Low Income Home Energy Trends
For Fiscal Year 2020

U.S. DEPARTMENT OF
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Administration for Children and Families
Office of Community Services
Division of Energy Assistance
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Figures and Tables

List of Acronyms and Abbreviations

ACF	HHS's Administration for Children and Families
ASEC	CPS Annual Social and Economic Supplement
BLS	Bureau of Labor Statistics
Btu	British thermal unit
CARES	Coronavirus Aid, Relief, and Economic Security Act
CDD	Cooling Degree Day
CPI	Consumer Price Index
CPS	Current Population Survey
DEA	OCS's Division of Energy Assistance
DOE	U.S. Department of Energy
EIA	DOE's Energy Information Administration
EMEU	EIA's Office of Energy Markets and End Use
FY	Fiscal Year
HDD	Heating Degree Day
HHS	U.S. Department of Health and Human Services
LIEAP	Low Income Energy Assistance Program
LIHEAP	Low Income Home Energy Assistance Program
MMBtus	Million British thermal units
NOAA	National Oceanographic and Atmospheric Administration
OCS	ACF's Office of Community Services
P.L.	Public Law
RECS	Residential Energy Consumption Survey

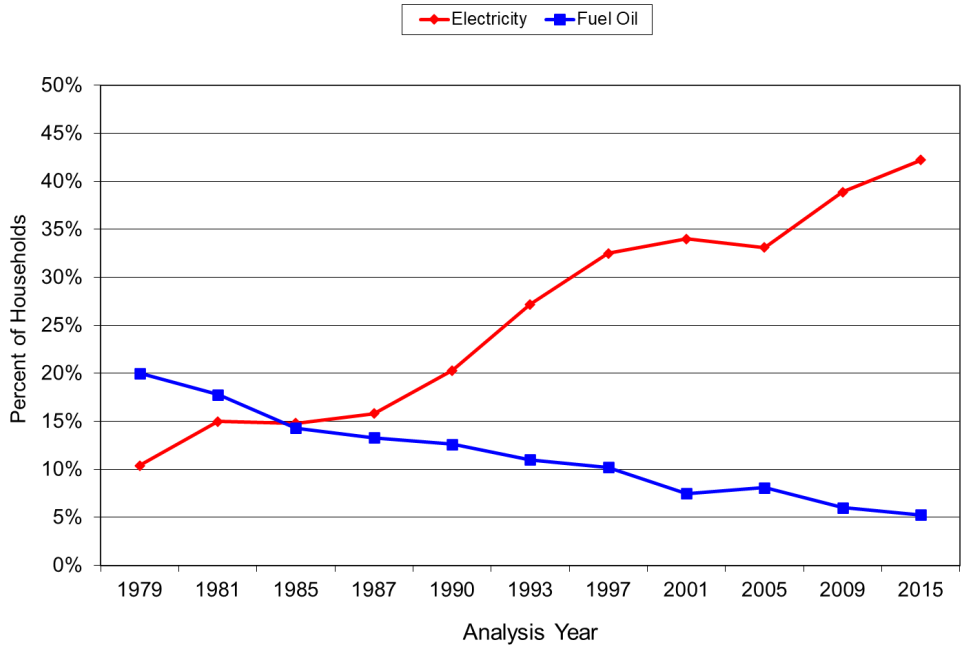
Executive Summary

This report presents data on home energy trends for low income households from 1979 through 2015 or FY 2020, depending upon the latest year of availability.[1] Statistics are derived from a series of national residential energy consumption surveys (including the Residential Energy Consumption Survey, or RECS), and from the U.S. Department of Health and Human Services' (HHS's) administrative statistics.[2] The analyses show significant shifts since 1979 in the types and amounts of energy used by low income households.

Home Heating and Cooling Trends

Figure 1 demonstrates that the share of low income households that used electricity as their main heating fuel increased from about 10 percent in 1979 to 34 percent in 2001, dropped slightly to 33 percent in 2005, increased to almost 39 percent in 2009, and rose again to 42 percent in 2015. In contrast, the share of low income households that used fuel oil as their main heating fuel steadily declined from 20 percent in 1979 to 6 percent in 2009 and fell to 5 percent in 2015. Natural gas remained the dominant type of space heating fuel used over the 30-year period, 1979-2009. In 2015, however, electricity surpassed natural gas as the dominant main heating fuel by a 0.4 percentage point margin, 42.2 percent versus 41.8 percent.

Figure 1. Percent of Low Income Households Using Electricity and Fuel Oil as Main Heating Fuels, 1979 to 2015



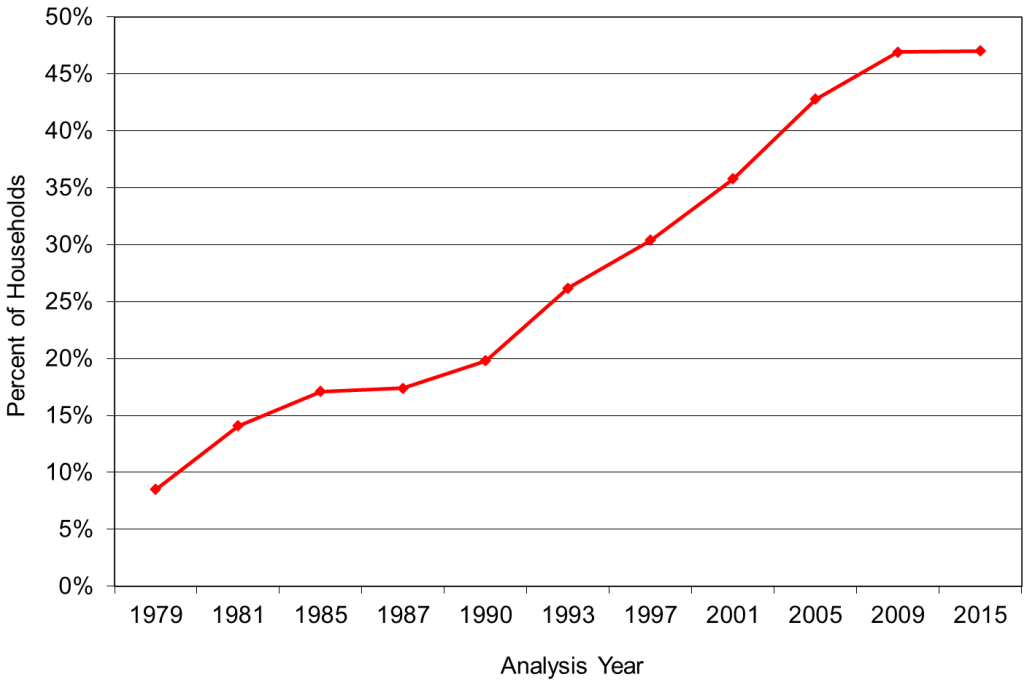
As shown in Figure 2, the most important change in home cooling on the part of low income households has been in the percentage of households with central air-conditioning. The share of low income

[1] In this report, low income households are defined as those households with incomes at or below 150 percent of HHS Poverty Guidelines.

[2] The most recent RECS was conducted in 2015. In that iteration of the RECS, significant methodological changes were introduced, including changes to end-use modeling procedures, particularly for electricity usage, and changes that impact the ability to characterize low income households. Therefore, readers should use caution when comparing the estimates for 2015 and FY 2020 with prior years, which are based on previous versions of the RECS.

households who use central air-conditioning increased from 8.5 percent in 1979, to almost 47 percent in 2009, and further increased to exactly 47 percent in 2015.

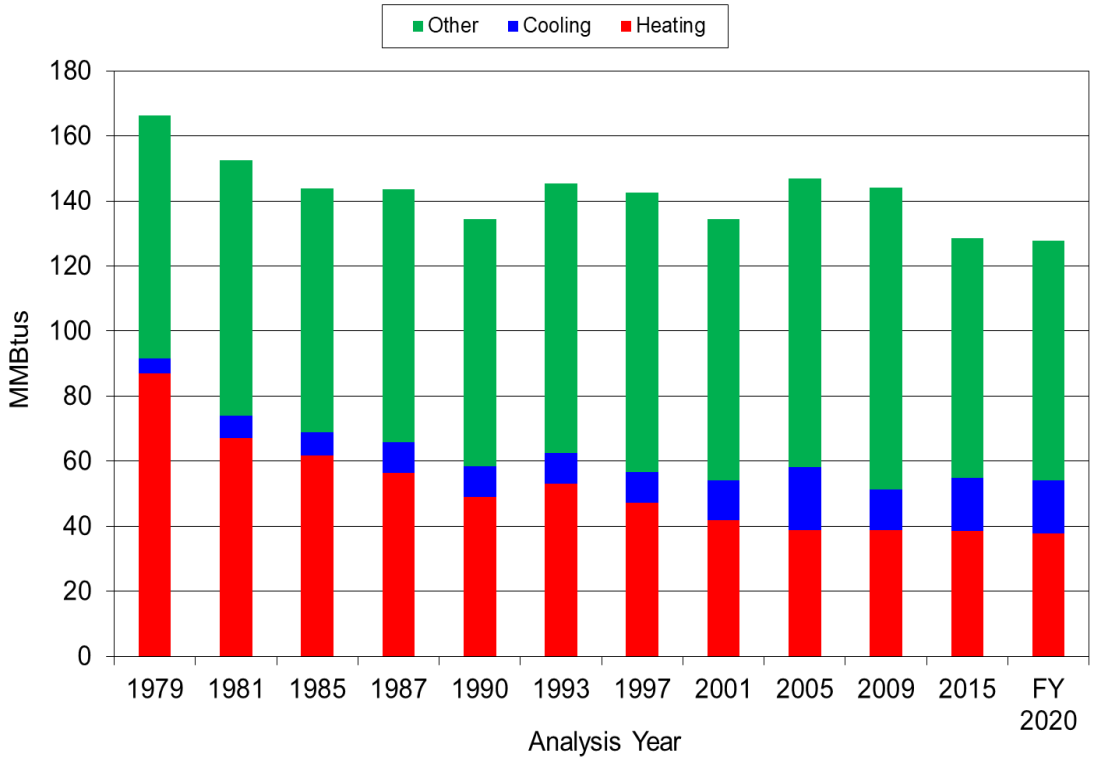
Figure 2. Percent of Low Income Households Using Central Air-Conditioning, 1979 to 2015



Trends in Mean Residential Consumption, Expenditures, and Energy Burden

Low income households substantially decreased their mean residential energy consumption between 1979 and 1985, as shown in Figure 3. This suggests a significant increase in efficiency resulting from conservation measures or actions. From 1985 to 1990, mean residential energy consumption fluctuated from year to year, corresponding to expected changes in heating and cooling consumption because of changes in heating and cooling degree days. For 1993 through 2005, there appears to have been an increase in the use of energy for purposes other than home heating and home cooling. Between 2005 and 2009, the decrease in home cooling was slightly offset by higher consumption for purposes other than home cooling or heating. Between 2009 and 2015 home heating stayed the same while consumption for home cooling consumption increased. Between 2015 and FY 2020, there was a slight decrease in home heating while consumption for home cooling remained flat.

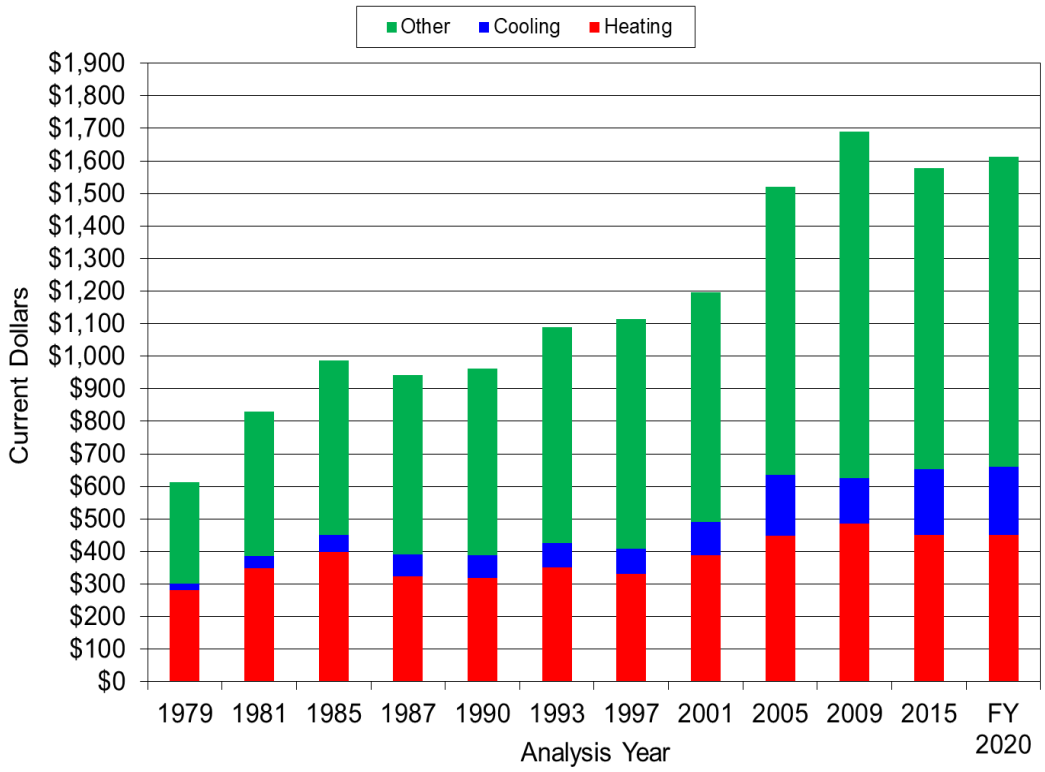
Figure 3. Mean Residential Energy Consumption (in MMBtus) per Low Income Household, 1979 to FY 2020[i]



[i] A British thermal unit (Btu) is the amount of energy necessary to raise the temperature of one pound of water one degree Fahrenheit. MMBtus refer to values in millions of Btus.

Mean residential energy expenditures increased rapidly between 1979 and 1985 because of fuel price increases, as shown in Figure 4. From 1987 through 1997, these expenditures rose moderately; however, from 2001 through 2009, mean expenditures on heating increased steadily as the result of fuel price increases and colder winter weather but decreased slightly in 2015. Between 2015 and FY 2020, mean expenditures for home cooling increased but for home heating mostly stayed the same. Mean expenditures on uses other than home heating or home cooling rose steadily from 1979 through 2009, dipped in 2015, then increased slightly in FY 2020. Mean expenditures for cooling rose significantly from 1979 to 2005 but fell in 2009. In 2015, cooling expenditures increased significantly relative to 2009 but expenditures on heating and for other purposes dropped. Between 2015 and FY 2020, mean residential energy expenditures rose for all uses but home heating.

