in the basement. BASEHEAT was set equal to zero if the housing unit was located in a multifamily unit or if the housing unit was a single-family (attached, detached, or mobile home) housing unit that did not have a basement or had an unheated basement. BASEHEAT was set equal to one if the housing unit was a single-family housing unit with a completely heated basement. BASEHEAT was set equal to 0.5 if the housing unit was a single-family housing unit with a partially heated basement.

BASEHTDX: A term that adjusts for the amount of heated floorspace in the basement and the type of foundation under the home.

BLACK: An indicator variable that equaled one if the respondent indicated that the householder's primary ethnic background was black.

CDD65: Number of cooling degree-days(CDD) using base 65 degrees Fahrenheit (see "Glossary" in this report).

CDDT2000: Equals CDD65 - 2,000 if CDD65 is greater than 2,000 and equals 0 if CDD65 is 2,000 or less.

CLSWASHR: An indicator variable that equaled one if the household had an automatic clothes washer.

COOKSTVH: An indicator variable that equaled one if the main space-heating equipment was a cooking stove.

COOLED: Cooled square footage.

DSHWASHR: An indicator variable that equaled one if the household had an electric dishwasher.

ELACADJ1: A term that adjusted the electricity air-conditioning component for the presence of central air-conditioning equipment.

ELACADJ2: A term that adjusted the electricity air-conditioning component for the reported amount of time the central air-conditioning equipment was used.

ELACADJ3: A term that adjusted the electricity air-conditioning component for the reported amount of time the wall unit air-conditioning equipment was used.

ELACADJ4: A term that adjusted the electricity air-conditioning component for the presence of ARAC (see ARAC).

ELACADJ5: A term that adjusted the electricity air-conditioning component if the housing type was a mobile home.

ELACCDD: A term within the electricity air-conditioning component that was a function of cooling degree-days and the average humidity during the summer months (See CDD65, CDDT2000, and HUMDT58).

ELACNHMM: A term that adjusted the electricity air-conditioning component for the number of household members that are from 13 to 65 years old.

ELACSIZE: A term within the electricity air-conditioning component that was a function of the amount of floorspace that can be cooled.

ELAIRCON: A midlevel term within the electricity air-conditioning component.

ELAPPLTOT: A midlevel term within the appliance subcomponent of the electricity general appliance component. This term represented the amount of electricity consumed in all appliances except refrigerators, freezers, and appliances used for space heating, water heating, and air conditioning.

ELCLSDRY: An indicator variable that equaled one if the household had an electric clothes dryer.

ELCOOK: An indicator variable that equaled one if electricity was the main energy source used for cooking.

ELFZZCON: A midlevel term within the electricity freezer subcomponent of the general appliance component.

ELHTTUB: An indicator variable that equaled one if the household had an electric hot tub.

ELMAINHT: A term in the electricity space-heating component that accounted for the use of electricity as the main space-heating energy source.

ELMHEAT: An indicator variable that equaled one if electricity was the main space-heating energy source.

ELMSHADJ: A term that adjusted the electricity main space-heating component if the household used a heat pump.

ELPLHEAT: An indicator variable that equaled one if the household had an electrically heated swimming pool.

ELRFGCON: A midlevel term within the electricity refrigerator component.

ELSECHEAT: A term in the electricity space-heating component that accounted for the use of electricity as a secondary space-heating energy source.

ELSHEAT: An indicator variable that equaled one if electricity was a secondary space-heating energy source and was not the main space-heating energy source.

ELSWHEAT: An indicator variable that equaled one if electricity was a secondary water-heating energy source and was not the main water-heating energy source.

ELTOTADJ: A term that adjusted all electricity components for demographic characteristics of the household, electricity price, geographic location, and the effect of housing structure. This term is the product of the eight adjustment terms below.

ELTOTADJ1: A term that adjusted all electricity components for the price of electricity.

ELTOTADJ2: A term that adjusted all the electricity components if the household members were not at home for part of the year.

ELTOTADJ3: A term that adjusted all the electricity components for the geographic location.

ELTOTADJ4: A term that adjusted all the electricity components for the householder's income.

ELTOTADJ5: A term that adjusted all the electricity components if the householder was 85 or older.

ELTOTADJ6: A term that adjusted all the electricity components if the head of the household was between 40 and 59 years of age.

ELTOTADJ7: A term that adjusted all the electricity components if the householder's primary ethnic background was Black.

ELTOTADJ8: A term that adjusted all electricity components for the type of housing structure.

ELWATADJ1: A term that adjusted the electricity water-heating component when electricity was only a secondary water-heating energy source or the housing unit did not have hot running water.

ELWATERHT: A midlevel term within the electricity water-heating component.

ELWHEAT: An indicator variable that equaled one if electricity was the main water-heating energy source.

FOAPLOTH: An indicator variable that equaled one if the household used fuel oil for something other than space heating, water heating, or hot tub heating.

FOMAINHT: A term in the fuel oil space-heating component that accounted for the use of fuel oil as the main space-heating energy source.

FOMHEAT: An indicator variable that equaled one if fuel oil was the main space-heating energy source.
FOSECHEAT: A term within the fuel oil space-heating component that accounted for the use of fuel oil as a secondary space-heating energy source.

FOSHEAT: An indicator variable that equaled one if fuel oil was a secondary space-heating energy source and was not the main space-heating energy source.

FOSHWHADJ: A term that adjusted the fuel oil space-heating and water-heating components for the type of equipment, number of fuel oil deliveries, and the estimated amount of fuel oil used.

FOSWTHT: An indicator variable that equaled one if fuel oil was a secondary water-heating energy source and was not the main water-heating energy source.

FOTTADJ: A term that adjusted the fuel oil space-heating and water-heating components if the main-heating equipment used radiators, convectors, or hot water pipes to distribute the heat.

FOTTBDJ: A fuel oil space-heating and water-heating adjustment term that adjusts for the number of times fuel oil is delivered to the household.

FOTTCDJ: A fuel oil space-heating and water-heating adjustment term that adjusts for the household's estimate of the amount of fuel oil used by the household.

FOTUB: An indicator variable that equaled one if the household used fuel oil to heat a hot tub.

FOWATERHT: A midlevel term within the fuel oil water-heating component.

FOWHTADJ: A midlevel term within the fuel oil water-heating component.

FOWTHT: An indicator variable that equaled one if fuel oil was the main water-heating energy source.

FREZZR: A term within the electricity appliance component that accounted for the use of electricity in freezers.

FRZRADJ: A term that adjusted the freezer component if the household owned a manual freezer.

FRZRBASE: A term that adjusted the freezer component if the household owned any type of freezer.

FRZRBDJ: A term that adjusted the freezer component if the household owned an upright freezer.

FRZRCDJ: A term that adjusted the freezer component for the age of the freezer.

FZZRCOM: Energy used for the freezer subcomponent.

HDD65: Number of heating degree-days(HDD) using base 65 degrees Fahrenheit (see "Glossary" in this report).

HEATED: Amount of heated floorspace (in square feet) in a housing unit.

HEATPUMP: An indicator variable that equaled one if the main space-heating equipment was a heat pump.

HHFEMALE: An indicator variable that equaled one if the head of household was a female.

HH66PLUS: An indicator variable that equaled one if the head of the household was age 66 years or older.

HIGHINCM: An indicator variable that equaled one if the household had an annual income greater than $75,000.

HOTSOALT: An indicator variable that equaled one if the household was in the South Atlantic and Climate Zone 6 (see Glossary).

HUMIDITY: The average humidity for the months of June, July, and August.

HUMDT58: Equals HUMIDITY - 58 if HUMIDITY is greater than 58 and equals 0 if HUMIDITY is 58 or less.

HVAUXHT: An indicator variable that equaled one if the household used a secondary heating energy source.

HVCENTAC: An indicator variable that equaled one if the household had a central air-conditioning system.

HVFRZR: An indicator variable that equaled one if the household had a manual or frost-free freezer that was not part of a refrigerator.

HVHTPOOL: An indicator variable that equaled one if the household had a heated swimming pool.

HVHTRUNW: An indicator variable that equaled one if the housing unit had hot running water.

HVPOOL: An indicator variable that equaled one if the household had a swimming pool.

HVREFRG1: An indicator variable that equaled one if the number of refrigerators owned by the household was one or greater.

HVREFRG2: An indicator variable that equaled one if the number of refrigerators owned by the household was two or greater.

HVREFRG3: An indicator variable that equaled one if the number of refrigerators owned by the household was three or greater.

KERSHEAT: An indicator variable that equaled one if kerosene was a secondary space-heating energy source.

KERAPPL: An indicator variable that equaled one if kerosene was used for some end use other than space heating or water heating.

KERMHEAT: An indicator variable that equaled one if kerosene was the main space-heating energy source.

KERODELV: An indicator variable that equaled one if kerosene was delivered to the housing unit.

KERSWTHT: An indicator variable that equaled one if kerosene was the secondary water-heating energy source.

KERTTADJ: A term within the kerosene space-heating component that adjusts both main and secondary space-heating terms upward when kerosene was delivered to the housing unit.

KERWTHT: An indicator variable that equaled one if kerosene was the main water-heating energy source.

KRMAINSH: A term within the kerosene space-heating component that represented the amount of kerosene consumed for space heating when kerosene was used as a main space-heating energy source.

KRSECSH: A term within the kerosene space-heating component that represented the amount of kerosene consumed for space heating when kerosene was used as a secondary space-heating energy source.

KRSHADJ: A term that adjusted the kerosene space-heating component upward when kerosene was used as a secondary space-heating energy source, and the main space-heating energy source was reported by the respondent to provide "about three-fourths" or "closer to half" of the heat.

KRSHBDJ: A term within the kerosene space-heating component that adjusts the secondary space-heating term if wood is also reported as a secondary space-heating energy source.

KRWATRH: A midlevel term in the kerosene water-heating component.

KERWHTADJ: A midlevel term in the kerosene water-heating component.

LOGCOOL: Log(base 10) of cooled square footage.

LOGFODLS: Log(base 10) of amount of fuel oil delivered to the household.

LOGHTSF: Log(base 10) of heated floorspace.

LOGRELPC: Log(base 10) of ((price of 1,000 kWh of electricity) / ($75.00)). Average revenue (cents per kilowatthour) data were used as average price in the electricity regression equations. These data were obtained from the 1990 EIA survey using Form EIA-861 undertaken by the Office of Coal, Nuclear, Electric, and Alternate Fuels. Average revenue per kilowatthour was calculated by dividing total annual revenue by total annual retail sales for each electric utility. An average revenue per kilowatthour was attached to each 1990 RECS household using electricity.

LOGRNGPC: Average price (dollars per thousand cubic feet) data used in the natural gas regression equations, were obtained from the 1990 EIA survey using Form EIA-176 undertaken by the Office of Oil and Gas. Price data are representative of the average price of the natural gas sold and delivered to residential customers. An average price was attached to each 1990 RECS household using natural gas.

LPGAPPL: A midlevel term within the LPG appliance component.

LPGCK: A midlevel term within the LPG appliance component.

LPGCLSDY: An indicator variable that equaled one if the household had a LPG clothes dryer.

LPGCOOK: An indicator variable that equaled one if LPG was the main cooking energy source.

LPGMAINHT: A term in the LPG space-heating component that accounted for the use of LPG as the main space-heating energy source.

LPGMHEAT: An indicator variable that equaled one if LPG was the main space-heating energy source.

LPGMHADJ: A term that adjusted the LPG main space-heating component if the household used a secondary space-heating energy source.

LPGOUTLT: An indicator variable that equaled one if the household had a LPG outdoor light.

LPGPLHT: An indicator variable that equaled one if the household used LPG to heat a swimming pool.

LPGSCOOK: An indicator variable that equaled one if LPG was a secondary cooking energy source and was not the main cooking energy source.

LPGSECHT: A term within the LPG space-heating component representing the use of LPG as a secondary space-heating energy source.

LPGSHADJ: A term that adjusted the LPG secondary space-heating component for the type of equipment and how the equipment was used.

LPGSHEAT: An indicator variable that equaled one if LPG was a secondary space-heating energy source and was not the main space-heating energy source.

LPGSWTHT: An indicator variable that equaled one if LPG was the secondary water-heating energy source.

LPGTUB: An indicator variable that equaled one if the household used LPG to heat a hot tub.

LPGUSEOT: An indicator variable that equaled one if the household used LPG for other appliances.

LPGWATHT: A midlevel term within the LPG water-heating component.

LPGWHTADJ: A midlevel term within the LPG water-heating component.

LPGWTHT: An indicator variable that equaled one if the household used LPG as its main water-heating energy source.

LPRANGE: An indicator variable that equaled one if the household used a LPG cooking stove as a secondary source of space heat.

LRGAPTBD: An indicator variable that equaled one if the housing unit was located in an apartment building that contains five or more units.

LRGQUNFO: An indicator variable that equaled one if the housing unit estimated that it used 1000 or more gallons of fuel oil yearly.

LRGWHTER: An indicator variable that equaled one if the housing unit water heater held 50 or more gallons of water.

MAJELSEC: A term that adjusted the electricity secondary space-heating component if auxiliary equipment used included a central furnace, heat pump, or built in electric units.

MANUFZZ: An indicator variable that equaled one if the household had a manual-defrost electric freezer.

MDHHINCM: An indicator variable that equaled one if the family income in the last 12 months was between $50,000 and $74,999.

MD39MNUS: An indicator variable that equaled one if the housing unit was built before 1940.

MD40TO49: An indicator variable that equaled one if the housing unit was built between 1940 and 1949.

MD70TO79: An indicator variable that equaled one if the housing unit was built between 1970 and 1979.

MD80PLUS: An indicator variable that equaled one if the housing unit was built in 1980 or later.

MD85PLUS: An indicator variable that equaled one if the housing unit was built in 1985 or later.

MHHDDSZ: A midlevel term within the electricity space-heating component.

MHTC9467: An indicator variable that equaled one if the respondent reported that the main space-heating equipment contributed between 67 and 95 percent of the heat.

MHTC66MN: An indicator variable that equaled one if the respondent reported that the main space-heating system contributed less than two-thirds of the heat.