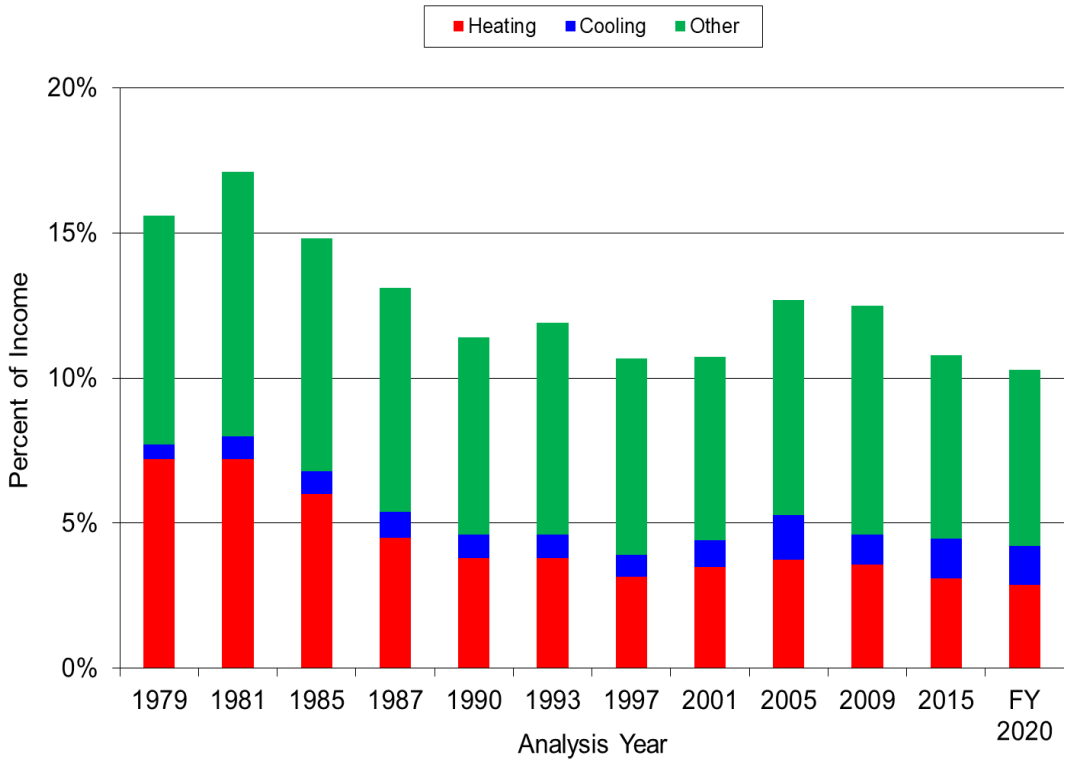
Figure 4. Mean Residential Energy Expenditures for Low Income Households, 1979 to FY 2020



As Figure 5 shows, the mean group home energy burden (i.e., burden associated with home heating and home cooling) declined from 7.7 percent in 1979 to 4.2 percent in FY 2020; a decrease of 3.5 percentage points.[3] The decrease in mean group residential energy burden from 1979 to FY 2020 was 5.3 percentage points (from 15.6 percent to 10.3 percent). Most of the decrease in residential energy burden is associated with a decrease in home energy burden rather than a decrease in the burden associated with energy use for other purposes (i.e., water heating, appliances, and refrigeration).

[3] Mean group burden is defined in Appendix A.

Figure 5. Mean Group Residential Energy Burden by End Use for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



Analysis of Fuel Price and Energy Efficiency Trends

Trends in energy consumption and expenditures are dependent on factors such as energy prices, weather, and energy efficiency. Fuel prices outpaced the Consumer Price Index (CPI) from 1979 through 1985, as shown in Figure 6 on the next page. While the CPI increased about 48 percent, the composite average of fuel prices (a weighted average of electric, natural gas, and fuel oil prices) increased by about 86 percent between 1979 and 1985. From 1985 through 1993, fuel prices rose at a slower rate than did the CPI (i.e., at a slower rate than the cost of other goods). From 1997 to 2009, however, fuel prices rose at a higher rate than did the prices of other goods. In FY 2020, the composite energy price index was 400 and the CPI was 355. Relative to 2015, the CPI rose at a faster rate than did the composite energy price index. In FY 2020, the composite energy price index increased by 3.4 percent while the CPI increased by 8.9 percent.

The impact of energy prices on energy expenditures resulted in low income household energy expenditures surging upward until 1985 even though energy consumption for these households declined over the same period. The 19 percent growth in composite fuel prices from 1985 to 1997 explains why residential energy expenditures per low income household rose slightly during that period. In 2001, fuel prices increased by 17 percent over 1997 prices; 2005 fuel prices increased by 24 percent over 2001 prices; 2009 fuel prices increased by nearly 15 percent over 2005 prices, 2015 fuel prices increased by nearly 5 percent over 2009 prices; and 2020 fuel prices increased by about 3.4 percent over 2015. The increases in fuel prices from 2015 through FY 2020 contributed to the rise in expenditures during that period.

Figure 6. Shifts in Composite Energy Price Index and Consumer Price Index (CPI), 1979 to FY 2020

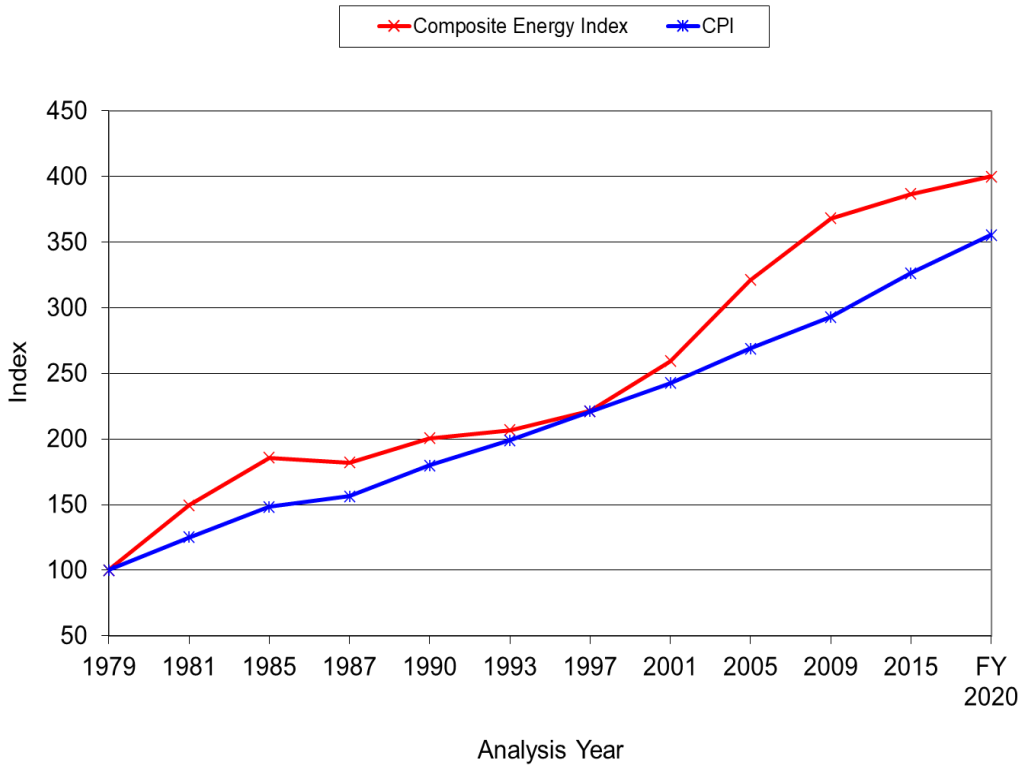
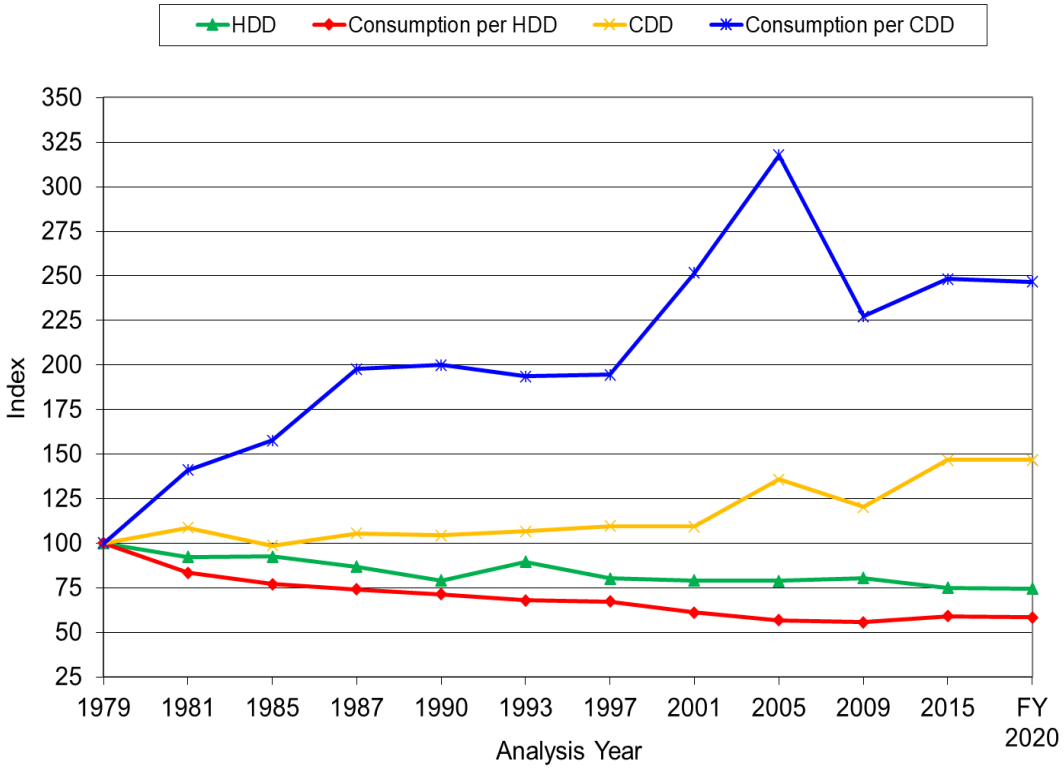


Figure 7 on the next page shows average energy consumption for heating and cooling compared to heating and cooling degree days from 1979 to FY 2020 for low income households. As shown, heating consumption per heating degree day generally declined from 1979 to FY 2020 probably at least in large part due to energy conservation efforts. In contrast, cooling consumption per cooling degree day was higher in FY 2020 than 1979, with a spike around 2001 and 2005 because of a large increase in the availability of air-conditioning to low income households.[4] Only 37 percent of low income households had air-conditioning equipment in 1979 but by 2005 the number had risen to 80 percent. This was followed by a slight decrease in 2009 to 77 percent and then increased to 82 percent in 2015.

[4] Air-conditioning equipment includes central air-conditioners and window or wall units, ceiling fans, and evaporative coolers. The availability of all household appliances increased for low income households over this period due to the overall increase in the wealth of the nation and to the decrease in the cost of older technologies.

Figure 7. Index of Heating Degree Days (HDD), Average Heating Consumption for Low Income Households per HDD, Cooling Degree Days (CDD), and Average Cooling Consumption for Low Income Households per CDD, 1979 to FY 2020



The mean group home energy burden for low income households has remained considerably higher than the burden for all households. In 1979, the mean group home energy burden was 7.7 percent for low income households, while the mean group home energy burden for all households was 1.9 percent. In FY 2020, the mean group home energy burden for all households was 1.1 percent, while the mean group home energy burden for low income households was 4.2 percent. Again, this is almost four times higher than the mean group home energy burden for all households.

Trends in LIHEAP

Between 1981 and FY 2020, as shown in Figure 8, the number of income eligible households has risen by about 69 percent, during which time federal fuel assistance funds have increased by about 118 percent.[5] Also during this period, the percentage of income eligible households receiving heating and/or winter crisis assistance has declined from 36 percent in 1981 to 16 percent in FY 2020 – though this figure has remained reasonably steady since 1997.[6] Before adjusting for inflation, average winter crisis and heating benefits per household increased until 1985, fell in 1987, stayed in the same range through 1997, increased significantly in 2001, dropped by over 16 percent in 2005, rose by nearly 66 percent in 2009, decreased by over 21 percent 2015, and then increased by over 39 percent in FY 2020. Cooling benefits per household fell until 1985 and increased sharply from 1993 through 2001, and then fell by over 6 percent in 2005, rose nearly 77 percent in 2009, decreased by nearly 15 percent in 2015, and then increased significantly by over 83 percent in FY 2020. After adjusting for inflation, the mean value of

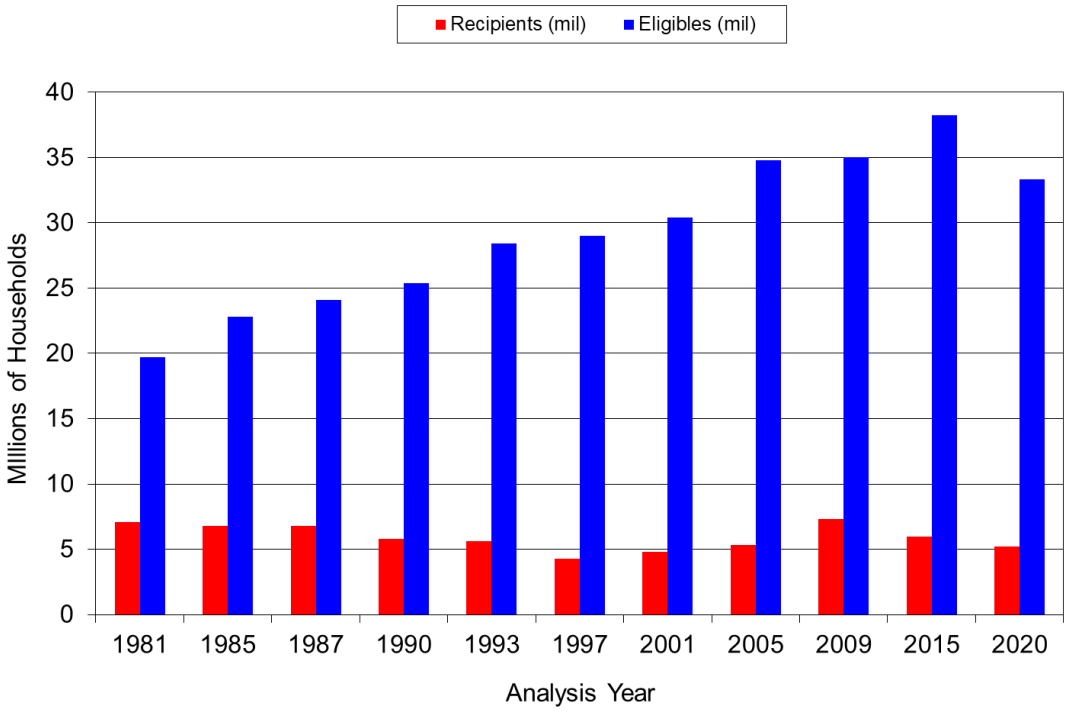
[5] Income eligible household estimates do not include those households with incomes greater than the statutory income standards but who may still qualify for LIHEAP benefits because they are categorically eligible for LIHEAP under Section 2605 (b)(2)(A) of the LIHEAP Act, 42 U.S.C. § 8624(b)(2)(A).

[6] Note that The FY 1981 estimate of income eligible households are not directly comparable to those of the other years because the income eligibility guidelines for the FY 1981 program differed from those of other years.

combined federal heating and winter crisis benefits fell (in 1981 dollars) from $213 in 1981 to $189 in FY 2020. Cooling benefits increased (in 1981 dollars) from $129 in 1981 to $188 in FY 2020.

The percentage of the total home heating bill for Low Income Energy Assistance Program/Low Income Home Energy Assistance Program (LIEAP/LIHEAP) income eligible households covered by LIEAP/LIHEAP heating and winter crisis benefits decreased from 23 percent in 1981 to 19 percent in FY 2020. The decrease resulted from the combination of higher home heating bills and an increase in the size of income eligible population.

Figure 8. Number of LIEAP/LIHEAP Income Eligible and Heating and/or Winter Crisis Assistance beneficiary Households, FY 1981 to FY 2020



The mean group home heating burden for LIEAP/LIHEAP assisted households is substantially reduced because of the LIHEAP benefits. In FY 2020, the net mean group home heating burden for LIHEAP assisted households was 0.5 percent. However, it has historically been about twice the burden of all households, even with the assistance.

I. Introduction

The Administration for Children and Families (ACF) within the U.S. Department of Health and Human Services (HHS) administers at the federal level the Low Income Home Energy Assistance Program (LIHEAP). ACF awards annual LIHEAP block grants to assist eligible low income households in meeting their home energy costs. ACF issues such grants to the 50 states and the District of Columbia, certain Indian tribes and tribal organizations, and certain U.S. insular areas.

In 1994, Congress amended the purpose of LIHEAP to clarify that LIHEAP is "to assist low income households, particularly those with the lowest incomes that pay a high proportion of household income for home energy, primarily in meeting their immediate home energy needs" (The Human Services Amendments of 1994, Public Law (P.L.) 103-252, Sec. 302). Congress further indicated that LIHEAP grant recipients need to reassess their LIHEAP benefit structures to ensure that they are actually targeting those low income households that have the highest energy costs or needs. The Energy Policy Act of 2005 (P.L. 109-58) reauthorized LIHEAP through FY 2007 without substantive changes. LIHEAP's reauthorization is currently pending.

For LIHEAP grant recipients to reassess their LIHEAP benefit structures, they need performance statistics on LIHEAP applicants and eligible households. In addition, they need technical assistance in how to make use of the performance statistics in planning and implementing changes to their programs.

The *Low Income Home Energy Trends Report* focuses on the home energy mission of LIHEAP by furnishing data and analyses on low income home energy trends for the period from 1979 to FY 2020. Subsections include trends in consumption, expenditures, and burden; analysis of energy price and energy efficiency trends; trends in LIHEAP; and analysis of LIHEAP benefits. Previously, the *Low Income Home Energy Trends Report* was published as part of the *LIHEAP Home Energy Notebook*, which included additional sections on the latest national and regional data on home energy consumption, expenditures, and burden; characteristics of the low income population in each state; federal LIHEAP targeting performance; and special studies of important issues related to LIHEAP and low income home energy needs. Beginning with data for FY 2015, the individual sections of the *LIHEAP Home Energy Notebook* have been published separately to make the data available to LIHEAP grant recipients in a more timely fashion.

The FY 2020 home energy data presented in this report were derived from existing data sources and analytic procedures. These include the following:

- For household-level data on home energy: The national Residential Energy Consumption Survey (RECS) for 2015, which is administered by the Department of Energy (DOE), Energy Information Administration (EIA).[7]

- For household-level data on income: The national Current Population Survey's (CPS's) Annual Social and Economic Supplement (ASEC), which is administered by the Department of Commerce, Bureau of the Census (Census).

- For national- and state-level data on residential energy prices: EIA's publication *Monthly Energy Review* for electricity price, natural gas price and consumption, and fuel oil/kerosene and liquefied petroleum gas (LPG) consumption; EIA's publication *Electric Power Monthly* for

[7] The most recent RECS was conducted in 2015. In that iteration of the RECS, significant methodological changes were introduced, including changes to end-use modeling procedures, particularly for electricity usage, and changes that impact the ability to characterize low income households. Therefore, readers should use caution when comparing the estimates for 2015 and FY 2020 with prior years, which are based on previous versions of the RECS.

electricity consumption; EIA website for LPG price; and the Bureau of Labor Statistics (BLS) Consumer Price Index for fuel oil/kerosene price.

- Other publicly available sources of data such as weather data from the Department of Commerce, National Oceanographic and Atmospheric Administration (NOAA).
- End use disaggregation procedures developed by EIA's Office of Energy Markets and End Use (EMEU).
- Data on states' expenditure of funds by component and numbers of households served by type: Office of Community Services (OCS), Division of Energy Assistance's (DEA's) administrative data from the *LIHEAP Household Report for Federal Fiscal Year (FFY) 2020* and the *LIHEAP Performance Data Form for Federal Fiscal Year (FFY) 2020.*[8]

[8] Starting in FY 2015, the *LIHEAP Grantee Survey* was incorporated into the *LIHEAP Performance Data Form* (OMB Control No. 0970-0449).

II. Low Income Home Energy Trends

Important shifts in energy prices and consumption have occurred since the 1973 oil embargo. As a result, the energy expenditures and energy burdens of low income households have changed significantly.

In the *LIHEAP Report to Congress for FY 1989*, Appendix K presented the results of a national study of residential energy consumption, expenditures, and burden for low income households from 1973 to 1989. Selected tables from that study were updated and published as a regular appendix in the annual *LIHEAP Reports to Congress* for FY 1991 through FY 1996. Beginning with the FY 1997-FY 1999 report, the tables are only published in the annual *LIHEAP Home Energy Notebook*. The tables present data for low income households and, for comparison purposes, include statistics on all households. Beginning with 1979, the year before HHS's first energy assistance program was enacted, trend data are furnished on the following:

- Home energy consumption, expenditures, and burden
- Factors affecting consumption, expenditures, and burden
- The impact of LIHEAP assistance on net home energy expenditures

Several special terms are used throughout this report. Table 2-1 on the next page defines these special terms. One such term is "low income," which is defined as having income at or below 150 percent of HHS Poverty Guidelines. Because of limitations on the availability of data, this definition is more restrictive than that used in the other reports comprising the *Notebook*. In those reports, "low income" refers to LIHEAP income eligible households, which are households that would be income eligible for LIHEAP if their states set the income eligibility guidelines at the federal maximum (the greater of 150 percent of HHS Poverty Guidelines or 60 percent of the state median income). Based on estimates from the 2020 CPS ASEC, the definition based solely on 150 percent of HHS Poverty Guidelines excludes about 11.0 million households of the 33.3 million households that meet the definition of LIHEAP income eligible households. Therefore, differences in FY 2020 home energy data included in this report and that included in the other reports comprising the *Notebook* are the result of the difference in the definition of "low income."[9] Unless indicated otherwise, the energy data in this report are based on eleven national residential energy surveys of occupied residential housing units and their fuel suppliers. Table 2-2 identifies the surveys used, the date on which household interviews began, the time period in which residential energy bills were collected from fuel suppliers, the time frame for household income, and the number of households included in the survey.

For each survey, a national sample of residential housing units was selected, and interviewers attempted personal contacts with the householder. For those housing units where an authorization form was completed, the household's fuel supplier was contacted and asked to supply fuel costs and consumption data.

The collection of income data is not a primary focus of the residential energy surveys. Income statistics from the CPS ASEC are used to improve income data.

[9] As noted in Table 2-2, the data files used in this study include surveys from 1979 and 1981. The variable that designates LIHEAP income eligibility was not coded for those data files.

Table 2-1. Definition of Special Terms

Term	Definition
Billing data	Energy cost and consumption data furnished by the household's fuel supplier.
Composite price	The weighted average price of electricity, natural gas, and fuel oil used for residential purposes.
Real dollar expenditures	Costs adjusted for changes in the price of a market basket of consumer goods between two years (i.e.,adjusted for inflation or deflation).
Cooling degree days	Daily cooling degree days are computed by subtracting a base temperature (65 degrees Fahrenheit) from a day's mean temperature when it exceeds 65 degrees Fahrenheit. If the mean temperature on a day is 70, the number of cooling degree days experienced on that day is 5 (70 minus 65). In this *Notebook*, we refer to annual cooling degree days, or the sum of all cooling degree days experienced during a year.
(Nominal) Dollar expenditures	Actual costs as reported in the year of the energy survey (unadjusted for inflation or deflation). Unless noted otherwise all dollar expenditures are unadjusted.
Energy burden	The share or percentage of annual household income that is used to pay annual energy bills.[i]
Energy end uses	The specific use of energy in the home for home heating, home cooling or ventilation, water heating, and appliances.
Fuel assistance	LIHEAP heating, cooling, and crisis assistance.
Heating degree days	Daily heating degree days are computed by subtracting the mean temperature for a day, when that temperature falls below 65 degrees Fahrenheit, from a base temperature (65 degrees Fahrenheit). For example, if the mean temperature on a day is 60 and the base temperature is 65, the number of heating degree days experienced on that day is 5 (65 minus 60). In this *Notebook*, we refer to annual heating degree days, or the sum of all heating degree days experienced during a year.
Home energy expenditures	Expenditures for home space heating and home space cooling.
LIHEAP burden offset	The reduction in mean group home heating burden as a result of LIHEAP benefits.
LIHEAP coverage rate	The percentage of the aggregate home energy bills for low income households that is covered by LIHEAP fuel assistance.
LIHEAP income eligible households	Households with incomes at or below the federal maximum LIHEAP income standard, i.e., at or below the greater of 150 percent of HHS Poverty Guidelines or 60 percent of the state median income.
LIHEAP participation rate	The percentage of LIHEAP income eligible households that receive fuel assistance.
LIHEAP beneficiary households	Households that indicated receiving home heating, cooling, or energy crisis benefits during the 12 months prior to a particular household survey.
Low income households	Households with incomes at or below 150 percent of HHS Poverty Guidelines.
Mean	The mean is the sum of all values divided by the number of values, or what is commonly called the average.
Median	The median is the value at the midpoint in the distribution of values.
MMBtus	A British thermal unit (Btu) is the amount of energy necessary to raise the temperature of one pound of water one degree Fahrenheit. MMBtus refers to millions of Btus. An average household uses about 100 MMBtus per year.
Residential energy expenditures	Fuel expenditures for all residential uses, including home heating, home cooling or ventilation, water heating, refrigeration, clothes drying, etc.

[i] Three different energy burden statistics are used in this report: mean group burden, mean individual burden, and median individual burden. The definitions of these statistics are presented preceding Figure 2-5.

Table 2-2 presents information on the series of surveys that were used to prepare this *Notebook*. The reader should note that the in-home interview dates lag the analysis year for the years 1979 through 1985. In those years, the energy supplier survey included data from the year following the in-home interview. In all cases, the analysis year coincides with the end of the energy consumption history.

Table 2-2. Data Used for the Study of Low Income Home Energy Trends

Analysis Year[i]	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Survey[ii]	NIECS	RECS	RECS	RECS	RECS	RECS	RECS	RECS	RECS	RECS	RECS	RECS
Interview date[iii]	9/78	9/80	9/84	9/87	9/90	10/93	5/97	5/01	8/05	2/10	8/15	[iv]
Billing data[v]	4/78 to 3/79	4/80 to 3/81	4/84 to 3/85	1/87 to 12/87	1/90 to 12/90	1/93 to 12/93	1/97 to 12/97	1/01 to 12/01	1/05 to 12/05	1/09 to 12/09	1/15 to 12/15	1/15 to 12/15
Income data[vi]	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Sample size	4,081	6,051	5,682	6,229	5,095	7,111	5,900	5,318	4,382	12,083	5,686	5,686

[i] Represents the year that includes the last month for which billing data were collected from fuel suppliers.
[ii] Surveys include the National Interim Energy Consumption Survey (NIECS) and the RECS.
[iii] Month and year in which household interviews began.
[iv] Data projected from the 2015 RECS using changes in weather and prices. See Appendix A for the procedure used to calculate the projections.
[v] Time period in which residential energy bills were collected from fuel suppliers.
[vi] Mean income computed using calendar year data from the CPS ASEC.

Trends in Energy Use, Consumption, Expenditures, and Burden

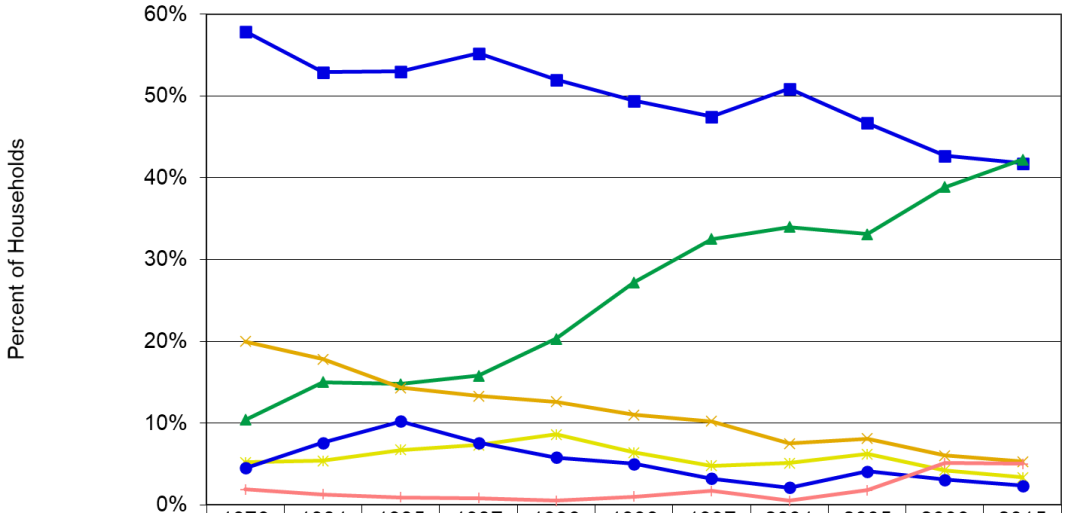
Since 1979, there have been important changes in the fuels used by households, the amount of energy consumed for specific residential end uses (i.e., home heating, water heating, home cooling, and for other appliances), total residential energy expenditures, and the burden that residential energy expenditures represent for low income households. This section presents data that illustrate these changes.