MIDDLEHH: An indicator variable that equaled one if the head of the household was between 40 and 59 years old.

MOBILEHM: An indicator variable that equaled one if the type of living quarters was a mobile home.

NDRSAWS: Number of doors and windows in the housing unit.

NEWFZZ: An indicator variable that equaled one if the freezer was less than 2 years old.

NGAIRCON: A midlevel term within the natural gas air-conditioning component.

NGAPPL: A midlevel term within the natural gas appliance component.

NGCLSDY: An indicator variable that equaled one if the household had a natural gas clothes dryer.

NGCOOK: An indicator variable that equaled one if natural gas was the main cooking energy source.

NGMHADJ1: A term that adjusted the natural gas space-heating component for the heated floorspace in the basement.

NGMHADJ2: A term that adjusted the natural gas space-heating component for the type of space-heating equipment.

NGMHADJ3: A term that adjusted the natural gas space-heating component for certain conservation characteristics present in the household. (See RECI in Definition of End-Use Variables.)

NGMHADJ4: A term that adjusted the natural gas space-heating component for the amount of space heating provided by secondary space-heating energy sources.

NGMHADJ5: A term that adjusted the natural gas space-heating component for the age of the housing unit.

NGMHADJ6: A term that adjusted the natural gas space-heating component for thermostat setting.

NGMHADJ7: A term that adjusted the natural gas space-heating component for the insulation characteristics of the housing unit.

NGMHADJ8: A term that adjusted the natural gas space-heating component for whether the housing unit was located in a multifamily unit.

NGMAINHT: A term within the natural gas space-heating component that accounted for the use of natural gas as the main space-heating energy source.

NGMHEAT: An indicator variable that equaled one if natural gas was the main space-heating energy source.

NGMHHDD: A term used in the natural gas space-heating component that was a function of the number of heating degree-days. (See HDD65 in Definition of End-Use Variables.)

NGMHSZ: A term used in the natural gas space-heating component that was a function of the size of the housing unit.

NGOTHER: An indicator variable that equaled one if the household used natural gas for other appliances.

NGOUTGR: An indicator variable that equaled one if the household used natural gas for an outdoor grill.

NGOUTLT: An indicator variable that equaled one if the household had a gas outdoor light.

NGPLHT: An indicator variable that equaled one if the household had a swimming pool heated by natural gas.

NGSCOOK: An indicator variable that equaled one if natural gas was a secondary cooking energy source and not the main cooking energy source.

NGSECHEAT: A term within the natural gas space-heating component that accounted for the use of natural gas as a secondary space-heating energy source.

NGSHDJDX: An adjustment term used in the natural gas, electricity, and kerosene space-heating components to adjust for characteristics of the structure and the household temperature.

NGSHEAT: An indicator variable that equaled one if natural gas was a secondary space-heating energy source and not the main space-heating energy source.

NGSWTHT: An indicator variable that equaled one if natural gas was a secondary water-heating energy source and not the main water-heating energy source.

NGTOTADJ: A term that adjusted all natural gas components for demographic characteristics of the household and the price of natural gas.

NGTOTADJ1: A term that adjusted all natural gas components if the householder's origin was Black.

NGTOTADJ2: A term that adjusted all natural gas components when the household used their first refrigerator less than the full year.

NGTOTADJ3: A term that adjusted all natural gas components when the householder was a female.

NGTOTADJ4: A term that adjusted all natural gas components for the price of natural gas.

NGTOTADJ5: A term that adjusted all natural gas components if the income for the household was greater than or equal to $75,000.

NGTOTADJ6: A term that adjusted all natural gas components when the householder is 66 or older.

NGTOTIDX: A term used to adjust the fuel oil, LPG, and kerosene space-heating and water-heating components for demographic characteristics of the household.

NGTOTIDXEL: A term used to adjust the electricity space-heating and water-heating components if the householder was a female and/or if the householder was 66 or older.

NGTUB: An indicator variable that equaled one if the household used natural gas to heat a hot tub.

NGWATERHT: A midlevel term that represented the use of natural gas for water-heating.

NGWATRHT: A term used in the natural gas water-heating component to adjust for the number of household members.

NGWHIDX: A midlevel term used in the electricity, fuel oil, LPG, and kerosene water-heating components.

NGWHTADJ1: A term that adjusted the natural gas water-heating component when natural gas was only a secondary water-heating energy source, or the housing unit did not have hot running water.

NGWHTADJ2: A term that adjusted the natural gas water-heating component for the climate.

NGWHTADJ3: A term that adjusted the natural gas water-heating component for the water heater size.

NGWTHT: An indicator variable that equaled one if natural gas was the main water-heating energy source.

NUMHSMEM: Number of household members in the housing unit.

NUMLGT4: Number of lights on 4-12 hours.

NUMTVCLC: Number of color television sets in the housing unit.

NUMWTBED: Number of water beds in the housing unit.

OFTNGONE: An indicator variable that equaled one if the respondent reported that the most used refrigerator was used less than 12 months.

OLDFZZ: An indicator variable that equaled one if the freezer was more than 20 years old.

POORINSL: An indicator variable that equaled one if the respondent reported that the housing unit was poorly insulated.

RADEQUIP: An indicator variable that equaled one if the main space-heating equipment used radiators, convectors, or hot water pipes to distribute the heat.

RECI: Residential Energy Conservation Index (RECI). A number derived for the purpose of characterizing a set of conservation activities at one point in time for the purpose of accounting for factors that contribute to the reduction of space heating in single-family homes and/or mobile homes. Each item in the index is weighted according to its importance as a conservation activity. The RECI lies between 0 and 10. The table below describes the items that are included in the RECI and the weights for the RECI.

Item	Weight
Storm Doors as Percent of Total Outside Doors	0 to 1.0
Storm Windows as Percent of Total Outside Windows	0 to 1.0
Presence of Roof or Ceiling Insulation	1.5
All of the Walls Insulated	1.5
Large Trees Shade Windows and Roof	1.0
Heating Ducts Insulated	1.0
Heating Equipment is Less than 10 Years Old	1.0
Have Weather Stripping	.5
Have Caulking	.5
Tuneup of Main Heating System in the Past 12 Months	.5
Have Thermal Drapes	.5
Total (Maximum RECI)	10.0

REFRIG: A term within the electricity refrigerator component that accounted for the use of electricity in refrigerators.

REFRIG1: A term which represents the electricity used to operate the primary refrigerator in the household.

REFRIG2: A term which represents the electricity used to operate the secondary refrigerator in the household.

REFRIG3: A term which represents the electricity used to operate the third refrigerator in the household.

RFRBASE1: A term used to adjust electricity use in REFRIG1 if the household uses a primary refrigerator.

RFRBASE2: A term used to adjust electricity use in REFRIG2 if the household uses a secondary refrigerator.

RFRBASE3: A term used to adjust electricity use in REFRIG3 if the household uses a third refrigerator.

RFRDD1: An indicator variable that equaled one if the primary refrigerator has side-by-side doors.

RFRDD2: An indicator variable that equaled one if the secondary refrigerator has side-by-side doors.

RFRDD3: An indicator variable that equaled one if the third refrigerator has side-by-side doors.

RFRGCOM: Energy used for the refrigerator component.

RFRLRG1: An indicator variable that equaled one if the primary refrigerator was large (23 cubic feet or more).

RFRLRG2: An indicator variable that equaled one if the secondary refrigerator was large (23 cubic feet or more).

RFRLRG3: An indicator variable that equaled one if the third refrigerator was large (23 cubic feet or more).

RFRLTU1: An indicator variable that equaled one if the primary refrigerator is used only 1 to 3 months of the year.

RFRLTU2: An indicator variable that equaled one if the secondary refrigerator is used only 1 to 3 months of the year.

RFRLTU3: An indicator variable that equaled one if the third refrigerator is used only one to three months of the year.

RFRMANU1: An indicator variable that equaled one if the primary refrigerator is manual.

RFRMANU2: An indicator variable that equaled one if the secondary refrigerator is manual.

RFRMANU3: An indicator variable that equaled one if the third refrigerator is manual.

RFRNEW1: An indicator variable that equaled one if the primary refrigerator was new (4 years or less).

RFRNEW2: An indicator variable that equaled one if the secondary refrigerator was new (4 years or less).

RFRNEW3: An indicator variable that equaled one if the third refrigerator was new (4 years or less).

RFRSML1: An indicator variable that equaled one if the primary refrigerator is small (10 cubic feet or less).

RFRSML2: An indicator variable that equaled one if the secondary refrigerator is small (10 cubic feet or less).

RFRSML3: An indicator variable that equaled one if the third refrigerator is small (10 cubic feet or less).

RFR1ADJ: Term used to adjust the electricity refrigerator term RFRBASE1 if the refrigerator is manual.

RFR2ADJ: Term used to adjust the electricity refrigerator term RFRBASE2 if the refrigerator is manual.

RFR3ADJ: Term used to adjust the electricity refrigerator term RFRBASE3 if the refrigerator is manual.

RFR1BDJ: Term used to adjust the electricity refrigerator term RFRBASE1 if the refrigerator has side-by-side doors.

RFR2BDJ: Term used to adjust the electricity refrigerator term RFRBASE2 if the refrigerator has side-by-side doors.

RFR3BDJ: Term used to adjust the electricity refrigerator term RFRBASE3 if the refrigerator has side-by-side doors.

RFR1CDJ: Term used to adjust the electricity refrigerator term RFRBASE1 if the refrigerator is new.

RFR2CDJ: Term used to adjust the electricity refrigerator term RFRBASE2 if the refrigerator is new.

RFR3CDJ: Term used to adjust the electricity refrigerator term RFRBASE3 if the refrigerator is new.

RFR1DDJ: Term used to adjust the electricity refrigerator term RFRBASE1 if the refrigerator is only used 1 to 3 months a year.

RFR2DDJ: Term used to adjust the electricity refrigerator term RFRBASE2 if the refrigerator is only used 1 to 3 months a year.

RFR3DDJ: Term used to adjust the electricity refrigerator term RFRBASE3 if the refrigerator is only used 1 to 3 months a year.

RFR1EDJ: Term used to adjust the electricity refrigerator term RFRBASE1 for the size of the refrigerator.

RFR2EDJ: Term used to adjust the electricity refrigerator term RFRBASE2 for the size of the refrigerator.

RFR3EDJ: Term used to adjust the electricity refrigerator term RFRBASE3 for the size of the refrigerator.

RZADJ: A term that adjusted the refrigerator and freezer terms for cooling degree-days. (See CDD65 in Definition of End-Use Variables.)

SECHTCAP: An indicator variable that equaled one if the respondent reported that the housing unit could be heated without using the main space-heating energy source.

SFATTACH: An indicator variable that equaled one if the housing unit was a single-family attached unit.

SMLAPTBD: An indicator variable that equaled one if the housing unit was located in a 2- to 4-unit apartment building.

SMLQUNFO: An indicator variable that equaled one if the respondent estimated that two housing units used between 100-499 gallons of fuel oil yearly.

SMLWHTER: An indicator variable that equaled one if the household's water heater held less than 30 gallons of water.

SPHEATER: An indicator variable that equaled one if the main space-heating equipment was a room or space heater.

SPHTCOM: Energy used for space-heating component.

SQRTARAC: The square root of the Apparatus to Reduce Air Conditioning (see ARAC).

SQRTCD65: Square root of the cooling degree-days base 65 degrees Fahrenheit (CDD65). (See CDD in Definition of End-Use Variables.)

SQRTFLLT: Square root of the number of flood lights.

SQRTHD65: Square root of number of heating degree-days (base 65 degrees Fahrenheit).

SQRTHM58: Square root of HUMDT58.

SQRTNHMM: Square root of the number of household members.

SQRTNL12: Square root of the number of lights on 12 or more hours.

SQR13T65: Square root of the number of persons (ages 13 to 65) in the household.

SRC65T20: Square root of CDDT2000.

TEMPINDX: Indexes summarizing thermostat settings. The indexes are:

NT70PL--An indicator variable that equaled one if the thermostat setting during night sleeping hours was 70 degrees Fahrenheit or higher.

HM70PL--An indicator variable that equaled one if the thermostat setting during the day when someone was home was 70 degrees Fahrenheit or higher.

GN70PL--An indicator variable that equaled one if the thermostat setting when no one was home was 70 degrees Fahrenheit or higher.

NT58MN--An indicator variable that equaled one if the thermostat setting during night sleeping hours was 58 degrees Fahrenheit or less.

HM58MN--An indicator variable that equaled one if the thermostat setting during the day when someone was home was 58 degrees Fahrenheit or less.

GN58MN--An indicator variable that equaled one if the thermostat setting when no one was home was 58 degrees Fahrenheit or less.

TEMPINDX = NT70PL + HM70PL + GN70PL - NT58MN - HM58MN - GN58MN.

UCNACASL, UCNACQBT: Indicator variables that show the amount the central air-conditioning equipment was used/not used. The respondents who stated they had central air-conditioning equipment were asked, "Which of the statements on this exhibit best describes the way you used/not used your air conditioner this summer?" The following indicator variables were set based on the respondent's response.

UCNACASL equaled one if the respondent reported "Turned on just about all summer."

UCNACQBT equaled one if the respondent reported "Turned on quite a bit."

UPRTFZZ: An indicator variable that equaled one if the household had an upright freezer.

USEACNOT: An indicator variable that equaled one if the respondent reported that they did not use their air-conditioning equipment.

UWWACASL, UWWACQBT: Indicator variables that show the amount the window/wall air-conditioning equipment was used/not used. The respondents who stated they had window/wall air-conditioning units were asked, "Which of the statements on this exhibit best describes the way you used/not used your air conditioner this summer?" The following indicator variables were set based on the respondent's response.

UWWACASL equaled one if the respondent reported "Turned on just about all summer."

UWWACQBT equaled one if the respondent reported "Turned on quite a bit."

VSLQUNFO: An indicator variable that equaled one if the respondent estimated that the housing unit used less than 100 gallons of fuel oil yearly.

WARMPACF: An indicator variable that equaled one if the household was located in the Pacific Census Division in one of the following climate zones : 4 through 7. (See Climate Zones in the Definition of End-Use Variables.)

WDSECHT: An indicator variable that equaled one if the household used wood as its secondary space-heating energy source.

WHRZONE1: An indicator variable that equaled one if the housing unit was located in Climate Zone 1. Zone 1 was defined as areas where the average annual heating degree-days (base 65 degrees F) were over 7,000.

WTHTCOM: Energy used for water-heating component.

WTWELLPP: An indicator variable that equaled one if the household used an electric pump for well water.

YCOM: Predicted annual energy consumption in thousands of Btu.

Appendix E

Survey Forms

Appendix E

Survey Forms

This appendix contains copies of the following data collection forms used in the 1990 Residential Energy Consumption Survey (RECS). Forms EIA-457A through C were used in the household portion of the RECS. Forms EIA-457D through G were mailed to energy suppliers. (The original color of each form is also indicated below.)

Appendix F

U.S. Climate Zone and Census Regions and Divisions Maps

Appendix F

U.S. Climate Zone and Census Regions and Divisions Maps

Appendix G

Related EIA Publications on Energy Consumption

Appendix G

Related EIA Publications on Energy Consumption

For information about how to obtain these publications, see the inside cover of this report. Please note that the prices quoted here are subject to change.

In addition to the reports listed below, public use data tapes and data diskettes for the residential, residential transportation, and commercial sectors are available from the National Technical Information Service (NTIS). To obtain information on how to order the tapes/diskettes, you may call NTIS at 703-487-4807, FAX number 703-321-8547. Data diskettes can also be obtained from GPO. For GPO ordering information, call 202-512-2235.

Residential Sector

Housing Characteristics

Note: The survey name was dropped from the beginning of the report title starting with the 1987 data reports.

Housing Characteristics 1990; May 1992, DOE/EIA-0314(90), GPO Stock No. 061-003-00754-6, $23.00.
Housing Characteristics 1987; May 1989, DOE/EIA-0314(87), GPO Stock No. 061-003-00619-1, $13.00.
Residential Energy Consumption Survey: Housing Characteristics 1984; October 1986, DOE/EIA-0314(84), GPO Stock No. 061-003-00499-7, $12.00.
Residential Energy Consumption Survey: Housing Characteristics, 1982; August 1984, DOE/EIA-0314(82), GPO Stock No. 061-003-00393-1, $7.00.

Residential Energy Consumption Survey Housing Characteristics, 1981; August 1983, DOE/EIA-0314(81), GPO Stock No. 061-003-00330-3, $6.50.

Residential Energy Consumption Survey: Housing Characteristics, 1980; June 1982, DOE/EIA-0314, GPO Stock No. 061-003-00256-1, $11.00.

Residential Energy Consumption Survey: Characteristics of the Housing Stock and Households, 1978; February 1980, DOE/EIA-0207/2, GPO Stock No. 061-003-00093-2, $4.25.

Residential Energy Consumption Survey: Conservation; February 1980, DOE/EIA-0207/3, GPO Stock No. 061003-00087-8, $6.00.

Preliminary Conservation Tables from the National Interim Energy Consumption Survey; August 1979, DOE/EIA-0193/P (no GPO Stock No.).

Characteristics of the Housing Stock and Households: Preliminary Findings from the National Interim Energy Consumption Survey; October 1979, DOE/EIA-0199/P (no GPO Stock No. available).

Consumption and Expenditures

Note: The survey name was dropped from the beginning of the report title starting with the 1987 data reports. The titles were changed to *Household Energy Consumption and Expenditures 1987, Part 1: National* and *Part 2: Regional*.

Household Energy Consumption and Expenditures 1987, Part 1: National Data; October 1989, DOE/EIA-0321/1(87), GPO Stock No. 061-003-00635-3, $15.00. Note: Energy end-use data are included in this report.

Household Energy Consumption and Expenditures 1987, Part 2: Regional Data; DOE/EIA-0321/2(87) (no GPO Stock No. available), $16.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1984 Through March 1985, Part 1: National Data; March 1987, DOE/EIA-0321/1(84), GPO Stock No. 061-003-00519-5, $9.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1984 Through March 1985, Part 2: Regional Data; May 1987, DOE/EIA-0321/2(84), GPO Stock No. 061-003-00528-4, $17.00. Note: Energy end-use data are included in this report.

Residential Energy Consumption Survey: Consumption

and Expenditures, April 1982 Through March 1983, Part 1: National Data; November 1984, DOE/EIA-0321/1(82), GPO Stock No. 061-003-00411-3, $7.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1982 Through March 1983, Part 2: Regional Data; December 1984, DOE/EIA-0321/2(82), GPO Stock No. 061-003-00414-8, $9.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1981 Through March 1982, Part 1: National Data; September 1983, DOE/EIA-0321/1(81), GPO Stock No. 061-003-00340-1, $6.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1981 Through March 1982, Part 2: Regional Data; October 1983, DOE/-EIA-0321/2(81), GPO Stock No. 061-00300357-5, $8.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1980 Through March 1981, Part 1: National Data; September 1982, DOE/EIA-0321/1(80), GPO Stock No. 061-003-00278-1, $7.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1980 Through March 1981, Part 2: Regional Data; June 1983, DOE/EIA-0321/2(80), GPO Stock No. 061-003-00319-2, $7.00.

Residential Energy Consumption Survey: 1979-1980 Consumption and Expenditures, Part 1: National Data (Including Conservation); April 1981, DOE/EIA-0262/1, GPO Stock No. 061-00300191-2, $6.50.

Residential Energy Consumption Survey: 1979-1980 Consumption and Expenditures, Part II: Regional Data; May 1981, DOE/EIA-0262/2, GPO Stock No. 061-003-00189-1, $8.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1978 Through March 1979; July 1980, DOE/EIA-0207/5, GPO Stock No. 061-003-00131-9, $7.50.

Single-Family Households: Fuel Oil Inventories and Expenditures: National Interim Energy Consumption Survey; December 1979, DOE/EIA-0207/1, GPO Stock No. 061-003-00075-4, $3.50.

Other Publications on the Residential Sector

"End-Use Consumption of Residential Energy" Monthly Energy Review (Article), pp. vii-xiv, July 1987, DOE/EIA-0035(87/07).

Residential Energy Consumption Survey: Trends in Consumption and Expenditures 1978-1984 June 1987, DOE/EIA-0482, GPO Stock No. 061-003-00535-7, $12.00.

Residential Conservation Measures; July 1986, SR/EEUD/86/01 (no GPO Stock No.).

An Economic Evaluation of Energy Conservation and Renewable Energy Tax Credits; October 1985, Service Report (no GPO Stock No.).

Residential Energy Consumption and Expenditures by End Use for 1978, 1980, and 1981; December 1984, DOE/EIA-0458, GPO Stock No. 061-003-00415-6, $4.50.

Weatherization Program Evaluation, SR-EEUD-84-1; August 1984 (available from the Office of the Assistant Secretary for Conservation and Renewable Energy, Department of Energy).

Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use; October 1983, DOE/EIA-0431, GPO Stock No. 061-003-00347-8, $5.00.

National Interim Energy Consumption Survey: Exploring the Variability In Energy Consumption; July 1981, DOE/EIA-0272, GPO Stock No. 061-003-00-205-6, $5.00.

National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption--A Supplement; October 1981, DOE/EIA-0272/S, GPO Stock No. 061-003-00217-0, $4.50.

Energy Use by U.S. Households; November 1980, DOE/EIA-0248 (brochure, no GPO Stock No.).

Residential Transportation Sector

Note: The survey name was dropped from the beginning of the report title starting with the 1988 data report, and the report title changed to *Household Vehicles Energy Consumption 1988*.

Household Vehicles Energy Consumption 1988; February 1990, DOE/EIA-0464(88), GPO Stock No. 061-003-00652-3, $11.00.

Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985; April 1987, DOE/EIA-0464(85), GPO Stock No. 061-003-00521-7, $8.50.

Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983; January 1985, DOE/EIA-0464(83), GPO Stock No. 061-003-00420-2, $4.50.

Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981; February 1983, DOE/EIA-0328, GPO Stock No. 061-003-00297-8, $4.75.

Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980; April 1982, DOE/EIA-0319 (no GPO Stock No.).

Commercial Sector

Note: The name of the Nonresidential Buildings Energy Consumption Survey was changed to the Commercial Buildings Energy Consumption Survey, beginning with the 1989 survey. The survey name was also dropped from the report title.

Characteristics of Buildings

Commercial Buildings Characteristics 1989; June 1991, DOE/EIA-0246(89), GPO Stock No. 061-003-00699-0, $18.00.

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1986; September 1988, DOE/EIA-0246(86), GPO Stock No. 061-003-00580-2, $16.00.

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983; July 1985, DOE/EIA-0246(83), GPO Stock No. 061-003-00439-3, $7.50.

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983; A Supplemental Reference, DOE/EIA-M008, $22.95. Available from the NTIS, Order No. DE-85015581.

Nonresidential Buildings Energy Consumption Survey: Fuel Characteristics and Conservation Practices; June 1981, DOE/EIA-0278, GPO Stock No. 061-003-00200-5, $9.00.

Nonresidential Buildings Energy Consumption Survey: Building Characteristics; March 1981, DOE/EIA--0246, GPO Stock No. 061-003-00171-8, $6.50.

Consumption and Expenditures

Commercial Buildings Consumption and Expenditures 1989; April 1992, DOE/EIA-0318(89), GPO Stock No. 061-003-00753-8, $25.00.

Nonresidential Buildings Energy Consumption Survey: Commercial Buildings Consumption and Expenditures 1986; May 1989, DOE/EIA-0318(86), GPO Stock No. 061-003-00613-2, $19.00.

Nonresidential Buildings Energy Consumption Survey: Commercial Buildings, Consumption and Expenditures 1983; September 1986, DOE/EIA0318(83), GPO Stock No. 061-003-00496-2, $13.00.

Nonresidential Buildings Energy Consumption Survey: 1979 Consumption and Expenditures, Part 1: Natural Gas and Electricity; March 1983, DOE/EIA-0318/1, GPO Stock No. 061-003-00298-6, $9.50.

Nonresidential Buildings Energy Consumption Survey: 1979 Consumption and Expenditures, Part 2: Steam, Coal, Fuel Oil, LPG, and Total Fuels; December 1983, DOE/EIA-0318(79)/2, GPO Stock No. 061--003-00366-4, $6.00.

Other Publications on the Commercial Sector

Energy Consumption Series--*User-Needs Study for the 1992 Commercial Buildings Energy Consumption Survey*, September 1992, DOE/EIA-0555(92)/4, GPO Stock No. 061-003-00770-8, $8.50.

Energy Consumption Series--*Lighting in Commercial Buildings*; March 1992, DOE/EIA-0555(92)/1, GPO Stock No. 061-003-00749-0, $6.50.

Industrial Sector

"Energy Efficiency in the Manufacturing Sector," Monthly Energy Review (Article), p.1, December 1992.

Manufacturing Energy Consumption Survey: Changes in Energy Intensity in the Manufacturing Sector 1980-1988, December 1991, DOE/EIA-0552(80-88). GPO Stock No. 061-003-00734-1, $4.75.

Manufacturing Energy Consumption Survey: Manufacturing Fuel-Switching Capability 1988; September 1991, DOE/EIA-0515(88), GPO Stock No. 061-003-00720-1, $9.00.

Manufacturing Energy Consumption Survey: Consumption of Energy, 1988; May 1991, DOE/EIA 0512(88), GPO Stock No. 061-003-00703-8, $11.00.

Manufacturing Energy Consumption Survey: Energy Efficiency in Manufacturing, 1985; January 1990, DOE/EIA-0516(85), GPO Stock No. 061-00300650-7, $4.25.

Manufacturing Energy Consumption Survey: Fuel-Switching Capability, 1985; December 1988, DOE/EIA-0515(85), GPO Stock No. 061-00300601-9, $3.50.

Manufacturing Energy Consumption Survey: Methodological Report, 1985; November 1988, DOE/EIA-0514(85), GPO Stock No. 061-00300595-1, $6.00.

Manufacturing Energy Consumption Survey: Consumption of Energy, 1985; November 1988, DOE/EIA-0512(85), GPO Stock No. 061-00300594-2, $6.00.

"Manufacturing Sector Energy Consumption 1985 Provisional Estimates," Monthly Energy Review (Article), pp. vii-x, January 1987, DOE/EIA-0035(-87/01).

Report on the 1980 Manufacturing Industries' Energy Consumption Study and Survey of Large Combustors; February 1983, DOE/EIA-0358, GPO Stock No. 061-003-00293-5, $5.00.

Industrial Energy Consumption, "Survey of Large Combustors: Report on Alternate Fuel-Burning-Capabilities of Large Boilers in 1979"; February 1982, DOE/EIA-0304, GPO Stock No. 061-003-0233-1, $2.50.

Methodological Report of the 1980 Manufacturing Industries Survey of Large Combustors (EIA-463); March 1982, DOE/EIA-0306 (no GPO Stock No.).

Other Publications on the Industry Sector

Energy Consumption Series--*Derived Annual Estimates of Manufacturing Energy Consumption 1974-1988*, August 1992, DOE/EIA-0555(92)/3, GPO Stock No. 061-003-00766-0, $7.00.

Energy Consumption Series--*Development of the 1991 Manufacturing Energy Consumption Survey*, May 1992, DOE/EIA-0555(92)/2, GPO Stock No. 061-003-00757-1, $5.50.

Cross-Sector

Energy Consumption by End-Use Sector: A Comparison of Measures by Consumption and Supply Surveys; April 6, 1990, DOE/EIA-0533 (no GPO Stock No. available), $2.50.

Natural Gas: Use and Expenditures; April 1983, DOE/EIA-0382, GPO Stock No. 061-003-00307-9, $5.50.

Public Use Tapes

Note: All tapes are available through the NTIS.

Residential and Residential Transportation Sectors

Residential Energy Consumption Survey: 1987 and Residential Transportation Energy Consumption Survey, 1988, Order No. PB90-501461, $220.