Figures 2-1 and 2-2, on the next page, furnish information on the fuel choices by low income households. Figure 2-1 shows that low income households have increased their use of electricity as a main heating fuel, from 10.4 percent in 1979, to 38.9 percent in 2009, and to 42.2 percent in 2015, while they have reduced their use of fuel oil or kerosene as a main heating fuel, from 20.0 percent in 1979, to 6.0 percent in 2009[10], and to 5.3 percent in 2015 Moreover, the use of wood or coal as a main heating fuel—included under "Other"—peaked in 1985, declined substantially through 2001, almost doubled by 2005, dropped to 3.1 percent in 2009, and decreased further to 2.3% percent in 2015.

Figure 2-2 shows that low income households increased their use of central air-conditioning systems from 8.5 percent in 1979 to 47 percent in 2015[11]. The proportion of low income households with no air-conditioning fell from 62.8 percent in 1979, to 22.7 percent in 2009, and to 18.4 percent in 2015. Other factors being equal, increased use of air-conditioning equipment among low income households can be expected to increase home cooling expenditures.

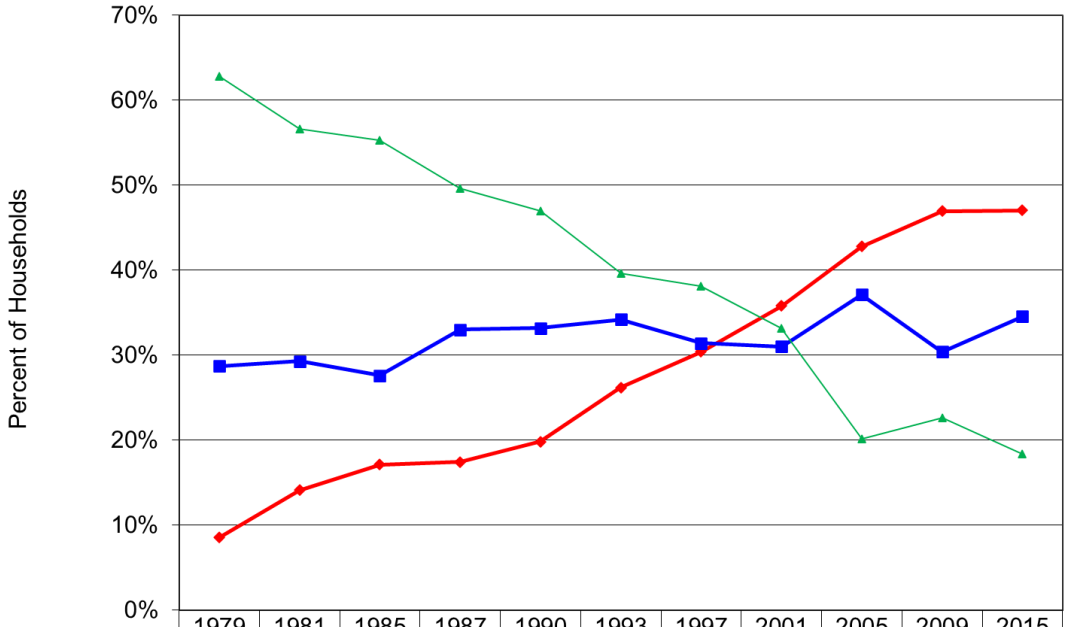
[10] For all households, the share using electricity as their main heating fuel grew from 15.8 percent in 1979 to 34.6 percent in 2015, and the share using fuel oil or kerosene as their main heat fell from 22.1 percent to 4.9 percent.
[11] For all households, the share using electric central air-conditioning grew from 23 percent in 1979 to 64 percent in 2015.

Figure 2-1. Main Heating Fuel for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to 2015



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015
Natural Gas	57.9	52.9	53.0	55.2	52.0	49.4	47.5	50.9	46.7	42.7	41.8
Electricity	10.4	15.0	14.8	15.8	20.3	27.2	32.5	34.0	33.1	38.9	42.2
Fuel Oil	20.0	17.8	14.3	13.3	12.6	11.0	10.2	7.5	8.1	6.0	5.3
LPG	5.2	5.4	6.7	7.3	8.6	6.4	4.8	5.1	6.2	4.2	3.4
Other	4.5	7.6	10.2	7.6	5.8	5.0	3.2	2.1	4.1	3.1	2.3
No Main Fuel	1.9	1.3	0.9	0.8	0.5	1.0	1.7	0.5	1.8	5.1	5.0

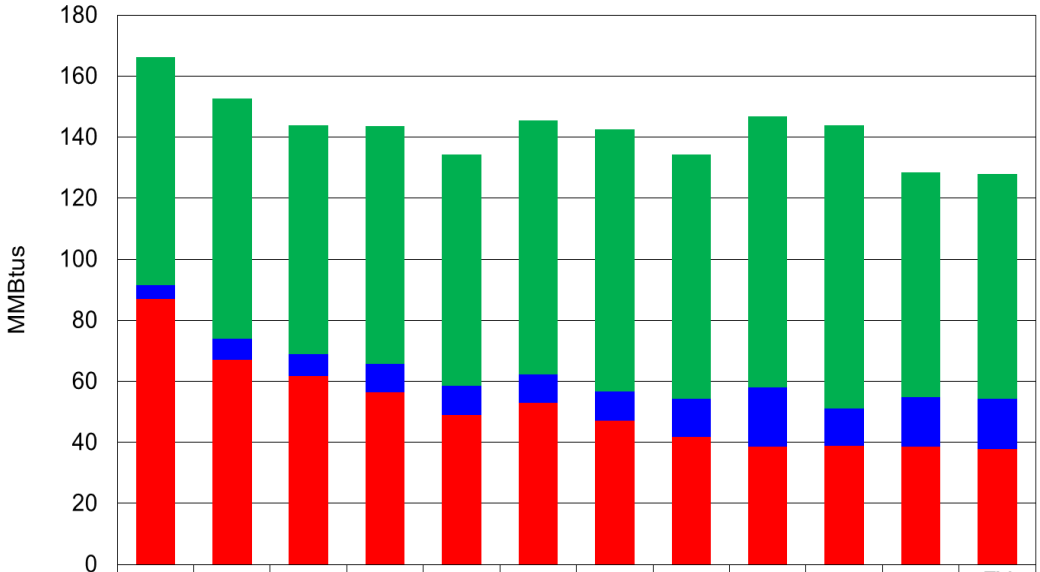
Figure 2-2. Air-Conditioning Type for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to 2015



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015
Central AC	8.5	14.1	17.1	17.4	19.8	26.2	30.4	35.8	42.8	46.9	47.0
Room AC	28.7	29.3	27.6	33.0	33.2	34.2	31.4	31.0	37.1	30.4	34.6
None	62.8	56.6	55.3	49.6	47.0	39.6	38.1	33.2	20.1	22.7	18.4

Figures 2-3 and 2-4 furnish information on the trends in mean residential energy consumption and expenditures for low income households from 1979 to FY 2020. Figure 2-3 shows that low income households substantially reduced their residential energy consumption between 1979 and 1985. This suggests a significant increase in efficiency resulting from conservation measures or actions. Examination of the components of residential energy consumption indicates that the reduction was the result of reductions in home heating consumption. From 1985 to 1990, mean residential energy consumption fluctuated from year to year, corresponding to expected changes in heating and cooling consumption that resulted from changes in heating and cooling degree days.[12] For 1993 through 1997, there appears to have been a significant increase in the use of energy for purposes other than home heating and home cooling. In 2001, the use of energy for purposes other than heating and cooling dropped, increased through 2009, and then fell again through 2015.

Figure 2-3. Mean Residential Energy Consumption per Household in MMBtus by End Use for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



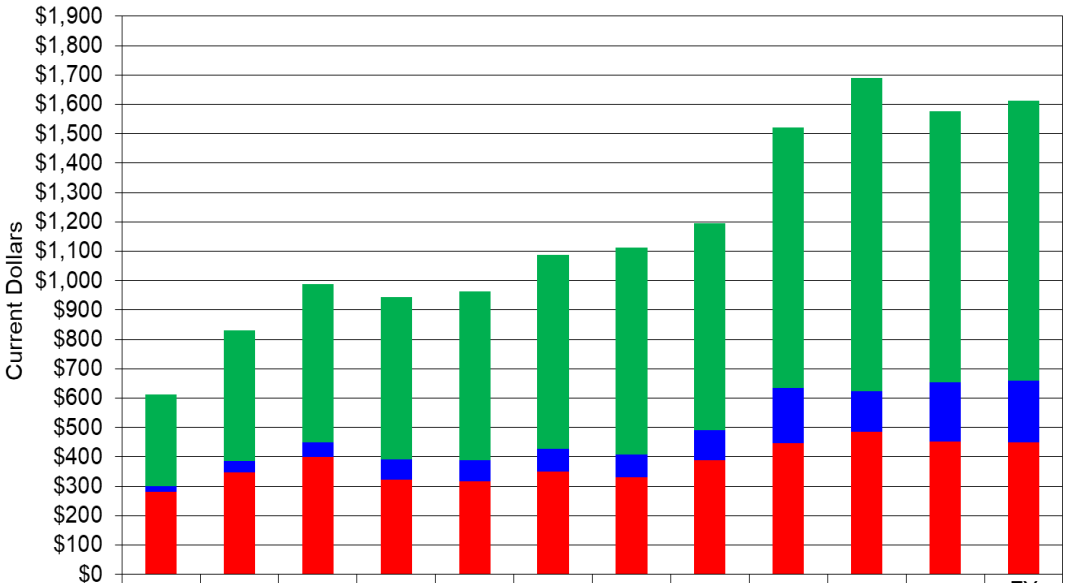
	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Total	166	153	144	143	134	145	143	134	147	144	129	128
Other	75	79	75	78	76	83	86	80	89	93	74	74
Cooling	5	7	7	9	9	9	10	12	19	12	16	16
Heating	87	67	62	56	49	53	47	42	39	39	39	38

Figure 2-4, on the next page, shows that mean residential energy expenditures for low income households increased rapidly from 1979 to 1985; the increases were the result of fuel price increases. Examination of the components of energy expenditures indicates that the greatest increases were in home cooling and other residential expenditures, while increases in home heating expenditures were more moderate until a spike in 2009 and followed by a decrease in 2015. Mean residential energy expenditures increased at a moderate rate from $943 in 1987 to $1,196 in 2001. From 2001 to 2005, mean residential energy expenditures increased by 27 percent to $1,522; from 2005 to 2009, mean residential energy expenditures increased by 11 percent to $1,690; and from 2009 to 2015, mean residential energy expenditures

[12] The numbers presented in this table are not directly comparable to the statistics that appear in Appendix A of the Low Income Home Energy Data report for FY 2020. In this figure, electricity Btus have been adjusted to be comparable to Btus for other fuels. This adjustment procedure is used to account for Btus lost in the generation and transmission of electricity to the housing unit and to thereby furnish a better picture of changes in energy efficiency over time.

decreased by about 7 percent to $1,578. In FY 2020, mean residential energy expenditures were $1,612, about two percent higher than in 2015. Mean home heating expenditures fell from $399 in 1985 to $318 in 1990, then rose and fell moderately until 1997. Home heating expenditures saw an 18 percent increase in 2001 over 1997, a 15 percent increase in 2005 over 2001, about an 8 percent increase in 2009 over 2005, and 7 percent decrease in 2015 over 2009. In FY 2020, home heating expenditures were $450, about the same ($1 higher) than in 2015. Mean home cooling expenditures rose continuously from $51 in 1985 to $187 in 2005. In 2009, mean home cooling expenditures fell to $139, increased to $202 in 2015, and then increased again to $210 in FY 2020.

Figure 2-4. Mean Residential Energy Expenditures by End Use for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Total	$612	$830	$987	$943	$963	$1,088	$1,113	$1,196	$1,522	$1,690	$1,578	$1,612
Other	$311	$444	$537	$552	$574	$661	$705	$705	$887	$1,065	$924	$952
Cooling	$20	$38	$51	$68	$71	$77	$78	$103	$187	$139	$202	$210
Heating	$281	$348	$399	$323	$318	$350	$330	$388	$448	$485	$451	$450

The next series of Figures, 2-5 through 2-7, furnishes information on energy burden for low income households.[13] Three different energy burden summary statistics are presented in the three figures: mean group energy burden, mean individual energy burden, and median individual energy burden. Each of the statistics offers somewhat different information and gives somewhat different results. All three are valid from a statistical perspective. The statistics are defined as follows:

- *Mean Group Burden*: Computed as the ratio between mean energy expenditures and mean income for a given set of households, such as low income households. Energy expenditures are computed from RECS and income is derived from the CPS ASEC.
- *Mean Individual Burden*: Computed by finding, using the RECS data, the energy burden for each individual household in a given set (such as low income households) and then taking the mean of these energy burdens for all households in that set.