Residential Energy Consumption Survey: 1984 and Residential Transportation Energy Consumption Survey, 1985; Order No. PB87-186540, $220.

Residential Energy Consumption Survey: 1982 and Residential Transportation Energy Consumption Survey, 1983; Order No. PB85-221760, $220.

Residential Energy Consumption Survey: Consumption and Expenditures, 1980-1981; Monthly Billing Data; Order No. PB84-166230, $220.

Residential Energy Consumption Survey: Housing Characteristics, 1981; Consumption and Expenditures, 1981-1982; Monthly Billing Data; Order No. PB84-120476, $220.

Residential Energy Consumption Survey: Housing Characteristics, Annualized Consumption and Expenditures, 1980-1981; Order No. PB83-199554, $220.

Residential Energy Consumption Survey: Household Transportation Panel Monthly Gas Purchases and Vehicle and Household Characteristics, 6/79-9/81; Order No. PB84-162452, $220.

Residential Energy Consumption Survey: Household Screener Survey, 1979-1980; Order No. PB82-114877, $220.

Residential Energy Consumption Survey: Household Monthly Energy Consumption and Expenditures, 1978-1979; Order No. PB82-114901, $220.

National Interim Energy Consumption Survey (Residential), 1978; Order No. PB81-108714, $220.

Commercial Sector

Nonresidential Buildings Energy Consumption Survey: 1986 Data; Order No. PB90-500034, $220.

Nonresidential Buildings Energy Consumption Survey: 1979 and 1983 Data; Order No. PB88-245162, $220.

Public Use Diskettes

Note: Diskettes are available through the NTIS and GPO.

Residential Energy Consumption Survey 1987 Data, **NTIS** - ASCII format: Order No. PB-91-505115, $130, and dBASE format: Order No. PB-91-505107, $130. **GPO** - ASCII/dBASE format, order by title, $45 for each set.

Commercial Buildings Energy Consumption Survey 1989 data, **GPO** - ASCII format, order by title, $45.00. **NTIS** - ASCII format: Order No. PB92-504232, $140.

Nonresidential Buildings Energy Consumption Survey 1986 Data, **NTIS** - ASCII format: Order No. PB91-506808, $130.

Residential Transportation Energy Consumption Survey 1988 Data, **NTIS** - ASCII format: Order No. PB91-507269, dBASE format: Order No. PB91-507277, $50 each. **GPO** - ASCII/dBASE format, order by title, $15 for each set.

Planned Publications

Manufacturing Energy Consumption Survey: Changes in Energy Consumption 1985-1988; planned for early 1993.

Household Vehicles Energy Consumption 1991; planned for Mid-1993.

Note: The Energy Information Administration also publishes the *State Energy Data Report, Consumption Estimates*, DOE/EIA-0214, annually; the *State Energy Price and Expenditures Report*, DOE/EIA-0376, annually; and the *Monthly Energy Review*, DOE/EIA-0035, monthly. These reports contain monthly and annual consumption information derived from EIA supply surveys.

Glossary

Account Classification: In this report this term refers to the way in which suppliers of electricity, natural gas, or fuel oil classify and bill their customers. Commonly used account classifications are "Commercial," "Industrial," and "Residential." Suppliers' definitions of these terms vary from supplier to supplier and from the definitions used in RECS. In addition, the same customer may be classified differently by each of its energy suppliers.

Active Solar: As an energy source, energy from the sun collected and stored using mechanical pumps or fans to circulate heat-laden fluids or air between solar collectors and the building. Examples include the use of solar collectors for water or space heating. The 1990 RECS did not gather consumption and expenditures data for active solar.

Adequacy of Insulation: The perception of the respondent as to the adequacy of insulation present in the housing unit; or how "good" the insulation in the unit is. This was first asked in the 1990 RECS.

Adjusted Electricity: A measurement of electricity that includes the approximate amount of energy used to generate electricity. To approximate the adjusted amount of electricity, the site-value of the electricity is multiplied by a factor of three. This conversion factor of three is a rough approximation of the Btu value of raw fuels used to generate electricity in a steam-generation power plant. In this report, electricity is represented as site energy. (See **Site Energy** and **Btu Conversion Factors**.)

Aggregate Ratio: The ratio of two population aggregates (totals). For example, the aggregate floorspace per household is the ratio of the total floorspace in each category to the total number of households in the category.

Air-Conditioned Rooms: The number of rooms the air-conditioning equipment *usually* cools when the equipment is used. In previous RECS, this question referred to the number of rooms that *could* be cooled by the air conditioner. (See **Air-Conditioning Usage**.)

Air Conditioning: Air conditioning is one of the five end-use categories in this report. It is defined as cooling and dehumidification of the air in a building by a refrigeration unit driven by electricity or gas. This definition excludes fans, blowers, or evaporative cooling systems ("swamp coolers") that are not connected to a refrigeration unit. Air-conditioning units that are not currently in working condition or are not used are still included in the RECS if they are in place in the housing unit. (See **Refrigeration Unit and Evaporative Cooler(Swamp Cooler)**.)

Air-Conditioning Equipment: Either a central air-conditioning system with ducts or window or wall air conditioners that cool the air in a housing unit by a refrigeration unit driven by electricity or natural gas. Excluded are fans, blowers, or evaporative cooling systems ("swamp coolers") that are not connected to a refrigeration unit. Air-conditioning units that were not in working condition or were not used, are still included in RECS if they are in place in the housing unit. (See **Room Air Conditioner**.)

Air Conditioning Usage: The way the central air conditioner or the most used room air conditioner was used during the summer of 1990. When a household had both a central air conditioner and a room air conditioner, the tabulation was based on the use of the central air conditioner. Some households responded "other" to this question of "use last summer"; these were mainly households that said they did not live in their house last summer. Some households responded that they did not use their air conditioner at all last summer but "usually" air condition some rooms; for these respondents their usual behavior did not include last summer. Note: If householder did not live there summer 1990 - the consumption was imputed. (See **Air-Conditioned Rooms**.)

Appliance Combination: Refers to several variables created for the stub of the appliance end-use consumption table in the main body of the report. Households were characterized as using or not using a particular combination of appliances.

Appliance Efficiency Index: As used in this report, the index of appliance efficiency was a relative comparison of trends in new-model efficiencies for major appliances and energy-using equipment. The base year for relative comparisons was 1972 (1972=100). Efficiencies for each year were efficiencies of different model types, which were weighted by their market shares. (See *Energy Conservation Trends*, DOE/PE-0092, U.S. Department of Energy, Office of Policy, Planning & Analysis, Office of Conservation & Renewable Energy September 1989, p. 37) and **Calculation of Stock Efficiencies** in Appendix B, "Quality of the Data."

Appliance Efficiency Standards: The National Appliance Energy Conservation Act of 1987 established minimum efficiency standards for major home appliances including furnaces, central and room air conditioners, refrigerators, freezers, water heaters, dishwashers, and heat pumps. Most of the standards took effect in 1990. The standards for clothes washers, dishwashers, and ranges took effect in 1988 because they required only minor changes in product design, such as eliminating pilot lights and requiring cold water rinse options. The standards for central air conditioners and furnaces take effect in 1992. Appliance efficiency standards for refrigerators go into effect in 1993. Virtually no refrigerator models on the market in 1990 met the 1993 standards.

Appliances: One of the main end-use categories in RECS. It is defined as the use of energy for all uses except those covered by space heating, water heating, refrigerators (starting with the 1990 RECS), and air conditioning. This includes energy used for freezers, lights, televisions, personal computers, washing machines, and most small appliances. Special energy uses for appliances are energy used to heat: food, water for cooking, water for hot drinks, air to dry clothes, water for a swimming pool, water in a water bed. Also included is energy to operate fans for a central forced-air space-heating system or air-conditioning system and energy for an evaporative cooling system (swamp coolers). (See **End-Use**.)

Appliances Used: Appliances used in the home during the year, including those loaned to the householder for regular use. Appliances possessed by the household but not used are not counted, except for air-conditioning equipment. Appliances temporarily not in working condition but generally used by the household are included, only if a repair person has been called or the appliance has been taken to a repair shop, except for air-conditioning equipment. Cooking appliances included the following: gas stove-top or burners, gas oven, electric stove-top or burners, electric oven, microwave oven, gas grill (that uses bottled gas or propane), and natural gas grill. Stove-top or burners includes range tops and stand-alone cook tops. Range burners and ovens are counted as separate appliances. Cooling appliances included: evaporative cooler (swamp cooler), whole house or attic fan, exhaust fan, window or ceiling fan, portable or table fan. Other appliances counted included: refrigerators, freezers, dishwashers, clothes washer and dryers, swimming pool and hot tub pumps and heaters, televisions and personal computers, waterbed heaters and portable space heaters and dehumidifiers. (See **Air-Conditioning Equipment** and **Lights**.)

Assistance for Heating in Winter: Indicates the household answered "yes" to whether the household received assistance from the Low-Income Home Energy Assistance Program (LIHEAP). The purpose of LIHEAP is to help pay home energy costs of low-income households. The most recent report on the program is the U.S. Department of Health and Human Services' *Low-Income Home Energy Assistance Program: Report to Congress for Fiscal Year 1990*, September 11, 1991. Copies are available from: Administration for Children and Families, Office of Community Services, Division of Energy Assistance, 370 L'Enfant Promenade, S.W., Washington, DC 20447.

Assistance for Weatherization of Residence: The household received any of the following services free, or at a reduced cost, from the Federal, State, or local Government:

- Insulation in the attic, outside wall, or basement/crawlspace below the floor of the house
- Insulation around the hot water heater
- Repair of broken windows or doors to keep out the cold or hot weather
- Weather stripping or caulking around any windows or doors to the outside
- Storm doors or windows added
- Repair of broken furnace
- Furnace tuneup and/or modifications
- Other home energy-saving devices.

Attic Insulation: Insulating materials in the attic, either placed underneath the roof, on the roof, or on the floor of the attic.

Authorization Form: A form signed by the RECS household respondent authorizing the energy supplier companies that serve the household to release information on the amounts and costs of energy consumed during a specified reporting period.

Automatic Set-Back or Clock Thermostat: A thermostat that can be set to turn the heating/cooling system off and on at predetermined times and temperatures.

Availability of Natural Gas in the Neighborhood: Respondents were asked "Is gas from underground pipes available in this neighborhood?" The meaning of "available" and "neighborhood" were left to individual interpretation by the respondents. The intent of this question was to determine whether a residence could be "readily" hooked up to a gas line.

Average: The simple arithmetic average for a population; that is, the sum of all the values in a population divided by the size of the population. Population means are estimated by computing the weighted sum of the sample values, then dividing by the sum of the sample weights. (See **Weight**.)

Average Age of Appliances: Respondents were provided four age categories to determine the age of selected appliances (central and room air conditioners, first and second refrigerators, freezers, water heaters and their main heating system). The midpoint of each category was used to estimate an average age of the appliances. The midpoints for each age category were as follows:

Age Category	Midpoint
Less than 2 years	1
2 to 4 years	3
5 to 9 years	7
10 to 19 years	14.5
20 years or more	20

Backup Fuel: In a central heat pump system, the fuel used in the furnace, which is used for space heating when the outdoor temperature drops below that which is feasible to operate a heat pump. (See **Heat Pump**).

Basement: An enclosed space in which a person can walk upright under all or part of the building.

Baseboard Heating Units: See **Built-In Electric Units.**

Bathroom: For this report, a full bathroom contains a sink with running water, a flush toilet, and a bathtub or shower. A half bathroom contains a toilet or bathtub or shower.

Bedroom: Room intended for sleeping, even if not presently used for sleeping. Number of bedrooms are those that

would be listed as descriptive of the apartment or house if it were on the market for sale or rent. A one-room efficiency or studio apartment has no bedrooms.

Billing Period: The time between meter readings. It does not refer to the time when the bill was sent or when the payment was to have been received. In some cases, the billing period is the same as the billing cycle that corresponds closely (within several days) to meter-reading dates. For fuel oil and LPG, the billing period is the number of days between fuel deliveries.

Block-Rate Structure: A utility rate structure in which the charge for energy decreases as the amount of energy consumed increases. A reduced rate charged on succeeding blocks is called a declining rate. An increased rate charged on succeeding blocks is called an inclining rate.

Boiler: A type of space-heating equipment consisting of a vessel or tank where heat produced from the combustion of fuels such as natural gas, fuel oil, or coal is used to generate hot water or steam.

British Thermal Unit: See **Btu**.

Btu (British Thermal Unit): A Btu is defined as the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit, at normal atmospheric pressure. Energy consumption is expressed in Btu in this report to allow for consumption comparisons among fuels that are measured in different units. (See **Metric Conversion Factors.**)

Btu Conversion Factors: The Btu conversion factors used for this survey here:

Electricity	3,412 Btu/kilowatthour
Natural gas	1,027 Btu/cubic foot*
Fuel Oil No.1	135,000 Btu/gallon
Kerosene	135,000 Btu/gallon
Fuel Oil No.2	138,690 Btu/gallon
LPG (propane)	91,330 Btu/gallon
Wood	20,000,000 Million btu/cord

*Varied by company, for the 1990 RECS, conversion rate was an aggregate of those reported on Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition." (See **Metric Conversion Factors**.)

Built-In Electric Units: An individual electric resistance space heating unit that is permanently installed in the floors, walls, ceilings, or baseboards and is part of the electrical installation of the building. Electric space-heating devices that are plugged into an electric socket or outlet are not considered built in.

Caulking: Moldable sealing material around any windows or doors to the outside that (when put into cracks around the frames of windows or doors, or cracks in other stationary parts of a house) reduces the passage of air and moisture. Caulking can be applied either to the inside or to the outside of the home.

CDD: See **Cooling Degree-Days (CDD).**

Ceiling Insulation: Insulating materials placed between the ceiling and the roof.

Census Division: A geographic area consisting of several States defined by the U.S. Department of Commerce, Bureau of the Census. (See the map in Appendix F.) The States are grouped into nine divisions and four regions.

Region	Division	States
Northeast	New England	Connecticut, Maine, Massachusetts, New Hampshire, Vermont, and Rhode Island
	Middle Atlantic	New Jersey, New York, and Pennsylvania
Midwest	East North Central	Illinois, Indiana, Michigan, Ohio, and Wisconsin
	West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
South	South Atlantic	Delaware, the District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia

	East South Central	Alabama, Kentucky, Mississippi, and Tennessee
	West South Central	Arkansas, Louisiana, Oklahoma, and Texas
West	Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming
	Pacific	Alaska, California, Hawaii, Oregon, and Washington

Census Region: See **Census Division** and the map in Appendix F.

Central Air-Conditioning: See **Air-Conditioning Equipment**.

Central City: Is usually one or more legally incorporated cities within the Metropolitan Statistical Area (MSA) that is significantly large by itself or large relative to the largest city in the MSA. Additional criteria for being classified "central city" include having at least 75 jobs for each 100 employed residents and having at least 40 percent of the resident workers employed within the city limits. Every MSA has at least one central city, which is usually the largest city. Central cities are commonly regarded as relatively large communities with a denser population and a higher concentration of economic activities than the outlying or suburban areas of the MSA. Those parts of the MSA that are not designated as central city are called "suburban." For this report, the central city and suburban areas are called urban areas, whereas, in previous RECS reports, these components were referred to as metropolitan areas. (See **Metropolitan Statistical Area (MSA), Urban, Suburban**, and **Rural**.)

Central Warm-Air Furnace: A type of space-heating equipment where a central combustor or resistance unit--generally using gas, fuel oil, or electricity provides warm air through ducts leading to the various rooms. Heat pumps are not included in this category. A forced-air furnace is one in which a fan forces air through the ducts. In a gravity furnace, air circulated by gravity, relies on the natural flow of warm air up and cold air down; the warm air rises through ducts and the cold air falls through ducts that return it to the furnace to be reheated and this completes the circulation cycle.

CEUI: See **Conditional End-Use Intensity**.

CF: See **Cubic Foot (cf)**.

Climate Zone: One of five climatically distinct areas, defined by long-term weather conditions affecting the heating and cooling loads in buildings. The zones were developed by the Energy End Use and Integrated Statistics Division (EEUISD) from seven distinct climate categories originally identified by the American Institute of Architects (AIA) for the U.S. Department of Energy and the U.S. Department of Housing and Urban Development. The zones were determined according to the 30-year average (1951-1980) of the annual heating and cooling degree-days (base 65 degrees Fahrenheit). The zones are defined as follows:

Climate Zone	Average Annual Cooling Degree-Days	Average Annual Heating Degree-Days
1	Under 2,000	Over 7,000
2	Under 2,000	5,500 to 7,000
3	Under 2,000	4,000 to 5,499
4	Under 2,000	Under 4,000
5	2,000 or More	Under 4,000

An individual household was assigned to a climate zone according to the 30-year average annual degree-days for an appropriate nearby weather station. (See **Heating Degree-Days (HDD)** and **Cooling Degree-Days (CDD)**.)

Clothes Dryer: An appliance that dries laundry through the application of heat and rapid air movement. The hot air used is typically heated by electricity or gas, either natural gas or liquefied petroleum gas.

Clothes Washer: An appliance that automatically cleans home laundry using either an agitator or a rotating tub.

Coal: A combustible mineral substance (carbonized vegetable matter); in this report, the term includes its derivative (formed by destructive distillation or imperfect combustion) coke. Only statistics on the number of households using coal are collected in RECS. (See **Energy Source.**)

Compressor: Used in air-conditioning equipment and usually powered by an electric motor, most compressors are of the reciprocating (piston) type, which compress the refrigerant to maintain the proper pressure in the air-conditioning system. The compressor is contained in the outdoor unit of central air-conditioning systems which usually contains a condenser also. The refrigerant circulates through the tubes with finned surfaces (the condenser), which removes heat and condenses the refrigerant to a liquid. (See **Refrigeration Unit**.)

Conditional Energy Intensity: A measure of intensity that adjusts either the amount of energy consumed or expenditures spent for the effects of certain characteristics such as weather, size of unit, and number of household members for households that use a particular energy source. (See **CEUI, Conditional End-Use Intensity** and **Intensity**.)

Conditional End-Use Intensity (CEUI): A measure of intensity that adjusts either the end-use consumption or expenditures for the effects of certain characteristics such as: floorspace, degree-days, or household members for households that use an energy source for a particular end use. In the case of **space-heating intensity**, only the heated floorspace and heating degree-days are used. The **air-conditioning intensity** uses only the cooled floorspace and cooling degree-days. The **water-heating intensity** adjusts consumption and expenditures for the effects of the number of household members on water-heating consumption. (See **CEUI, Conditional Energy Intensity** and **Intensity**.)

Conservation Program: As used in this report, a program in which a utility company furnishes home weatherization services free or at reduced cost, or provides free or low-cost devices for saving energy, such as energy-efficient light bulbs, water-flow restrictors, weather stripping, and water-heater insulation. (See **Demand-Side Management Programs (DSM).**)

Consumption: The amount of electricity or natural gas used by, or delivered to, the household during a 365-day period. For fuel oil, kerosene, and LPG, the quantity represents fuel purchased, not fuel consumed. If the level of fuel in the tank was the same at the beginning and end of the annual period, then the quantity consumed would be the same as the quantity purchased. Measurements or reports of the level of fuel in the tank were not included in the RECS data collection.

Control Total: The number of elements in the population or a subset of the population. The sample weights for the observed elements in a survey are adjusted so that they add up to the control total. The value of a control total is not obtained from the survey; it is obtained from an outside source. For the RECS, the control totals are given by the number of households in one of the 12 cells by categorizing households by the four Census regions and by three categories of urban status (Urban--central city, Urban--outside central city, and Rural). The control totals were obtained from the Current Population Survey. See Table B8 in Appendix B, "Quality of the Data."

Conversion Factors: See **Btu Conversion Factors** and **Metric Conversion Factors**.

Cooking Stove: A stove built for preparing food. In this survey, it may be used as the main heating equipment. (See **Heating Equipment** and **Appliances**.)

Cooled Floorspace: See **Floorspace**.

Cooling Degree-Days (CDD): A measure of how hot a location was over a period of time, relative to a base temperature. In this report, the base temperature is 65 degrees Fahrenheit, and the period of time is one year. The cooling degree-days for a single day is the difference between that day's average temperature and the base temperature if the daily average is greater than the base and zero if the daily average temperature is less than or equal to the base temperature. The cooling degree-days for a longer period of time is the sum of the daily cooling degree-days for the days in that period. Average daily temperature is the mean of the maximum and minimum temperature for a 24-hour period. Cooling degree-days can also be calculated using a base temperature other than 65 degrees. The computation is performed in an analogous manner.

Since the 1987 RECS, cooling degree-days for households are taken from records of an appropriate nearby weather station. In previous RECS, weather data were assigned to households according to the NOAA division in which the household was located. (See **Heating Degree-Days (HDD)**, **Climate Zone**, and **30-Year Average Degree-Days**.)

Cord of Wood: A cord of wood measures 4 feet by 4 feet by 8 feet, or 128 cubic feet.

Crawl Space: Space between the ground and the floor of a house in which a person cannot walk upright. An enclosed crawl space is one not accessible from the outside of the house (except by a door or window); the walls of the crawl space protect it from the weather.

Cubic Foot (cf): As a natural gas measure, the volume of gas contained in a cube with an edge that is 1 foot long at standard temperature and pressure (60 degrees Fahrenheit and 14.73 pounds standard per square inch.) The thermal content varies by the composition of the gas. (See **Natural Gas** and **Btu Conversion Factors.)**

Current Dollars: As used in this report, dollar values expressed in the current dollars at the time of the specific RECS data collection. The dollar amounts are not directly comparable across time periods since they have not been adjusted for the effects of inflation. In contrast, real dollars have been adjusted for the effects of inflation.

Dehumidifier: A dehumidifier is an appliance that removes moisture from the air (often used in the summer when the high moisture content of air makes it uncomfortable). (See **Humidifier** and **Humidity**.)

Demand-Side Management (DSM) Programs: These are organized utility-sponsored activities that are intended to affect the amount and timing of customer electricity use.

Dishwasher: A built-in or portable appliance used for automatically cleaning dishware, utensils, and cutlery.

Door: A movable, usually solid barrier for opening and closing an entrance way. Outside doors lead from a heated area to the outside or to an unheated area, such as a porch or garage. Doors leading to a heated hallway in an apartment building, doors permanently sealed shut, and doors to an unheated attic or basement are not counted, because they are not usually fitted with storm doors. Therefore, an apartment with one door leading to a heated hallway would have zero doors for RECS purposes. Double doors are counted as one door. A pair of sliding glass doors is counted as one door in this survey. The definition of "standard doors" includes doors both with and without glass panels.

DSM: See **Demand-Side Management (DSM) Programs.**

Electric Air-Conditioning Intensity: In this report, the ratio of end-use electric air-conditioning consumption or expenditures to square footage of cooled floorspace and cooling degree-days (base 65 degrees Fahrenheit). Only the CDD and square feet for households that have air-conditioning equipment are included in the ratio. The intensity provides a way of comparing different types of housing units and households by controlling for differences in housing unit size and weather conditions. The square footage of cooled floorspace is equal to the product of the total square footage times the ratio of the number of rooms that are cooled to the total number of rooms. If the entire housing unit is cooled, the cooled floorspace is the same as the total floorspace. The ratio is calculated on a weighted, aggregate basis. (See the main text of this report for a detailed description of energy intensity measures used and **Floorspace**.)

Electric Pump for Well Water: This pump forces the water from a well below ground level up into the water pipes that circulate through the house. When this pump is not working, there is a limited supply of running water in the house.

Electricity: Metered electric power supplied by a central utility company to a residence via power lines. Since there are no volumetric measures of electricity as with the fossil fuels, electricity is measured as the amount of power used at any instant (demand expressed in watts or kilowatts) or as power used over a given time (consumption expressed in kilowatthours). The heat equivalent for electricity is 3,412 Btu per kWh, but this is a derived form of energy and does not represent the amount of energy needed to generate the electricity and transmit it to the building. Generation and transmission requires about 3 times 3,412 or 11,620 Btu per kWh. Energy is used in preparing other fuels for consumption from their condition as mined and delivering them to a site for use, but these amounts of energy are relatively small compared to the Btu value of the fuel consumed. (See **Adjusted Electricity**.)

Electricity Paid by Household: The household paid the electric utility company directly for all household uses of electricity (such as water heating, space heating, air conditioning, cooking, lighting, and operating appliances.) Bills paid by a third party are not counted as paid by the household. (See **Electricity**.)

Eligible for Federal Assistance: Households are categorized as eligible for federal energy assistance if their income is below the federal maximum standard. The federal standard is 150 percent of the poverty line or 60 percent of statewide median income, whichever is the higher income. Individual states can set the standard at a lower level than the federal maximum. (See **Poverty Line**.)

End Use: A function for which energy sources or fuels are used in the household. In the 1990 RECS, five main energy end-use categories were estimated: space heating, air conditioning, water heating, refrigerator, and appliance usage. The amount of energy used for these end uses is estimated by means of a nonlinear regression technique, rather than by using metered data. (See **Space Heating, Air Conditioning, Water Heating, Refrigerators, Appliances, Metered Data**, and Appendix D, "End-Use Estimation Methodology.")

Energy: The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of the capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatthours, while heat energy is usually measured in British thermal units (Btu).

Energy Audit: An inspection carried out by a utility company that determines where and how energy is used and suggests ways energy can be saved or used more efficiently.

Energy Source: A type of energy or fuel consumed by the household. For this report, the energy sources identified are electricity, natural gas, fuel oil, kerosene, liquefied petroleum gas (propane), wood, coal, and active solar. (See **Electricity, Natural Gas, Fuel Oil, Kerosene, Liquefied Petroleum Gas (LPG), Wood, Coal,** and **Active Solar**.)

Energy Supplier: A company that provides electricity, natural gas, fuel oil, kerosene or LPG to the household. (See **Authorization Form** and Appendix A, "How the Survey Was Conducted.")

Estimated Bill: A set of charges for a fuel, calculated by the supplier when the meter is not read. The estimate may be based on one or more of the following factors: past usage, usage by similar households, and weather data.

Evaporative Cooler (Swamp Cooler): A type of cooling equipment using the evaporation of water to cool air. This type of equipment is commonly found in warm, dry climates. Evaporative cooling units do not cool air by use of a refrigeration unit, so for this report they are not considered air-conditioning equipment.

Exhaust Fan: Small fans located in the wall or ceiling which exhaust air, odors, and moisture from the bathroom, kitchen, or basement to the outside.

Expenditures: Charges spent for the energy consumed in, or delivered to, a building during a given period of time. For this report, all expenditure statistics are presented on an annual basis, for calendar year 1990. The total dollar amount includes State and local taxes, but excludes merchandise, repairs, or special service charges. For households on a budget plan, the expenditures are for the actual consumption. Electricity and natural gas expenditures are for the amount of those energy sources consumed. Fuel oil, kerosene, and LPG expenditures are for the amount of fuel purchased, which may differ from the amount of fuel consumed. For households that do not pay their fuel supplier directly, the expenditures for fuels are estimated and included in the tables. (See **Consumption** and Appendix B, "Quality of the Data.")

Expenditures as a Percentage of Income: The annual household energy expenditures divided by the family's annual income. The median percentage is the percentage of income spent on energy for the middle household, when the households are ranked by the percentage they spend on energy. That is, 50 percent of the weighted households in the cell spend a lower percentage on energy than the median value.

Family Income Category: The income grouping for the total combined income (before taxes and deductions) of all members of the family from all sources, for the 12 months prior to the interview. Sources of income include the following: wages, salaries, tips, commissions, interest, dividends, rental income, Social Security or railroad retirement, pensions, food stamps, Aid to Families with Dependent Children, unemployment compensation, Supplemental Security Income, General Assistance and other public assistance. This definition includes the total income of all family members who lived in the household during the 12 months prior to the interview, regardless of whether they were living there at the time of the interview. Income of nonfamily members of the household is not included. "Family" includes the following types of relationships: mother, father, sister, brother, son, daughter, father-in-law, uncle, aunt, niece, grandchild, foster child (and similar relationships). (See "Quality of Specific Data Items" in Appendix B, "Quality of the Data.")