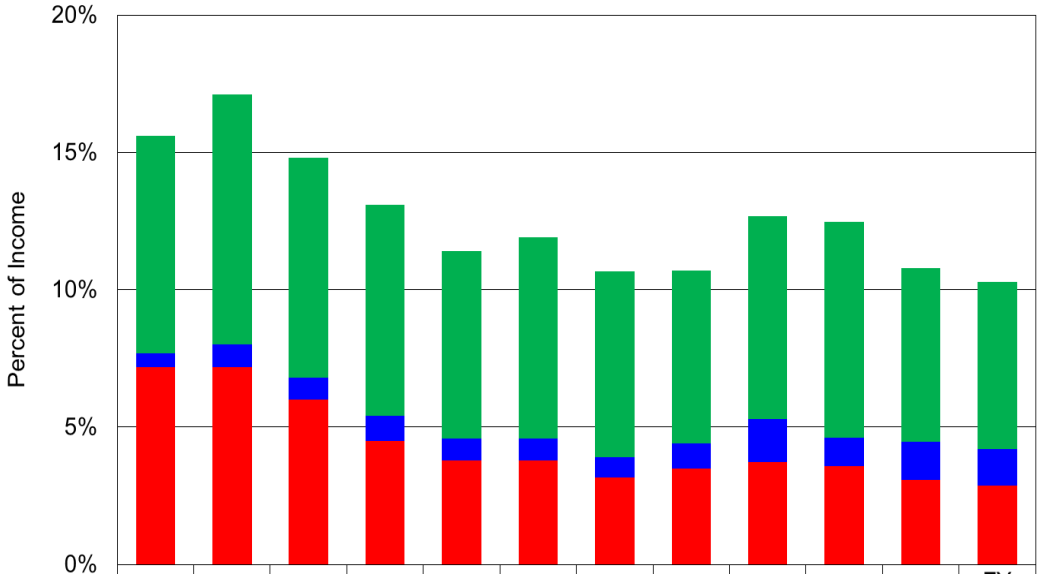
[13] These figures present gross burden statistics; they do not present net burden statistics, which account for the reduction in burden attributable to the receipt of LIHEAP benefits. Figure 2-26 compares gross burden and net burden for LIHEAP recipient households.

- *Median Individual Burden*: Computed by finding, using the RECS data, the energy burden for each individual household in a given set (such as low income households) and finding the median, or middle point, of the distribution of these household-level energy burdens in the set.

Mean group burden is the burden statistic that has been used in the series of annual *LIHEAP Reports to Congress*. Recent technical research has furnished additional insights on the range of alternative burden summary statistics.[14]

Figure 2-5 shows the time series for mean group energy burdens by end use for low income households. Mean group home energy burden, the sum of the heating and cooling burden components of mean residential energy burden from Figure 2-5, grew from 7.7 percent of income in 1979 to 8.0 percent in 1981, and then fell considerably after 1981 to 3.9 percent in 1997. From 1981 through 1997 mean group home energy burden declined because mean home energy expenditures for low income households fell, while mean incomes for low income households rose. Mean group home energy burden rose to 4.4 percent in 2001 and to 5.3 percent in 2005, fell to 4.6 percent in 2009, decreased slightly to 4.5 percent in 2015, and decreased further to 4.2 percent in FY 2020. Mean group home energy burden for FY 2020 was about seven percent lower than in in 2015, nine percent lower than in 2009, and 48 percent below the peak level in 1981.

Figure 2-5. Mean Group Residential Energy Burden by End Use for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



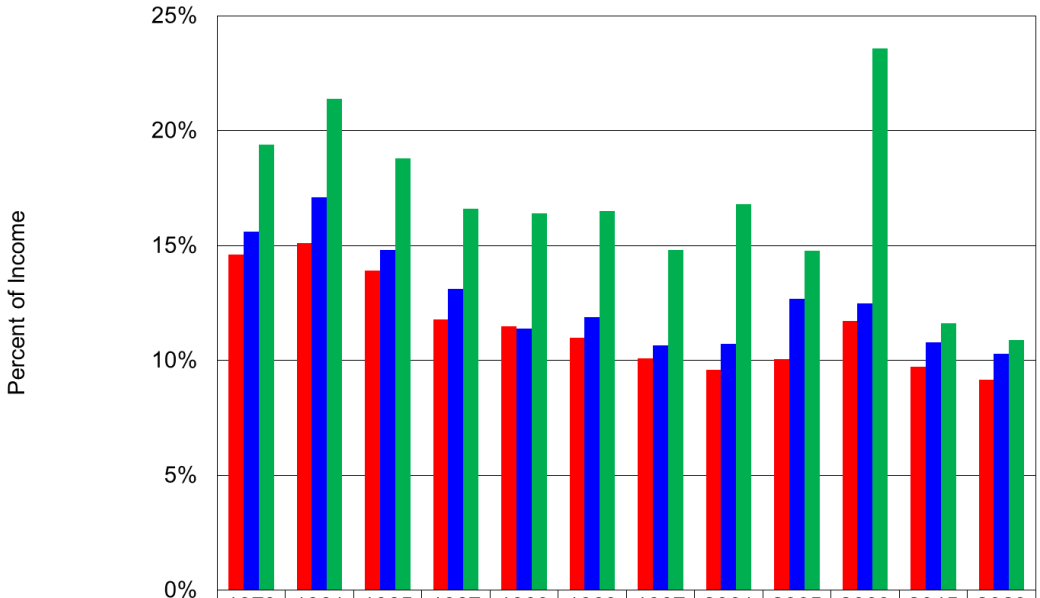
	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Total	15.6	17.1	14.8	13.1	11.4	11.9	10.7	10.7	12.7	12.5	10.8	10.3
Other	7.9	9.1	8.0	7.7	6.8	7.3	6.8	6.3	7.4	7.9	6.3	6.1
Cooling	0.5	0.8	0.8	0.9	0.8	0.8	0.7	0.9	1.6	1.0	1.4	1.3
Heating	7.2	7.2	6.0	4.5	3.8	3.8	3.2	3.5	3.7	3.6	3.1	2.9

Figures 2-6 and 2-7 show how the mean individual and median individual energy burden statistics compare to the group energy burden statistics. Figure 2-6 shows the trends in residential energy burden for low income households. In 2015, the mean individual residential energy burden was 11.6 percent, higher than the median individual burden of 9.7 percent and the mean group burden of 10.8 percent. For FY 2020, median individual residential energy burden was 9.2 percent – about 39 percent lower than the

[14] See Appendix A for additional information on the interpretation of alternative burden statistics.

peak in 1981; mean group residential energy burden was 10.3 percent – about 40 percent lower than the 1981 peak; and the mean individual residential energy burden of 10.9 percent was about 54 percent lower than the peak in 2009.

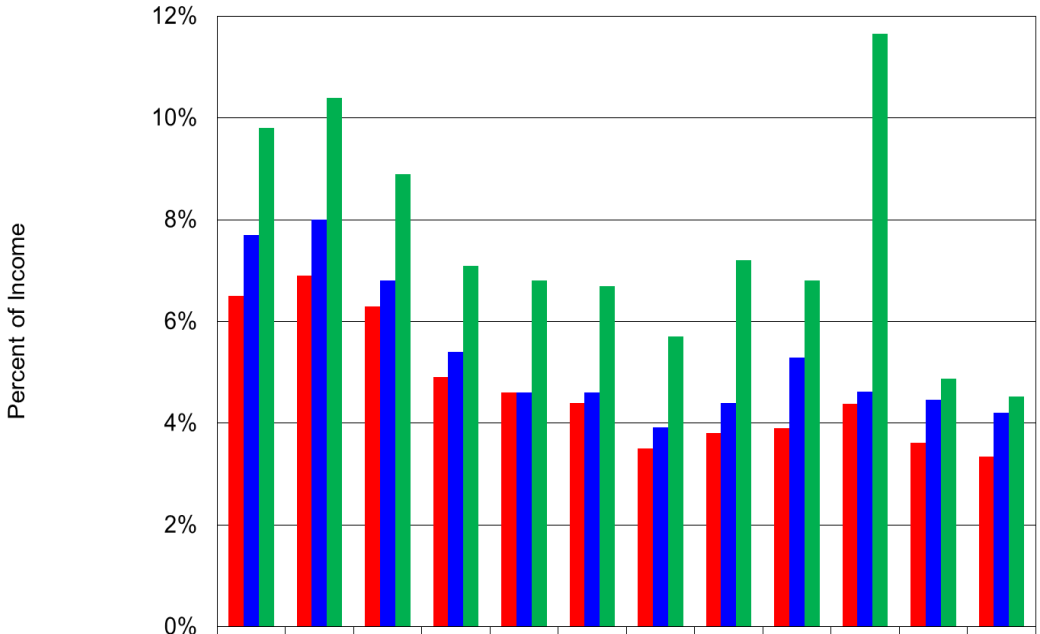
Figure 2-6. Comparison of Mean Group, Mean Individual, and Median Individual Residential Energy Burden for households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Individual Median	14.6	15.1	13.9	11.8	11.5	11.0	10.1	9.6	10.1	11.7	9.7	9.2
Group Mean	15.6	17.1	14.8	13.1	11.4	11.9	10.7	10.7	12.7	12.5	10.8	10.3
Individual Mean	19.4	21.4	18.8	16.6	16.4	16.5	14.8	16.8	14.8	23.6	11.6	10.9

Figure 2-7 shows the trends in home energy burden for low income households. In 2015, the mean individual home energy burden was 4.9 percent, the median individual home energy burden was 3.6 percent, and the mean group home energy burden was 4.5 percent. In FY 2020, the mean individual home energy burden was 4.5 percent, the median individual home energy burden was 3.3 percent, and the mean group home energy burden was 4.2 percent. The lowest home energy burden for the individual median, the individual mean, and the group mean occurred in FY 2020. The highest home energy burden for the individual median and group mean occurred in 1981, while the highest individual mean occurred in 2009.

Figure 2-7. Comparison of Mean Group, Mean Individual, and Median Individual Home Energy Burden for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Individual Median	6.5	6.9	6.3	4.9	4.6	4.4	3.5	3.8	3.9	4.4	3.6	3.3
Group Mean	7.7	8.0	6.8	5.4	4.6	4.6	3.9	4.4	5.3	4.6	4.5	4.2
Individual Mean	9.8	10.4	8.9	7.1	6.8	6.7	5.7	7.2	6.8	11.7	4.9	4.5

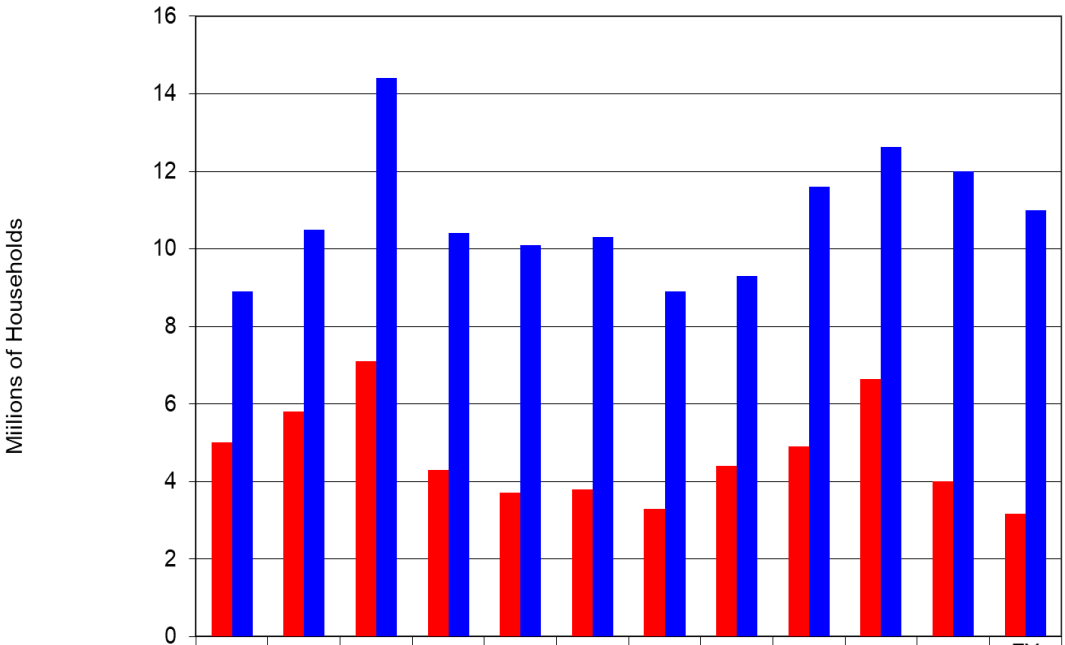
Figures 2-8 and 2-9, on the next page, present information on the number and percent of low income households that had home energy burdens that exceeded specified levels. The levels are reference points and do not represent any judgment regarding an "affordable" level of energy burden.

As shown in Figure 2-8, the number of low income households with home energy burdens exceeding 10 percent of income grew from 5.0 million in 1979 to 7.1 million in 1985, an increase of 42 percent. The number of low income households with home energy burdens exceeding 5 percent of income grew by 62 percent from 1979 to 1985. These increases were primarily the result of growth in the total number of low income households. As Figure 2-9 shows, the percentage of low income households with home energy burdens exceeding 5 percent remained quite stable from 1979 through 1985. However, the percentage of low income households with home energy burdens exceeding 10 percent dropped by 17 percent over that same period.

For the period 1985 through 1997, however, both the number and percentage of low income households exceeding specified levels fell significantly from previous levels. For these years, both a reduction in home energy expenditures and increased incomes caused burden to decrease for low income households. In 2001, both the number and percent of households exceeding the specified levels rose. From 2001 to 2009, both the percent of households exceeding the specified levels and the number of households exceeding the specified levels, increased, while from 2009 to FY 2020, it decreased. In FY 2020, an estimated 3.2 million low income households spent over 10 percent of income on home energy, down from 4.0 million in 2015; the percent of low income households spending over 10 percent of income on home energy also decreased from 12 percent in 2015 to nine percent in FY 2020. Over the same period, the number of low income households spending over five percent of income on home energy decreased from 12.0 million to 11.0 million, while the percent of low income households spending over five percent

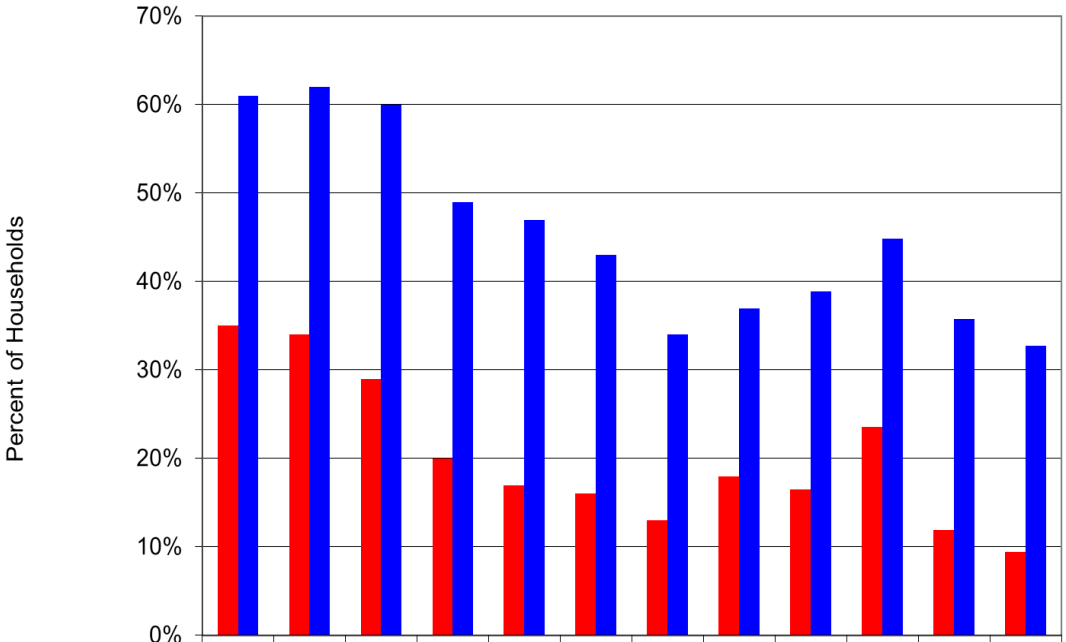
of income on home energy decreased from 36 percent to 33 percent. The number of low income households with home energy burdens exceeding 10 percent of income in FY 2020 was about 55 percent less than the 1985 level and 36 percent less than the 1979 level.