Fan: An electric appliance that uses a motor to rotate rigid vanes to move air for cooling. (See **Whole-House Cooling Fan**, **Exhaust Fan**, **Window or Ceiling Fan**, **Portable Fan** and **Furnace Fan**.)

Fireplace: Usually a masonry unit which burns wood, that is built into the wall of a house or mobile home and has a permanent chimney. Fireplaces in mobile homes are included. Fireplaces may have glass doors or metal shields to cover the opening into the room. Accessories such as convective grates or radiant grates may be present to increase the efficiency of the fireplace. A free-standing fireplace that can be detached from its chimney is a heating stove. (See **Heating Stove**.)

Fireplace Insert: A heating stove that occupies most of the burning area of a fireplace. Fireplace accessories such as glass doors, metal shields to cover the opening into the room, convective or radiant grates, or air circulation devices (including fans) are not considered fireplace inserts.

Floodlights: Lights that illuminate large areas, often used outdoors. Incandescent floodlights, the most common, are at least 150 watts. Mercury vapor or sodium vapor floodlights are at least 100 watts. Floodlights cannot be fluorescent lights.

Floor, Wall, or Pipeless Furnace: Space-heating equipment consisting of a ductless combustor or resistance unit, having an enclosed chamber where fuel is burned or where electrical-resistance heat is generated to warm the rooms of a building. A floor furnace is located below the floor and delivers heated air to the room immediately above or (if under a partition) to the room on each side. A wall furnace is installed in a partition or in an outside wall and delivers heated air to the rooms on one or both sides of the wall. A pipeless furnace is installed in a basement and delivers heated air through a large register in the floor of the room or hallway immediately above.

Floorspace: The floor area of the housing unit that is enclosed from the weather. For RECS, the following are included in the floorspace: basements, whether or not they contain finished space; finished and/or heated space in attics; and garages, if they have a wall in common with the house. Not included are: crawl spaces, even if they are enclosed from the weather; and sheds and other buildings that are not attached to the house. Floorspace (in square feet) is derived from an actual measurement made by the RECS interviewer using a metallic, retractable, 50-foot tape measure. For details on how the measurement was made and how the data were treated, see "Estimates of Housing Unit Size" in Appendix B, "Quality of the Data."

"Heated Floorspace" is the portion of the floorspace that is heated during most of the winter season. Rooms that are shut off during the heating season to save fuel are not counted as heated square footage. Attached garages that are unheated and unheated areas in basements and attics are not counted as heated square feet.

"Cooled Floorspace" is computed as total floorspace times the percentage of rooms that are cooled over total rooms.

Fluorescent Lamps: A lamp made of a glass tube coated on the inside with fluorescent material. The lamp produces light by passing electricity through mercury vapor, which causes the fluorescent coating to glow or fluoresce.

Freezer: A cabinet designed as a unit for storing food at temperatures of about 0 degrees Fahrenheit and having a refrigeration unit driven by an electric motor. For this report, this is a separate appliance, not part of the refrigerator and can be an upright model (vertical cabinet with the door opening outward) or a chest model (horizontal cabinet with the door opening upward).

Frost-Free Refrigerator: Indicates that the freezer section of the refrigerator automatically defrosts usually on 12- or 24-hour cycles.

Fuel: See **Energy Source.**

Fuel Oil: A liquid petroleum product less volatile than gasoline, used as an energy source. In this report, fuel oil includes distillate fuel oil (No. 1, No. 2, and No. 4). (See **Energy Source**.)

Fuel Oil Paid by Household: The household paid the supplier directly for all household uses of fuel oil or kerosene (such as space heating or water heating). Bills paid by a third party are not counted as paid by the household. (See **Energy Source**.)

Fuel-Switching Capability: To switch from a petroleum main space-heating fuel to a nonpetroleum fuel in the short term. (See **Fuel Switching in 30 Days** and **Fuel Switching in 6 Months**.)

Fuel Switching in 30 Days: The capability to switch from a petroleum main space-heating fuel to a nonpetroleum secondary fuel within 30 days. Prior studies assumed that only heating stoves and built-in-electric units could maintain the same level of comfort as the main heating equipment could. In the 1990 RECS, the respondent was asked whether the secondary fuel used could maintain the same comfort level. If it could, it was considered an acceptable means of fuel switching (within 30 days). Households that do not have secondary capability but do use

natural gas for cooking or water heating were also assumed to have the capability to switch to natural gas in 30 days.

Fuel Switching in 6 Months: The capability to switch from a petroleum main space-heating fuel to natural gas as the main space-heating fuel. These households do not use a nonpetroleum secondary heating fuel and do not use natural gas for cooking or water heating, but have natural gas available in the neighborhood.

Furnace: Space-heating equipment consisting of an enclosed chamber where fuel is burned or electrical resistance is used to heat air directly, without using steam or hot water. The warm air is for heating, which is distributed throughout the house, typically by air ducts.

Furnace Fan: A fan that forces air through the ducts for a central warm-air furnace.

Garage (Attached): A space large enough to accommodate a car, with a door opening at least 6 feet wide and 7 feet high. This space is attached directly to the house (it shares part of a wall in common with the house) or under part or all of the house. Not included are carports, barns, buildings not connected to the house, or storage space for golf carts or motorcycles.

Gas Air Conditioning: Cooling and dehumidification of the air in a building by a refrigeration unit driven by gas (either natural gas or LPG). (See **Refrigeration Unit**.)

Gas Paid by Household: The household paid the utility company directly for all household uses of natural gas (such as water heating, space heating, air conditioning, cooking, and operating appliances including outdoor gas lights). Bills paid by a third party are not counted as paid by the householder. (See **Energy Source**.)

Group Quarters: Living arrangement for institutional groups containing 10 or more unrelated persons. Such quarters are excluded from the RECS. Group quarters are typically found in hospitals, nursing homes, military barracks, halfway houses, college dormitories, fraternity and sorority houses, convents, monasteries, shelters, jails, and correctional institutions. Group quarters may also be found in houses or apartments shared by 10 or more unrelated persons. Group quarters are often equipped with a dining area for residents. (See **Housing Unit**.)

Halogen Lamp: See **Incandescent Lamp**.

HDD: See **Heating Degree-Days** (HDD).

Heat Pump (Reverse Cycle System): Heating and/or cooling equipment that, during the heating season, draws heat into a building from outside and, during the cooling season, ejects heat from the building to the outside. Heat pumps are vapor-compression refrigeration systems whose indoor/outdoor coils are used reversibly as condensers or evaporators, depending on the need for heating or cooling.

Heated Floorspace: See **Floorspace**.

Heating Degree-Days (HDD): A measure of how cold a location was over a period of time, relative to a base temperature. In this report, the base temperature used is 65 degrees Fahrenheit and the period of time is one year. The heating degree-days for a single day is the difference between the base temperature and the day's average temperature if the daily average is less than the base, and zero if the daily average temperature is greater than or equal to the base temperature. The heating degree-days for a longer period of time is the sum of the daily heating degree-days for days in that period. Average daily temperature is the mean of the maximum and minimum temperature for a 24-hour period. Heating degree-days can also be calculated using a base temperature other than 65 degrees. The computation is performed in an analogous manner.

Since the 1987 RECS, heating degree-days for households are taken from records of an appropriate nearby weather station. In previous RECS, weather data were assigned to households according to the NOAA division in which the household was located. (See **Cooling Degree-Days (CDD), Climate Zone** and **30-Year Average Degree-Days**.)

Heating Equipment: The equipment used for heating ambient air in the housing unit, such as: central warm-air furnace, heat pump, built-in electric units, steam or hot-water system, floor, wall or pipeless furnace, heating stove, room heater, fireplace, or portable heater. The main space-heating equipment is reported as such even if it was built for preparing food. (See also description of specific types of space-heating equipment, **Central Warm-Air Furnace**, **Heat Pump**, **Built-In Electric Units**, **Steam or Hot-Water System**, **Floor**, **Wall or Pipeless Furnace**, **Heating Stove**, and **Room Heater**.)

Heating Stove Burning Wood, Coal, and Coke: Any free-standing box or controlled-draft stove; or a stove installed in a fireplace opening, using the chimney of the fireplace. Stoves are made of cast iron, sheet metal, or plate steel. Free-standing fireplaces that can be detached from their chimneys are considered heating stoves.

High Efficiency (Replacement Main Heating Equipment): The respondent's perception of the level of efficiency of new main heating equipment purchased since September 1, 1987. High efficiency was not defined.

High-Intensity Discharge (HID) Lamp: A lamp that produces light by passing electricity through gas, which causes the gas to glow. Examples of HID lamps are mercury vapor lamps, metal halide lamps, and high-pressure sodium lamps.

Hispanic Descent: This, as the question on origin, was self-determined by the respondent. The respondent was asked, "Is the householder of Spanish or Hispanic origin or descent?" and the respondent's answer was recorded.

Hot-Deck Imputation: An imputation procedure using random resampling from nonmissing cases to fill values for missing cases. (See **Imputation** and Appendix B, "Quality of the Data.")

Hot Tub: Water-filled wood, plastic, or ceramic container in which up to 12 people can lounge. Normally equipped with a heater which heats the water from 80 degrees to 106 degrees Fahrenheit. It may also have jets to bubble the water. An average-size hot tub holds 200-400 gallons of water. All reported hot tubs were assumed to include an electric pump. These are also called Spas or Jacuzzis.

Household: A family, an individual, or a group of up to nine unrelated persons, occupying the same housing unit. "Occupy" means the housing unit was the person's usual or permanent place of residence at the time of the first field contact. Household members include babies, lodgers, boarders, employed persons who live in the housing unit, and persons who usually live in the household but are away traveling or in a hospital. The household does not include (1) persons who are normally members of the household but who were away from home as college students or members of the armed forces at the time of the contact; (2) persons temporarily visiting with the household if they have a place of residence elsewhere; (3) persons who take their meals with the household but usually lodge or sleep elsewhere; (4) domestic employees or other persons employed by the household who do not sleep in the same housing unit; and (5) persons who are former members of the household, but have since become inmates of correction or penal institutions, mental institutions, homes for the aged or needy, homes or hospitals for the

chronically ill or handicapped, nursing homes, convents or monasteries, or other places in which residents may remain for long periods of time. By definition, in the RECS, the number of households is the same as the number of occupied housing units. (See **Primary Residence**.)

Household Member: See **Household**.

Householder: The person (or one of the people) in whose name the home is owned or rented. If there is no lease or similar agreement, or if the person who owns the home or pays the rent does not live in the housing unit, the householder is the person responsible for paying the household bills, or whoever is generally in charge.

Housing Unit: A house, an apartment, a group of rooms, or a single room if it is either occupied, or intended for occupancy, as separate living quarters by a family, an individual, or a group of one to nine unrelated persons. Separate living quarters means the occupants (1) live and eat separately from other persons in the house or apartment and (2) have direct access from the outside of the building or through a common hall--that is, they can get to it without going through someone else's living quarters. Housing units do not include group quarters such as prisons or nursing homes where ten or more unrelated persons live. Hotel and motel rooms are considered housing units if occupied as the usual or permanent place of residence. (See **Primary Residence**, **Group Quarters**, **Year-Round Units**, **Seasonal Units** and **Migratory Units**.)

Humidifier: A humidifier is an appliance that adds moisture to the air (often used in the winter when the indoor air is very dry).

Humidity: The moisture content of air. Relative humidity is the ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature. (See **Dehumidifier** and **Humidifier**.)

Imputation: A statistical method used to fill in values for missing items, designed to minimize the bias of estimates. (See **Hot-Deck Imputation** and Appendix B, "Quality of the Data.")

Incandescent Lamp: A lamp that produces light by electrically heating a filament so that it glows. Included in this category are the familiar household light bulbs which screw into sockets, as well as the energy-efficient incandescent bulbs such as Tungsten Halogen (spotlights), Reflector or R-lamps (accent and task lighting), Parabolic Aluminized Reflector (PAR) lamps (flood and spot lighting), and Ellipsoidal Reflector (ER) lamps (recessed lighting).

Insulation: A conservation feature consisting of material placed between the interior of a building and the outdoor environment to reduce the rate of heat loss to the environment or heat gain from the environment. Examples include glass wool fill and foam board. (See **Insulation Around Heating and/or Cooling Ducts** and **Insulation Around Water Heater** and **Insulation Around Hot-Water Pipes**.)

Insulation Around Heating and/or Cooling Ducts: Extra insulation around the heating and/or cooling ducts, intended to reduce the loss of hot or cold air as it travels to different parts of the residence.

Insulation Around Hot-Water Pipes: Wrapping of insulating material around hot-water pipes to reduce the loss of heat through the pipes.

Insulation Around Water Heater: Blanket insulation wrapped around the water heater to reduce loss of heat. To qualify under this definition, this wrapping must be in addition to any insulation provided by the manufacturer.

Intensity: This is a method of adjusting either the amount of energy consumed or expenditures spent, for the effects of various housing unit and/or household characteristics, such as size of the housing unit, climate, and number of household members, to facilitate comparisons of energy across time, regions of the country, fuels, and housing units. (See **Conditional Energy Intensity**, **Conditional End-Use Intensity**, and **Intensity**.)

Jacuzzi: See **Hot Tub**.

Kerosene: A petroleum distillate with properties similar to No. 1 fuel oil, used primarily in space heaters, cooking stoves, and water heaters.

Kerosene Paid by Household: The household paid the fuel supplier directly for all household uses of kerosene such as water heating, and space heating. Bills paid by a third party are not counted as paid by the household. (See **Energy Source**.)

Kilowatthour: See **kWh**.

kWh (Kilowatthour): A unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu. (See **Btu** and **Btu Conversion Factor**.)