Figure 2-8. Number of Low Income Households (in Millions) Spending over 5 Percent and 10 Percent of Income on Home Energy, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
More than 10%	5.0	5.8	7.1	4.3	3.7	3.8	3.3	4.4	4.9	6.6	4.0	3.2
More than 5%	8.9	10.5	14.4	10.4	10.1	10.3	8.9	9.3	11.6	12.6	12.0	11.0

Figure 2-9. Percent of Low Income Households Spending over 5 Percent and 10 Percent of Income on Home Energy, 1979 to FY 2020

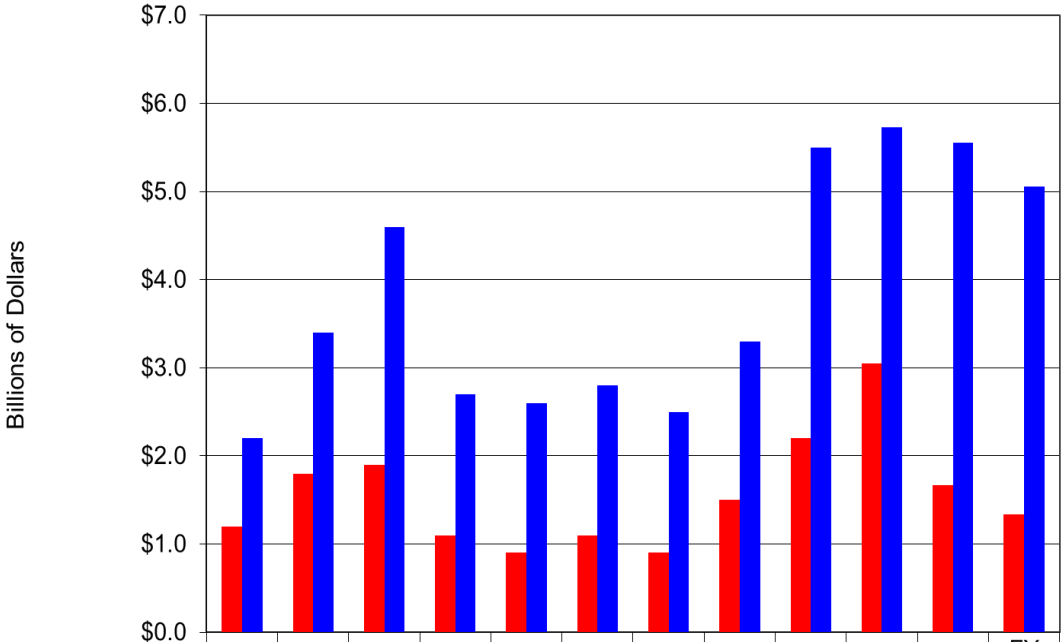


	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
More than 10%	35	34	29	20	17	16	13	18	17	24	12	9
More than 5%	61	62	60	49	47	43	34	37	39	45	36	33

Figure 2-10 shows the total assistance funding that would be required to reduce the home energy burden for all low income households to 10 percent of income and five percent of income.[15] The amount required for a reduction in the home energy burden of low income households to five percent of income was $2.2 billion in 1979, $4.6 billion by 1985, $3.3 billion in 2001, $5.5 billion in 2005, $5.7 billion in 2009, $5.6 billion in 2015, and $5.1 billion in FY 2020. As shown in Figure 2-8, the number of low income households with home energy burdens exceeding five percent of income fell between 1985 and 1997. The total dollars of assistance funding required to reduce the home energy burden of low income households to five percent also fell through 1997. From 1997 to 2005, increased expenditures caused the number of low income households exceeding the percent of income reference points to rise. Accordingly, the total dollars of assistance funding required to reduce the home energy burden to five percent also rose substantially. In FY 2020, the number of low income households exceeding the five percent of income and 10 percent of income was less than in 2015. Total dollars of assistance funding required to reduce home energy burden to 10 percent decreased from $1.7 billion required in 2015 to $1.3 billion required in FY 2020. Similarly, the total dollars of assistance funding required to reduce home energy burden to five percent decreased from $5.6 billion required in 2015 to $5.1 billion required in FY 2020.

[15] This is calculated first by finding the amount of funds for each low income household that would be required to reduce its home energy burden to the specified percent of income. This amount is the difference between the household's actual home energy burden and the specified home energy burden (the dollar amount of the specified percent of household income). Then the household amounts are aggregated to produce the total assistance funding that is needed for all low income households.

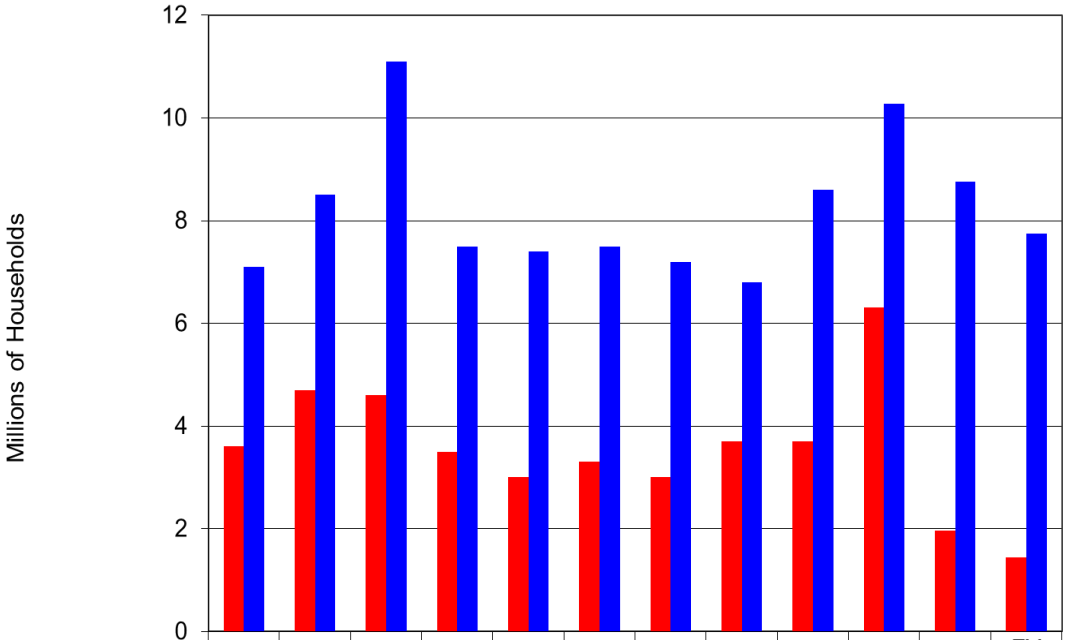
Figure 2-10. Total Fuel Assistance Dollars (in Billions) Needed to Reduce Low Income Household Spending on Home Energy to 5 Percent and 10 Percent of Income, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Reduce to 10%	$1.2	$1.8	$1.9	$1.1	$0.9	$1.1	$0.9	$1.5	$2.2	$3.1	$1.7	$1.3
Reduce to 5%	$2.2	$3.4	$4.6	$2.7	$2.6	$2.8	$2.5	$3.3	$5.5	$5.7	$5.6	$5.1

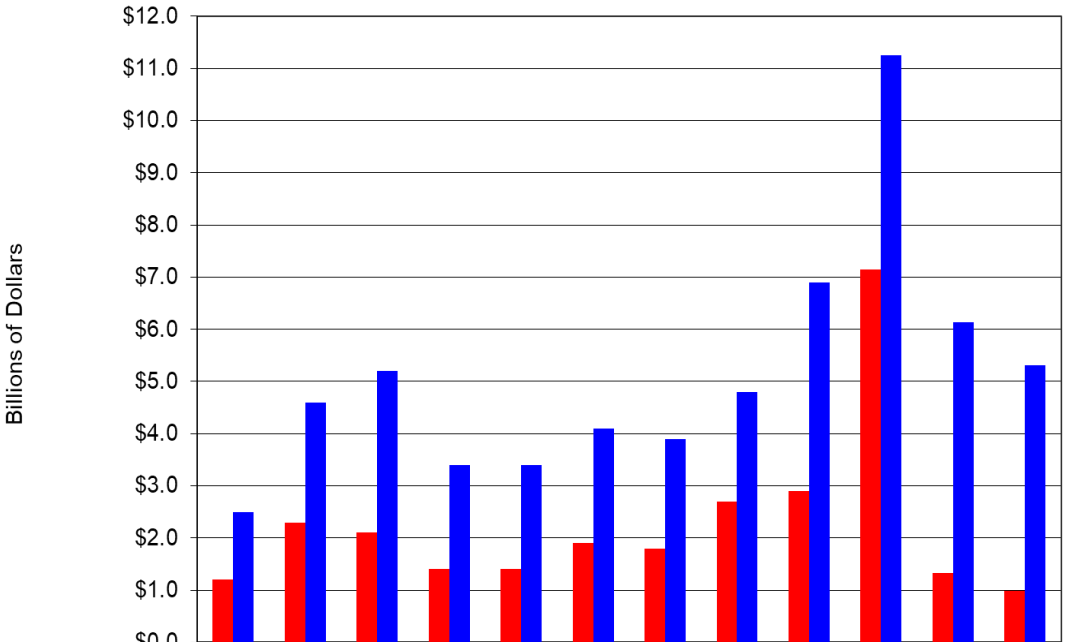
Figure 2-11, on the next page, furnishes estimates on the number of low income households that had residential energy expenditures that exceeded specified levels. Figure 2-12, on the following page, furnishes estimates on total fuel assistance dollars needed to reduce residential energy burden to specified levels. Figure 2-11 shows that the number of low income households spending over 15 and 25 percent of their income on residential energy followed a pattern similar to that observed in Figure 2-8. The largest number of low income households exceeding 15 percent of income spent on residential energy occurred in 1985, followed by 2009 and 2015. The largest number of low income households exceeding 25 percent of income spent on residential energy occurred in 2009, followed by 1981 and 1985. Figure 2-12 demonstrates that the funding assistance required to reduce spending on residential energy by all low income households to the specified percentages reached its highest level in 2009, followed by 2005.

Figure 2-11. Number of Low Income Households (in Millions) Spending over 15 Percent and 25 Percent of Income on Residential Energy, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
More than 25%	3.6	4.7	4.6	3.5	3.0	3.3	3.0	3.7	3.7	6.3	2.0	1.4
More than 15%	7.1	8.5	11.1	7.5	7.4	7.5	7.2	6.8	8.6	10.3	8.8	7.7

Figure 2-12. Total Fuel Assistance Dollars (in Billions) Needed to Reduce Low Income Household Spending on Residential Energy to 15 Percent and 25 Percent of Income, 1979 to FY 2020

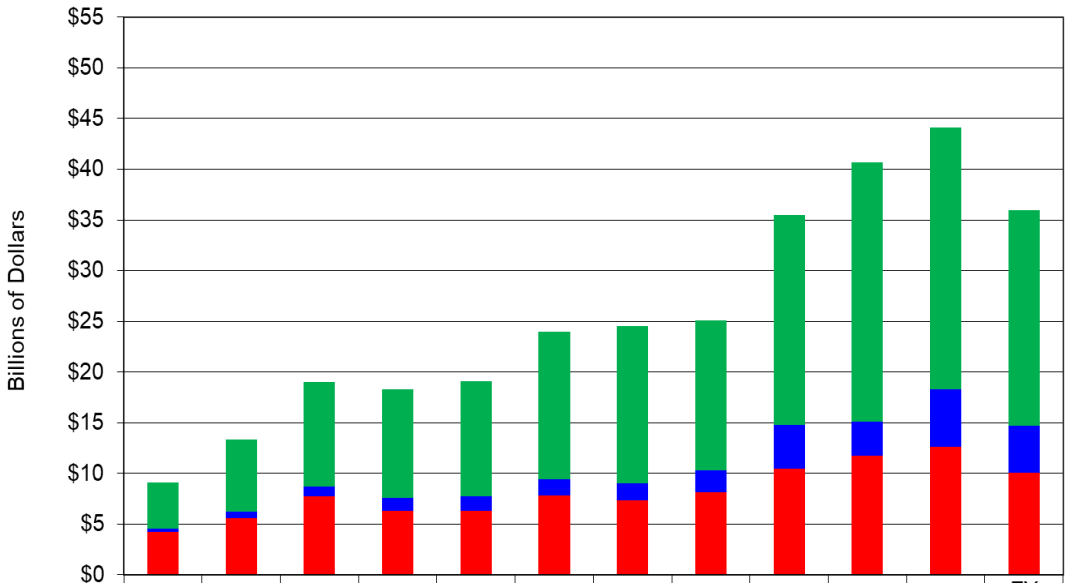


	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Reduce to 25%	$1.2	$2.3	$2.1	$1.4	$1.4	$1.9	$1.8	$2.7	$2.9	$7.1	$1.3	$1.0
Reduce to 15%	$2.5	$4.6	$5.2	$3.4	$3.4	$4.1	$3.9	$4.8	$6.9	$11.3	$6.1	$5.3

Figure 2-13 shows how the aggregated residential energy bill for all low income households has changed from 1979 to FY 2020. In 1979, the aggregated home energy bill (heating costs plus cooling costs) for low income households was $4.5 billion. By FY 2020, the aggregated home energy bill had grown to about $14.8 billion. This growth results from both the increase in average home energy bills and growth in the size of the low income population.

Figure 2-13 also shows that in 1979, home energy costs accounted for about half of the total low income residential energy bill. In FY 2020, home energy costs accounted for about 41 percent of the total low income residential energy bill.

Figure 2-13. Aggregated Residential Energy Expenditures (in Billions of Dollars) by End Use for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020

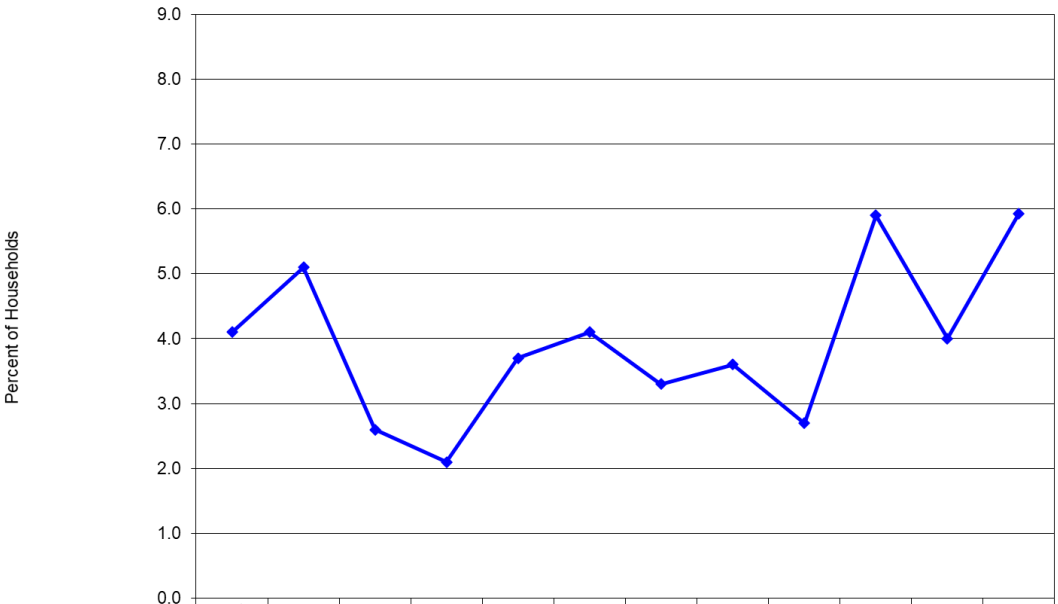


	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Total	$9.1	$13.3	$19.0	$18.3	$19.1	$24.0	$24.5	$25.1	$35.5	$40.7	$44.1	$36.0
Other	$4.6	$7.1	$10.3	$10.7	$11.4	$14.6	$15.5	$14.8	$20.7	$25.7	$25.9	$21.2
Cooling	$0.3	$0.6	$1.0	$1.3	$1.4	$1.6	$1.7	$2.2	$4.3	$3.4	$5.7	$4.7
Heating	$4.2	$5.6	$7.7	$6.3	$6.3	$7.8	$7.3	$8.2	$10.4	$11.7	$12.6	$10.1

Figure 2-14, on the next page, demonstrates the impact of the inability to afford home energy on LIHEAP income eligible households. It shows the number of LIHEAP income eligible households that reported that they were unable to use their main source of heat for a period of two hours or more during the heating season because they were unable to pay for their main heating fuel. In 1981-82, 984 thousand LIHEAP income eligible households (4.1 percent of LIHEAP income eligible households) had heat interruptions during the heating season. The number and percentage grew to 1.33 million (5.1 percent) in 1984-85 and then fell consistently to 547 thousand (2.1 percent) in 1987-1988. In 1989-90 there was a sharp increase to 1.0 million (3.7 percent). This higher level of heat interruptions was sustained in 1990-91 when 1.1 million (4.1 percent) LIHEAP income eligible households had heat interruptions and in 1992-93 when 1.0 million (3.3 percent) LIHEAP income eligible households had heat interruptions. The number and percentage increased to 1.2 million (3.6 percent) in 1996-97. In 2000-01, the number and percentage of LIHEAP income eligible households with heat interruptions decreased to 904 thousand (2.7 percent). The number and percentage increased substantially to 2.1 million (5.9 percent) in 2004-2005. In 2009, 1.4 million (4.0 percent) LIHEAP income eligible households had heat interruptions due to bill payment-

related problems for the household's main heating fuel.[16] In 2015, 2.0 million (5.9 percent) LIHEAP income eligible households had heat interruptions.

Figure 2-14. Percentage of LIHEAP Income Eligible Households with Heat Interruptions of Two Hours or More Caused by an Inability to Pay for Energy to Run the Household's Main Heating System, 1981-82 Heating Season to Calendar Year 2015[i]



	81-82	84-85	86-87	87-88	89-90	90-91	92-93	96-97	00-01	04-05	2009	2015
Rate (%)	4.1	5.1	2.6	2.1	3.7	4.1	3.3	3.6	2.7	5.9	4.0	5.9
Number(000)	984	1,333	678	547	1,001	1,110	1,023	1,223	904	2,097	1,424	1,993

[i] The 2015 RECS collected information on heating interruptions in the previous year, not for the heating season. Data for 2004-2005 heating season and 2015 refer to heat interruptions of any length. Data for the 1981-82 heating season refer to heat interruptions of one day or more. Data for 2015 exclude those households heating with other fuels that were unable to use their heating equipment because the electric company disconnected service for nonpayment and electricity was needed to run the heating equipment. Between 10 and 15 percent of heat interruptions for LIHEAP income eligible households last at least 2 hours but less than 24 hours. The procedures for analyzing heat interruption data have changed since the issuance of the *LIHEAP Report to Congress for FY 1993*. The heat interruption rates for 1984-85 through 1987-88 are slightly higher with this new analysis.

Analysis of Energy Price and Energy Efficiency Trends

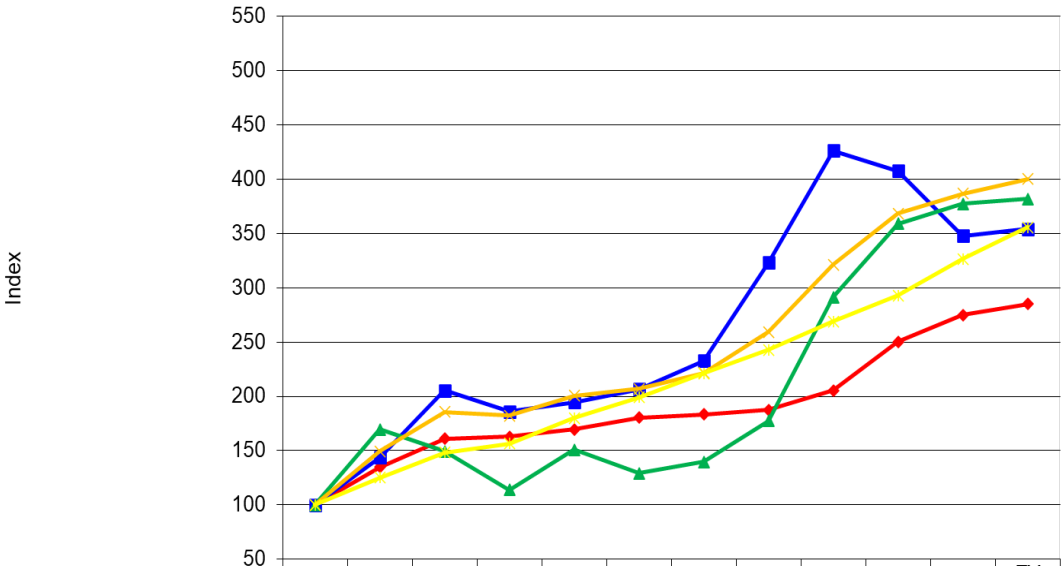
Several factors underlie the energy consumption and expenditures trends. Three of the most important factors are fuel prices, weather, and energy efficiency. Figures 2-15, 2-16, and 2-17 furnish information on trends in these factors.

Figure 2-15, on the next page, furnishes an index of average fuel prices compared to an index of inflation that is based upon the Consumer Price Index (CPI). The fuel price index shows the percentage change from 1979 to FY 2020. For example, the CPI-based inflation index grew from 100 in 1979 to 125 in 1981, indicating a 25 percent increase in consumer prices. Figure 2-15 shows that fuel prices outpaced the overall level of inflation from 1979 through 1985. The CPI increased by 48 percent during that period, while the composite average of fuel prices increased by 86 percent. From 1985 through 1997, the

[16] Data for 2015 exclude those households heating with other fuels that were unable to use their heating equipment because the electric company disconnected service for nonpayment and electricity was needed to run the heating equipment.

increase in the composite average of fuel prices moderated somewhat and generally grew more slowly than did the CPI. However, from 1997 to 2005, the pattern was reversed; the composite average fuel price index grew by over 45 percent while the CPI grew by only 22 percent. The rapid growth of prices from 1979 through 1985 explains why residential energy expenditures per low income household rose so rapidly (Figure 2-4) while consumption was declining (Figure 2-3). The moderate growth in fuel prices from 1985 to 1997 (19 percent) explains why residential energy expenditures per low income household rose slightly during that period. In 2009, fuel prices increased by about 15 percent over 2005 prices. The increase in fuel prices explains why expenditures also rose. In 2015, fuel prices increased by five percent over 2009 prices. In FY 2020, fuel prices again increased slightly, by about three percent, over 2015 prices, once more contributing to an increase in expenditures. For low income households, residential energy expenditures also increased slightly from 2015 to FY 2020 (see Figure 2-4).

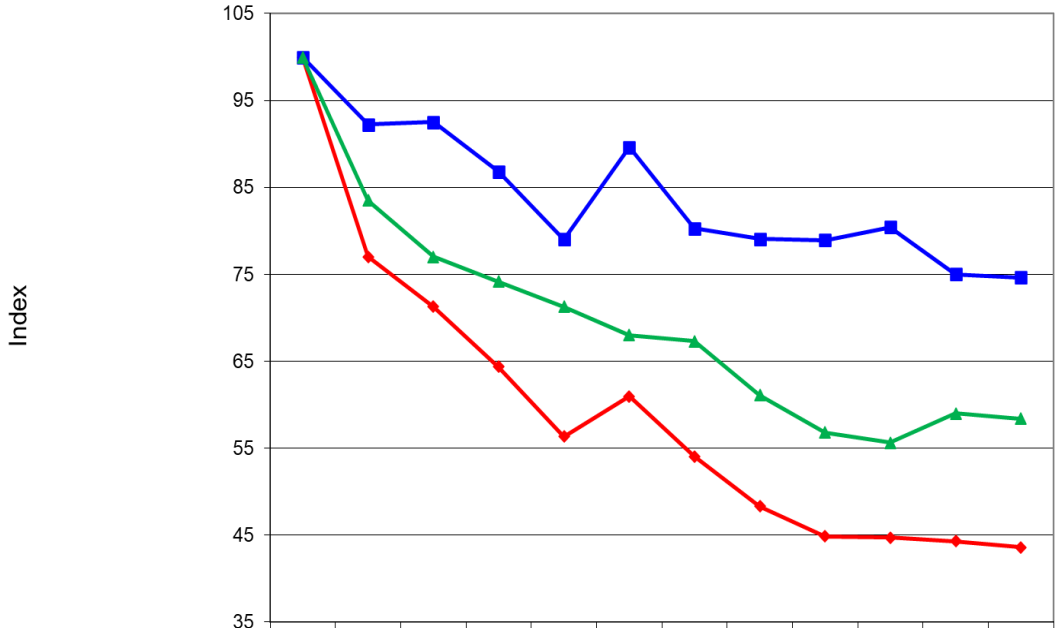
Figure 2-15. Index of Dollar Prices for Fuel Oil, Natural Gas, Electricity, and a Composite Compared to the Consumer Price Index (CPI), 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Electricity	100	135	161	163	170	180	183	187	205	250	275	285
Natural Gas	100	144	205	186	195	207	233	323	426	407	348	354
Fuel Oil	100	170	150	114	151	129	140	178	291	359	377	382
Composite Energy Index	100	150	186	182	201	207	221	259	321	368	387	400
CPI	100	125	148	156	180	199	221	243	269	293	326	355

Figure 2-16 shows the changes in heating energy consumption among low income households from 1979 to FY 2020 compared to changes in heating degree days for the same period. From 1979 to 1985, home heating consumption fell more rapidly than did heating degree days, suggesting a significant increase in efficiency because of conservation measures or actions. Consumption per heating degree day dropped rapidly for that period. From 1985 to 1997, there was a more moderate reduction in consumption per heating degree day. Thus, heating consumption fluctuations appear to be primarily a result of the changes in the weather for those years. From 1997 to 2005, home heating consumption again fell more rapidly than did heating degree days, suggesting a moderate increase in efficiency because of conservation measures or actions. This was perhaps driven by the high fuel prices experienced in 2001 and 2005. From 2005 to 2009, there was a slim reduction in consumption per heating degree day. From 2009 to FY 2020, consumption per heating degree day increased by about four percent.