Lamp: A term generally used to describe a manmade source of light. The term is often used when referring to a "bulb" or "tube." (See **Lights**.)

Lights: For the RECS, all of the light bulbs controlled by one switch were counted as one light. For example, a chandelier with multiple lights controlled by one switch is counted as one light. A floor lamp with two separate globes or bulbs controlled by two separate switches would be counted as two lights. Indoor and outdoor lights were counted if they were under the control of the householder. This would exclude lights in the hallway of multifamily buildings. **(**See **Floodlights**, **Fluorescent, High-Intensity Discharge** and **Incandescent Lamps**.)

LIHEAP: See **Assistance for Heating in Winter**.

Liquefied Petroleum Gas (LPG): Any fuel gas supplied to a residence in liquid form, such as propane or butane. It is usually delivered by tank truck and stored near the residence in a tank or cylinder until used. Propane was the most common liquefied petroleum gas supplied to RECS households. (See **Energy Source**.)

Load-Control Program: A program in which the utility company offers a lower rate in return for having permission to turn off the air conditioner or water heater for short periods of time by remote control. This control allows the utility to reduce peak demand. (See **Peak Demand**.)

LPG Paid by Household: The household paid the fuel supplier directly for all household uses of LPG such as water heating, space heating, air conditioning, cooking, (other than cooking on an outdoor grill, which is excluded) and operating appliances. Bills paid by a third party are not counted as paid by the household. (See **Fuel**.)

LPG: See **Liquefied Petroleum Gas**.

Main: In this report, main means *Used Most*, as in "Main Space-Heating Fuel," which is the fuel used most for space heating. (See **Used Most**.)

Master-Metering: Measurement of electricity or natural gas consumption of several tenants or housing units using a single meter. That is, one meter measures the energy usage for several households collectively. RECS identifies units that have their energy use included in the rent and also identifies buildings with equipment that serves more than one housing unit, but does not specifically identify a building as "master metered."

Mean Indoor Temperature: Is the "usual" temperature. If different sections of the house are kept at different temperatures, the reported temperature is for the section where the people usually are. A thermostat setting is accepted if the temperature is not known.

Metric Conversion Factors: In this report, estimates are presented in customary U.S. units. Floorspace estimates may be converted to metric units by using the relationship, 1 square foot is approximately equal to .0929 square meters. Energy estimates may be converted to metric units by using the relationship, 1 Btu is approximately equal to 1,055 joules. One kilowatthour is exactly equal to 3,600,000 joules. One gigajoule is approximately 278 kilowatthours (kWh). (See **Btu** and **Btu Conversion Factors**.)

Metropolitan: See **Urban**.

Metropolitan Statistical Area (MSA): Areas defined by the U.S. Office of Management and Budget. An MSA is (1) a county or group of contiguous counties that contain at least one city of 50,000 inhabitants or more, or (2) an urbanized area of at least 50,000 inhabitants and a total MSA population of at least 100,000 (75,000 in New England). The contiguous counties are included in an MSA if, according to certain criteria, they are essentially metropolitan in character and are socially and economically integrated with the central city. In New England, MSA's consist of towns and cities, rather than counties. (See **Urban**, **Central City**, **Suburban**, and **Rural**.)

Microwave Oven: A household cooking appliance consisting of a compartment designed to cook or heat food by means of microwave energy. It may also have a browning coil and convection heating as additional features.

Migratory Units: Housing units intended for occupancy by migratory workers employed in farm work during the crop season.

Mobile home: A housing unit built on a movable chassis and moved to the site. It may be placed on a permanent or temporary foundation and may contain one room or more. If rooms are added to the structure, it is considered a single-family housing unit. A manufactured house assembled on site is a single-family housing unit, not a mobile home.

MSA: See **Metropolitan Statistical Area (MSA)**.

Multifamily (2 to 4 units): A housing unit in a building with two to four housing units--a structure that is divided into living quarters for two, three, or four families or households.

Multifamily (5 or more units): A housing unit in a building with five or more housing units--a structure that contains living quarters for five or more households or families.

Multistage Area Probability Sample: A sample design executed in stages with geographic "clusters" of sampling units selected at each stage. This procedure reduces survey expense while maintaining national coverage. (See Appendix A, "How the Survey Was Conducted.")

Natural Gas: Hydrocarbon gas (mostly methane) supplied as an energy source to individual buildings by pipelines from a central utility company. Natural gas does not refer to liquified petroleum gas or to privately owned gas wells operated by a building owner. (See **Energy Source**.)

Nonmetropolitan: See **Rural.**

Normalized: Refers to the standardization of the efficiency of the stock of household appliances to 100 for the year 1972. (See "Conversion of Stock Efficiencies" in Appendix B, "Quality of the Data.")

Occupied Housing Unit: A unit in which someone was living as his or her usual or permanent place of residence when the first RECS field contact was made. (See **Housing Unit**.)

Origin: The primary ethnic background of the person considered to be the householder as determined by the respondent. Each respondent was asked, "Which of the groups on this exhibit best describes the householder?" The groups included: white, black or Negro, American Indian, Alaskan native, Asian, and Pacific Islander. (See **Hispanic Descent**.)

Outside Central City: See **Suburban**.

Oven: An appliance which is an enclosed compartment supplied with heat and used for cooking food. Toaster ovens are not considered ovens for this survey. For this survey, the range stove top or burners and the oven are considered two separate appliances, although they are often purchased as one appliance. (See **Appliances.**)

Owned/Rented: The relationship of a housing unit's occupants to the structure itself, not the land on which the structure is located. "Owned" means the owner or co-owner is a member of the household and the housing unit is either fully paid for or mortgaged. A household is classified "rented" even if the rent is paid by someone not living in the unit. "Rent free" means the unit is not owned or being bought and no money is paid or contracted for rent. Such units are usually provided in exchange for services rendered or as an allowance or favor from a relative or friend not living in the unit. Unless shown separately, rent-free households are grouped with rented households.

Ownership: See **Owned/Rented**.

Passive Solar: A system in which solar energy alone is used for the transfer of thermal energy. Pumps, blowers, or other heat transfer devices which use energy other than solar are not used. (See **Active Solar**.)

Pay for Electricity or Gas for Air Conditioning: Household uses electricity or gas for air conditioning and pays directly to a Utility Company for that use.

Payment Method for Utilities: Method by which fuel suppliers or utility companies were paid for all electricity, natural gas, fuel oil, kerosene, or liquefied petroleum gas used by a household. Households that paid the utility company directly were classified in this survey as "all paid by household." Households that paid directly for at least one but not all of their fuels used and that has at least one fuel charge included in the rent were classified as "some paid, some included in rent." Households for which all fuels used were included in rent were classified as "all included in rent." Some households were classified as "other method," if they did not fall into any of those three categories. These are households for which fuel bills were paid by a social services agency or a relative, and households that paid for some of their fuels used but paid for other fuels through another arrangement.

Peak Demand: The maximum rate of energy consumption per unit time over a period of measurement.

Perceptions of Householders: Items in which the opinions of the respondent were being sought, in order to gain insight into particular energy-related behavior. Technical definitions were not used as prompts by the interviewers, nor was the information provided *verified* by the interviewer. (See **Adequacy of Insulation** and **High Efficiency (Replacement Main Heating Equipment)**.)

Personal Computer: A microcomputer for producing written, programmed or coded material, playing games, or doing calculations; included as an appliance in RECS.

Portable Electric Heater: A heater that uses electricity and that can be picked up and moved.

Portable Kerosene Heater: A heater that uses kerosene and that can be picked up and moved.

Portable Fan: Box fans, oscillating fans, table or floor fans, or other fans that can be moved. (See **Appliances**.)

Poverty Line: Low-income classifications to which certain households are assigned. "Below 100 percent of poverty" encompasses a group of households with incomes below the poverty level as defined by the U.S. Bureau of the Census and the Office of Management and Budget. "Below 125 percent of poverty" includes a group of households with incomes below 125 percent of the poverty level. These groups of the poor and near-poor represent alternative levels for defining poverty. The poverty line varies with the number of family members in the household and the income of the entire family. (See Appendix B, "Quality of the Data" and **Eligible for Federal Assistance**.)

Primary Residence: A **housing unit** in which a householder spends the largest part of the calendar year; it is the householder's usual or permanent residence. This would normally be a **year-round** housing unit. It would generally exclude **migratory** and **seasonal** units. However, if a seasonal unit happened to be occupied for half of the year by the householder, that unit would be considered the primary residence. (See **Housing Unit**, **Migratory Units**, **Seasonal Units**, **Year-Round Units**, and **Second Home**.)

Primary Sampling Unit (PSU): A sampling unit selected at the first stage in multistage area probability sampling. A PSU typically consists of one to several contiguous counties--for example, a metropolitan area with surrounding suburban counties. The approximately 3,100 counties and independent cities of the contiguous United States were grouped into about 1,800 PSU's by a procedure similar to the one used by the

Census Bureau for its Current Population Survey. PSU's can be composed of one or more MSA's or can be composed of rural counties. (See **Metropolitan Statistical Area** and Appendix A, "How the Survey Was Conducted.")

Propane: See **Liquefied Petroleum Gas**.

PSU: See **Primary Sampling Unit (PSU)**.

Public Housing: Housing units owned by a local housing authority or other local public agency such as a housing and redevelopment authority or a housing development agency. These organizations receive subsidies from the Federal or State government, but the local agency owns the property. To live in such a project, one must apply to the local housing authority.

Quadrillion: The quantity 1,000,000,000,000,000 (10^{15}).

Race: See **Origin**.

Radiator: Space-heating equipment that transfers heat from steam or hot water to air by a combination of direct radiation, conduction, and convection. Typically, a radiator is a freestanding, cast-iron fixture exposed in the space it heats.

Range Top: The range burners or stove top and the oven are considered two separate appliances in this survey. Counted also with range tops are stand-alone "cook tops." (See **Appliances.**)

Rebate Program: A utility company-sponsored conservation program whereby the utility company returns a portion of the purchase price or cost when a more energy-efficient refrigerator, water heater, air conditioner, or other appliance is purchased.

Reflective Film: Transparent covering for glass that helps keep out heat from the sun.

Refrigeration Unit: Used to produce cooling in refrigerators, freezers, and air-conditioning equipment. In a typical refrigeration unit, electricity powers a motor that runs a pump to compress a refrigerant to maintain proper pressure. (A "refrigerant" is a substance that changes between liquid and gaseous states under desirable temperature and pressure conditions.) Heat from the compressed liquid is removed and discharged from the unit, and the refrigerant then evaporates when pressure is reduced. The refrigerant picks up heat as it evaporates and it returns to the compressor to repeat the cycle.

Refrigerator: A cabinet designed for cooling food at temperatures above 32 degrees Fahrenheit. Most also have a second compartment for freezing and storing frozen foods at temperatures of 8 degrees Fahrenheit or below. Refrigerators are one of the main end-use categories in RECS. (See **End Use** and Appendix D "End-Use Estimation Methodology.")

Regression Imputation: A statistical technique for predicting the value of a numerical variable that is missing. The technique involves developing a regression equation that predicts the value of the missing variable based upon variables that are not missing or have already been imputed. A random error is usually added to the predicted value. The sum of the predicted value and the random error is used as the imputed value for the missing variable. (See **Imputation**.)

Relative Standard Error: See **RSE or Relative Standard Error**.

Renewable Energy: Energy obtained from sources that are essentially inexhaustible (unlike, for example, the fossil fuels, of which there is a finite supply). Renewable sources of energy include wood, waste, geothermal, wind, photovoltaic cells, and solar thermal energy.

Rent: See **Owned/Rented**.

Residential: Occupied housing units, including mobile homes, single-family housing units (attached and detached), and apartments. The definition of "occupied housing units" is the same as that used by the U.S. Bureau of the Census. (See **Household** and **Housing Unit**.)

Residential Building: A structure used primarily as a dwelling for one or more households.

Roof Insulation: Insulating materials placed underneath the roof or on the roof.

Room Air Conditioner: Air-conditioning units that typically fit into the window or wall and are designed to cool only one room. (See **Air Conditioning**.)

Room Heater Burning Gas, Oil, Kerosene: Any of the following space-heating equipment: circulating heaters, convectors, radiant gas heaters, space heaters, or other nonportable room heaters that may or may not be connected to a flue, vent, or chimney.

Rooms: Subdivisions of a housing unit. Whole rooms are rooms such as living rooms, dining rooms, bedrooms, kitchens, lodgers' rooms, finished basements or attic rooms, recreation rooms, and permanently enclosed sun porches that are used year round. Rooms used for offices by a person living in the unit are included in this survey. "Finished" means that the ceiling and walls are covered with finishing materials.

Not considered to be rooms in this survey are bathrooms, halls, foyers, or vestibules, balconies, closets, alcoves, pantries, strip or pullman kitchens, laundry or furnace rooms, unfinished attics or basements, open porches, and unfinished space used for storage.

A partially divided room, such as a dinette next to a kitchen or a living room, is considered a separate room only if there is a partition from floor to ceiling--but not if the partition consists solely of shelves or cabinets. If a room is used by occupants of more than one unit, the room is included with the unit from which it is most easily reached. (See **Bedroom** and **Bathroom**.)

RSE Column Factor: An adjustment factor used to compute RSE's. For a survey estimate in a particular row and column of a table (that is, a particular "cell"), the approximate RSE is obtained by multiplying the RSE row

factor by the RSE column factor for that cell. (See **RSE or Relative Standard Error**, **RSE Row Factor**, and the "Generalized Variances" section of Appendix B, "Quality of the Data.")

RSE or Relative Standard Error: A measure of the reliability or precision of a survey statistic. The Relative Standard Error, or RSE, is defined as the standard error of a survey estimate, expressed as a percent of the estimate. For example, an RSE of 10 percent means that the standard error is one-tenth as large as the survey estimate. (See Appendix B, "Quality of the Data.")

RSE Row Factor: A factor used to compute RSE's. The row factor is equal to the geometric mean of the RSE's in a particular row of main tables. For a survey estimate in a particular row and column of a table (that is, a particular "cell"), the approximate RSE is obtained by multiplying the RSE row factor by the RSE column factor for that cell. (See **RSE or Relative Standard Error, RSE Column Factor**, and the "Generalized Variances" section of Appendix B, "Quality of the Data.")

Rural: Households not located within Metropolitan Statistical Areas as defined by the U.S. Office of Management and Budget. In previous RECS reports, rural areas were referred to as "nonmetropolitan" areas. (See **Metropolitan Statistical Area (MSA)** and **Urban**.)

Sampling: The procedure used to select housing units for interview from the population of all residential housing units in the United States. (See **Multistage Area Probability Sample** and Appendix A, "How the Survey Was Conducted.")

Seasonal Energy Efficiency Ratio (SEER): Ratio of the cooling output divided by the power consumption. It is the Btu of cooling output during its normal annual usage divided by the total electric energy input in watt-hours during the same period. This is a measure of the cooling performance for rating central air conditioners and central heat pumps. The appliance standards require a minimum SEER of 10 for split system central air conditioners and for split system central heat pumps, these new standards take effect in 1992. The average heat pump or central air conditioner sold in 1986 had a SEER of about 9. (See Appendix B, "Quality of the Data.")

Seasonal Units: Housing units intended for occupancy at only certain seasons of the year. Seasonal units include units intended only for recreational use, such as beach cottages and hunting cabins. Seasonal units are not usually included in the RECS count of occupied housing units unless they are occupied for more than half of the year. (See **Primary Residence**.)

Secondary Heating Equipment: Space-heating equipment used less often (fewer days) than the main space-heating equipment. (See **Main**.)

Secondary Heating Fuel: Energy Sources or fuels used in secondary space-heating equipment. When no secondary space-heating equipment is used, a secondary space-heating fuel that is used in the main space-heating equipment is not included in the tabulations. For example, if wood and coal are both used in a furnace, but wood is named the main space-heating fuel, coal would not be included in the tables.

Second Home: By definition, a second home is not the primary residence of a householder. Second homes are not included in the RECS count of occupied housing units. (See **Housing Units**, **Primary Residence**, and **Seasonal Units**.)

Setback Temperature Behavior: These data were derived from differences in the temperature settings reported by respondents for their daytime temperature when someone is at home, daytime temperature when no one is at home, and the temperature for sleeping hours (assumed to be nighttime). For example, if a respondent's reported temperature setting was lower when no one was at home than when someone was at home, respondents were assumed to be "setting" back the temperature.

Single-Family: A housing unit that provides living space for one household or family. The structure may be detached or attached to another unit. Attached houses are considered single-family houses as long as the house itself is not divided into more than one housing unit and has an independent outside entrance. A single-family house is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof. Townhouses, rowhouses, and duplexes are considered single-family attached housing units, as long as there is no household living above another one within the walls that go from the basement to the roof to separate the units. A mobile home with one or more rooms added is classified as a single-family home.

Site Energy: The Btu value of energy at the point it enters the home, sometimes referred to as "delivered" energy. (See **Adjusted Electricity** and **Btu Conversion Factors**.)

Solar: In this report, all solar energy is considered to be active solar. (See **Active Solar**.)

Spa: See **Hot Tub**.

Space Heating: The use of mechanical equipment (including wood stoves and active solar heating devices) to heat all, or part, of a building to at least 50 degrees Fahrenheit. This is one of the end uses of energy. (See **End Use.**)

Space-Heating Equipment: See **Heating Equipment**.

Split System: When applied to electric air-conditioning equipment, it means a two-part system—an indoor unit and an outdoor unit. The indoor unit is an evaporator coil mounted in the indoor-circulating air system, and the outdoor unit is an air-cooled condensing unit containing an electric motor-driven compressor and condenser fan and fan motor.

Square Feet: See **Floorspace.**

Standard Price: Average price data were obtained from EIA surveys other than the RECS and used in the end-use regression equations for natural gas and electricity. These average prices were attached to each 1990 RECS household that used the respective fuel. (See LOGRELPC and LOGRNGPC in Appendix D.)

Steam or Hot-Water System: Either of two types of a central space-heating system that supplies steam or hot water to radiators, convectors, or pipes. The more common type supplies either steam or hot water to conventional radiators, baseboard radiators, convectors, heating pipes embedded in the walls or ceilings, or heating coils or equipment that are part of a combined heating/ventilating or heating/air-conditioning system. The other type supplies radiant heat through pipes that carry hot water and are inlaid in a concrete slab floor.

Stock: The total number of household appliances or housing units in use at a given time, including newly purchased ones and those in use for some time.

Storm Door: A second door installed outside or inside a prime door creating an insulating air space. Included are sliding glass doors made of double glass or of insulating glass such as thermopane; sliding glass doors with glass or plexiglass placed on either the outside or inside of the door to create an insulating air space are also considered storm doors. Not included are doors or sliding glass doors covered by plastic sheets or doors with storm window covering on just the glass portion of the door.

Storm Window: A window or glazing material placed outside or inside a window creating an insulating air space. Windows with double glass or thermopanes are considered storm windows. Plastic material over windows is counted as a storm window if the same plastic material can be used year after year. If the plastic material must be put up new each year, it is not counted as a storm window. Glass or plexiglass placed over windows on either the interior or exterior side are counted as storm windows.

Stove: See **Heating Stove Burning Wood, Coal and Coke** and **Cooking Stove.**

Structure: In RECS, one of four categories used to categorize the building in which the housing unit was located. The categories were single-family, multifamily (2-4 units), multifamily (5 or more units), and mobile home. (See **Single-Family**, **Multifamily (2 to 4 units), Multifamily (5 or more units)**, and **Mobile Home**.)

Submetered Data: End-use consumption data obtained for individual appliances when a recording device has been attached to the appliance to measure the amount of energy consumed by the appliance. (See **Metered Data**.)

Suburban: Those parts of the Metropolitan Statistical Areas that are not designated as central city. In previous RECS reports, suburban areas were referred to as "outside central city." (See **Central City**, **Metropolitan Statistical Areas**, **Rural,** and **Urban**.)

Swamp Cooler: See **Evaporative Cooler**.

Swimming Pool Heater: Optional heating equipment that heats the pool water to an acceptable level of comfort, usually 80 to 85 degrees Fahrenheit.

Swimming Pool Pump: All swimming pools reported in RECS were assumed to have an electric pump for filtering and circulating the water. (See **Swimming Pool Heater.**)

Temperature: In this report, respondents reported estimates of the indoor temperature. If different sections of the house are kept at different temperatures, the temperature requested is for the part of the house being utilized. If the heat is turned off upstairs during the day because the family is downstairs, the downstairs temperature is reported. If the respondent does not know the temperature, the thermostat setting is requested.

30-Year Average Degree-Days: Annual cooling or heating degree-days averaged over 30 years (from 1951 to 1980). 30-year average is considered "normal weather" for a region. (See **Cooling Degree-Days (CDD)** and **Heating Degree-Days (HDD)**.)

Total Floorspace: Floorspace summed or aggregated over all households in a category (such as households in the United States). In this survey, aggregate floorspace was estimated by multiplying each household's square footage by its weight, then summing over all sample households of interest to represent nationwide totals. (See **Floorspace** and **Weight**.)

Tuneup of Main Heating Equipment: A cleaning or maintenance check of the main space-heating equipment.

Urban: Urban refers to a group of households located within Metropolitan Statistical Areas (MSA's) as defined by the U.S. Office of Management and Budget. For this report urban is composed of central city and suburban areas. In previous RECS reports, the equivalent terms were central city and outside central city. (See **Central City**, **Metropolitan Statistical Area, Suburban**, and **Rural.**)

Urban Status: Refers to geographic location of the households in relationship to Metropolitan Statistical Areas (MSA's). (See **Urban**, **Rural**, **Central City**, and **Suburban**.)

Used Most: For this report, used more days in the year. When two or more fuels are used for the same purpose (such as space heating), the fuel used more days is the one "used most." When the household uses more than one refrigerator, freezer, window/wall air-conditioning unit, or motor vehicle, the one used more days is the one "used most."

Utilities Paid by Household: Householder directly pays an energy supplier for all uses of a fuel or fuel types used.

Vacant Housing Unit: A housing unit not occupied when the first 1990 RECS field contact was made. An occupied seasonal or migratory housing unit is classified as vacant at the time of the first contact if all of its occupants had a usual place of residence elsewhere.

Vehicles: For this survey, motorized vehicles used by U.S. households for personal transportation. Excluded are motorcycles, mopeds, large trucks, and buses. Included are automobiles, station wagons, passenger vans, cargo vans, motor homes, pickup trucks, and jeeps or similar vehicles. To be included, vehicles must be: (1) owned by members of the household, or (2) company cars not owned by household members but regularly available to household members for their personal use and ordinarily kept at home, or (3) rented or leased for 1 month or more.

Wall Insulation: A shell conservation feature consisting of insulation placed between exterior and interior walls.

Water-Bed Heater: An appliance that uses an electric resistance coil to maintain the temperature of the water in a water bed at a comfortable level.

Water Heated in Furnace: Some furnaces provide hot water as well as heat the home. In these furnaces, water is heated by a coil that is part of the furnace; there is no separate hot water tank.

Water Heater: An automatically controlled, thermally insulated vessel designed for heating water and storing heated water at temperatures less than 180 degrees Fahrenheit .

Water Heater Blanket: See **Insulation Around Water Heater**.

Water Heater Size: Respondents were asked the size of their water heater tank. Three categories were provided, which were described by a range of gallon sizes: Small (30 gallons or less), Medium (31 to 49 gallons), Large (50 gallons or more). Households were not asked this question if they shared a water heater with other housing units or if their water heater was part of their furnace. (See **Water Heated in Furnace**.)

Water Heating: Water heating is one of the five end-use categories in this report. It is defined as the use of energy to heat water for hot running water, as well as the use of energy to heat water on stoves and in auxiliary water-heating equipment for bathing, cleaning and other noncooking applications of hot water. Not included in this category are the use of energy to heat water for cooking and hot drinks or the use of energy to heat water for a swimming pool. Both of these are included in the appliance end-use category. (See **End Use**.)

Water-Heating Fuel: The fuel used to heat bath and wash water. Households that did not have running water in the home were also asked what fuel was used for heating water. The hot water may have been available anywhere in the same building as the respondent's living quarters--in a hallway, in a room used by several units in the building, in the basement, or in an enclosed porch--provided the respondent's household had access to it. (See **Water Heating.**)

Water-Heating Intensity: The amount of energy used per household member to heat water. (See **Water Heating** and the main text of this report for a detailed description of energy-intensity measures used.)

Weather Stripping: A conservation feature where a material is placed between the door or window and the door frame or window frame to reduce the rate of loss of heat or cold caused by air infiltration.

Weight: The number of households in the United States that a particular sample unit represents. To estimate the total value of an attribute (such as floorspace) in the U.S. residential population as a whole, each sample household's value is multiplied by the household's weight. Summing the weighted sample values provides an estimate of the nationwide total. (See **Multistage Area Probability Sample**, **Total Floorspace** and Appendix B, "Quality of the Data.")

Well Pump: See **Electric Pump for Well Water.**

Whole-House Cooling Fan: A very large fan located in an upstairs ceiling or attic wall that pulls air through the house and out through the attic. The attic must have good air circulation--with fairly large vents--for such a fan to work well. (See **Appliances**.)

Window or Ceiling Fan: Fans located in the window or installed on the ceiling. Does not include portable table or floor fans. (See **Appliances**.)

Windows: Any openings in the wall of a building for admission of light and/or air that are usually closed by casements or sashes containing transparent material (as glass) and capable of being opened and shut. To be counted for RECS, the interior space must be heated; windows in unheated spaces such as a garage or unheated basement are not counted. Generally, each window that opens separately is counted as one window. Panes of glass in a large window are not counted separately unless they open separately. Double-hung slider windows count as one window. Windows (glass panels) in doors are not counted.

Wood-Burning Stove: See **Heating Stove**.

Wood Consumption: The amount of wood burned in the home at any time during the preceding 12 months in a fireplace, stove, or furnace, as reported by the respondent at the time of the interview. A cord of wood measures 4 feet by 4 feet by 8 feet and approximately 128 cubic feet. A third of a cord measures 16 inches by 4 feet by 8 feet. In order to enable respondents to be more accurate in reporting the amount of wood they burned, respondents were shown a drawing of a person holding an ax as a point of reference beside a 1-cord wood pile. A smaller scale copy of this drawing is reproduced below. (See **Wood Conversion to Btu**.)

Wood Conversion to Btu: Converting cords of wood into a Btu equivalent is an imprecise procedure. The number

of cords each household reports having burned is not exact, even with the more precise drawings provided, because the estimate requires the respondent to add up the use of wood over a 12-month period during which wood may have been added to the supply as well as removed. Besides errors of memory inherent in this task, the estimates are subject to problems in definition and perception of what a cord is. The nominal cord as delivered to a suburban residential buyer may differ from the dimensions of the standard cord. This difference is possible because wood is most often cut in lengths that are longer than what makes a third of a cord (16 inches) and shorter than what makes a half cord (24 inches).

In other cases, wood is bought or cut in unusual units (for example, pickup truck-load or trunk load). Finally, volume estimates are difficult to make when the wood is left in a pile instead of being stacked. Other factors that make it difficult to estimate the Btu value of the wood burned is that the amount of empty space between the stacked logs may vary from 12 to 40 percent of the volume. Moisture content may vary from 20 percent in dried wood to 50 percent in green wood. (Moisture reduces the useful Btu output because energy is used in driving off the moisture.) Finally, some tree species contain twice the Btu content of species with the lowest Btu value. Generally, hard woods have greater Btu value than soft woods. Wood was converted to Btu at the rate of 20 million Btu per cord, which is a rough average that takes all these factors into account. (See **Btu Conversion Factors**.)

Year of Construction: The year the structure was originally completed or the year any part of the structure was first occupied. For mobile homes, year of construction is the model year.

Year-Round Units: Housing units occupied or intended for occupancy at any time during the year. (See **Housing Unit** and **Seasonal Units**.)