Figure 2-16. Index of Heating Consumption, Heating Degree Days, and Heating Consumption per Heating Degree Day for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020

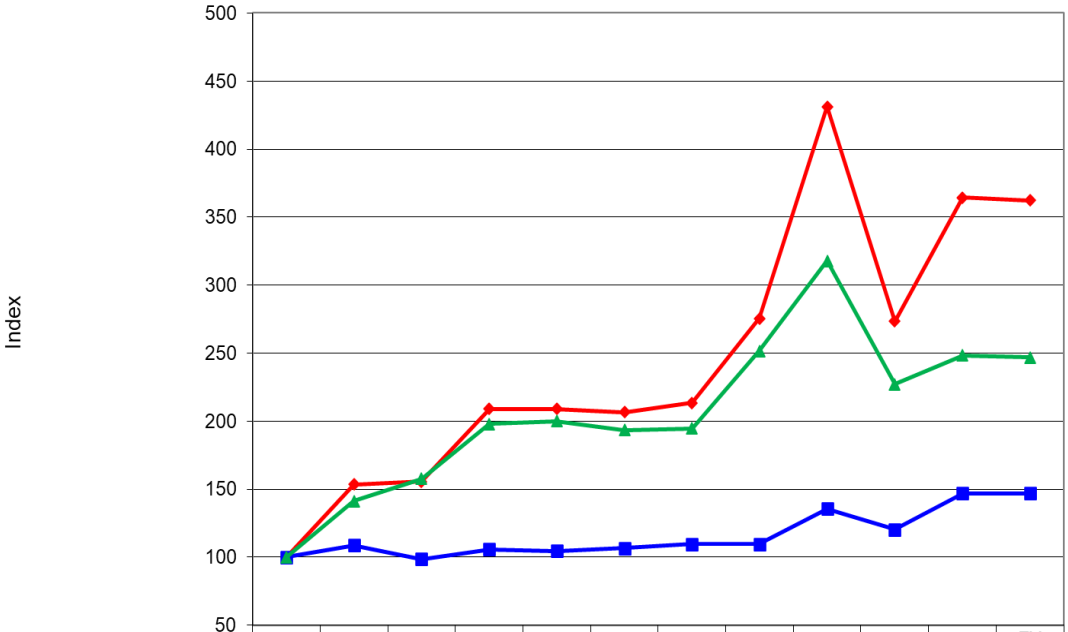


	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Consumption	100	77	71	64	56	61	54	48	45	45	44	44
HDD	100	92	93	87	79	90	80	79	79	80	75	75
Consumption per HDD	100	83	77	74	71	68	67	61	57	56	59	58

Figure 2-17 shows that home cooling consumption trends among low income households are somewhat more complex than are home heating consumption trends. In FY 2020, mean home cooling consumption was much higher than it was in 1979, even though households experienced a relatively smaller increase in cooling degree days. Thus, mean consumption per cooling degree day increased substantially from 1979 to FY 2020, making it appear as though there was a reduction in efficiency. However, the primary cause of the increase in mean home cooling consumption was the large increase in the availability of air-conditioning among low income households.[17] As shown in Figure 2-2, only 37 percent of low income households had air-conditioning in 1979, while in 2015, about 82 percent of low income households had air-conditioning. Because of this fundamental change in the number of households that use air-conditioning, it is very difficult to assess either changes in efficiency from 1979 to FY 2020 or year-to-year changes in consumption in response to changes in cooling degree days.

[17] Air-conditioning equipment includes central air-conditioners and window or wall units, ceiling fans, and evaporative coolers. The availability of all household appliances increased for low income households over this period due to the overall increase in the wealth of the nation and the decrease in the cost of older technologies.

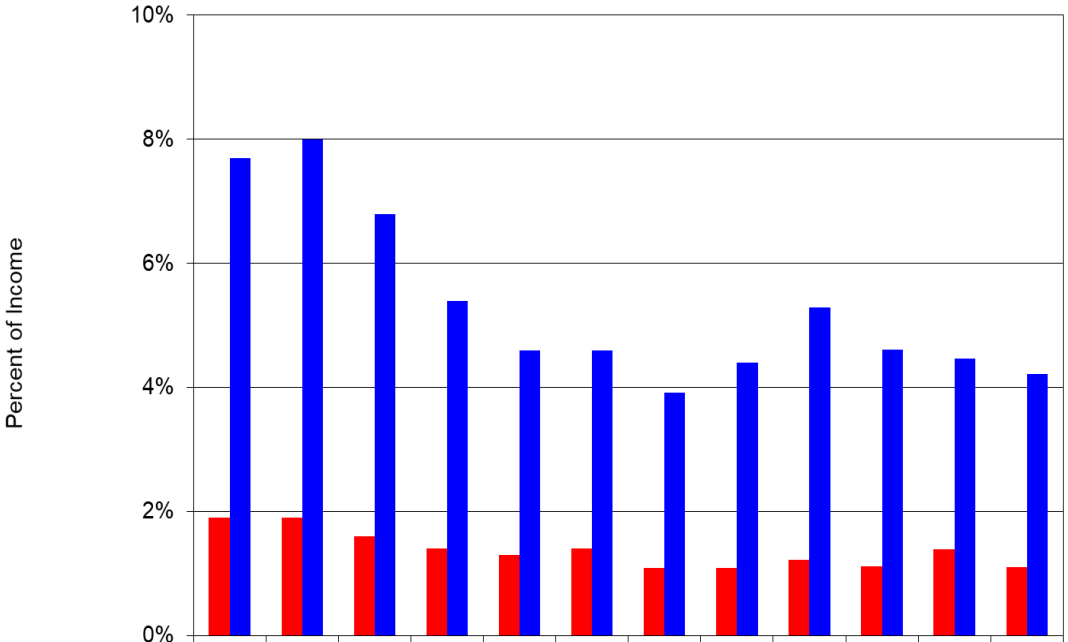
Figure 2-17. Index of Cooling Consumption, Cooling Degree Days, and Cooling Consumption per Cooling Degree Day for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
Consumption	100	153	156	209	209	207	213	276	431	273	364	362
CDD	100	109	99	106	104	107	110	109	136	120	147	147
Consumption per CDD	100	141	158	198	200	194	195	252	318	227	248	247

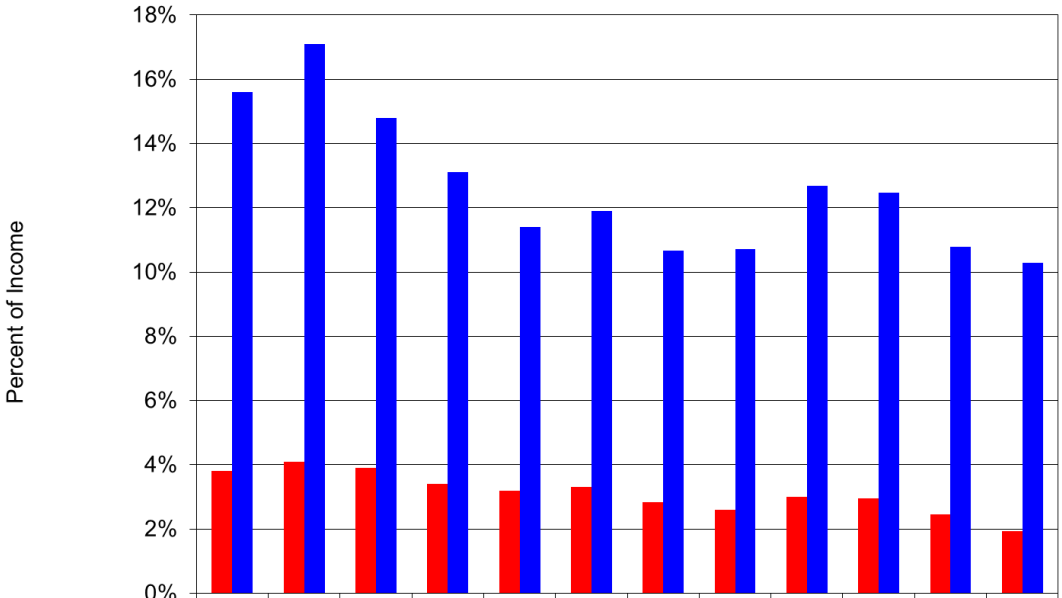
Figures 2-18 and 2-19, on the next page, show that the mean group energy burden for low income households is substantially higher than that for all households. In FY 2020, the mean group home energy burden for all households was 1.1 percent and 4.2 percent for low income households. In FY 2020, the mean group residential burden was 1.9 percent for all households and 10.3 percent for low income households. Over time, the gap between the burden for low income households and all households has fluctuated somewhat. Figure 2-18 shows that in 1979, the mean group home energy burden for low income households was just over four times that of all households, while in 1993, the mean group home energy burden for low income households was about three times that of all households. However, in FY 2020, the mean group home energy burden for low income households was again approaching four times that of all households.

Figure 2-18. Mean Group Home Energy Burden for All Households and for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020



	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
All Households	1.9	1.9	1.6	1.4	1.3	1.4	1.1	1.1	1.2	1.1	1.4	1.1
Low-Income	7.7	8.0	6.8	5.4	4.6	4.6	3.9	4.4	5.3	4.6	4.5	4.2

Figure 2-19. Mean Group Residential Energy Burden for All Households and for Households with Incomes at or Below 150 Percent of HHS Poverty Guidelines, 1979 to FY 2020

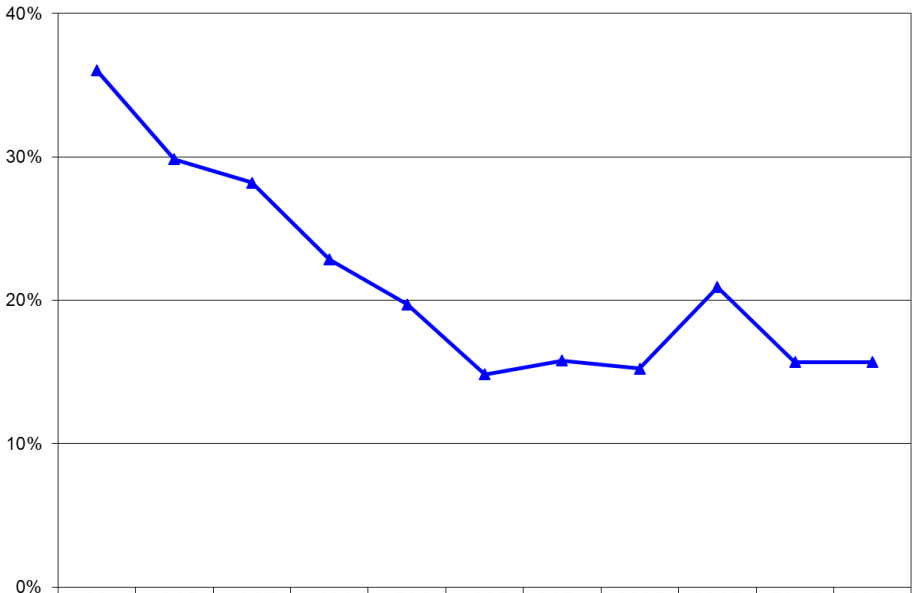


	1979	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	FY 2020
All Households	3.8	4.1	3.9	3.4	3.2	3.3	2.8	2.6	3.0	3.0	2.5	1.9
Low-Income	15.6	17.1	14.8	13.1	11.4	11.9	10.7	10.7	12.7	12.5	10.8	10.3

Trends in LIHEAP

Figures 2-20 through 2-24 furnish information on trends for HHS's energy assistance programs from FY 1981 through FY 2020.[18] Figure 2-20 shows that the percentage of LIHEAP income eligible households that have received heating and/or winter crisis assistance. In FY 1981, about 36 percent of eligible households received heating and/or winter crisis assistance benefits; this number fell steadily until 1997, when about 15 percent of LIHEAP income eligible households received heating and/or winter crisis benefits. Since 1997, the share of LIHEAP income eligible households receiving heating and/or winter crisis benefits has remained steady at about 15-16 percent, with an exception in FY 2009, when the share increased to about 21 percent. In FY 2020, about 16 percent of LIHEAP income eligible households received heating and/or winter crisis benefits.

Figure 2-20. Percentage of LIEAP/LIHEAP Federally Income Eligible Households Receiving LIEAP/LIHEAP Heating and/or Winter Crisis Assistance, FY 1981 to FY 2020



	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Recipients (mil)	7.1	6.8	6.8	5.8	5.6	4.3	4.8	5.3	7.3	6.0	5.2
Eligibles (mil)	19.7	22.8	24.1	25.4	28.4	29.0	30.4	34.8	35.0	38.2	33.3
Rate (%)	36%	30%	28%	23%	20%	15%	16%	15%	21%	16%	16%

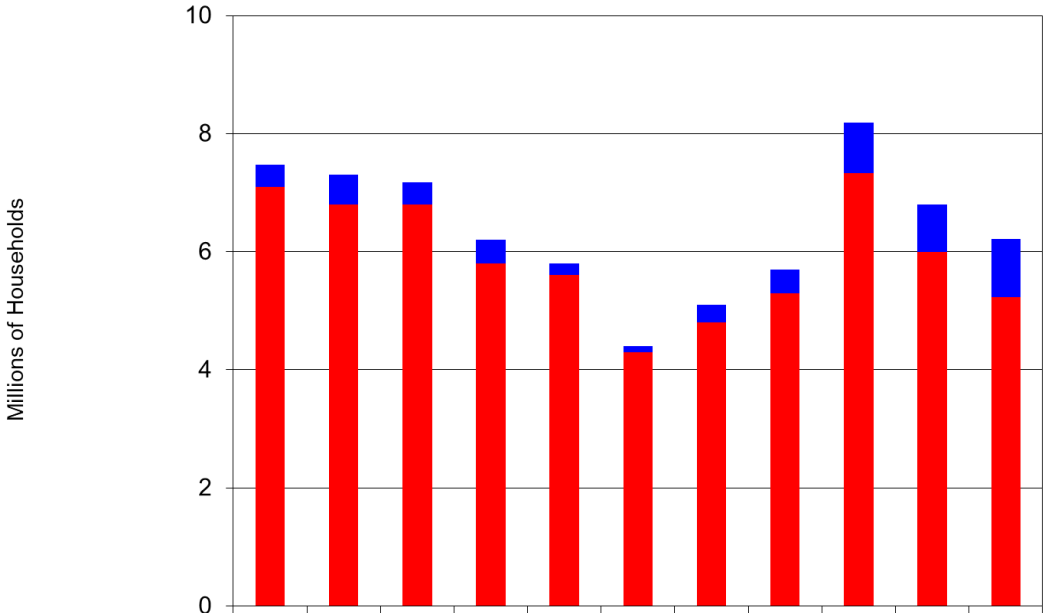
SOURCE: HHS Administrative Data — such data for FY 2020 are preliminary; thus, the actual figures may differ.
NOTE: The FY 1981 estimate of income eligible households is not directly comparable to those of the other years because the income eligibility guidelines for the FY 1981 program differed from those of other years.

Figure 2-21 furnishes statistics on the count of beneficiaries by benefit type. In FY 1981, approximately 7.1 million households received heating and/or winter crisis assistance. The number of households receiving assistance with their heating costs decreased from FY 1981 to FY 1997 before increasing and (for the years shown) peaking at 7.3 million households in FY 2009. In FY 2020, approximately 5.2 million households received heating and/or winter crisis assistance. In FY 1981, approximately 0.4 million households received cooling and/or summer crisis assistance. This number remained relatively

[18] Note that the federal income eligibility guidelines for the FY 1981 Low Income Energy Assistance Program (LIEAP) were different from the LIHEAP programs in other years included in the table. The federal income eligibility guidelines for the FY 1981 LIEAP program were based on the Lower Living Standard of the Bureau of Labor Statistics, whereas the federal income eligibility guidelines for the other years included in the table are based on the HHS Poverty Guidelines and state median income estimates.

low (0.5 million or less) until FY 2009. The number of households receiving cooling and/or summer crisis assistance peaked (for the years shown) in FY 2020 at 1.0 million.

Figure 2-21. Number of Households Receiving LIEAP/LIHEAP Heating and/or Winter Crisis Assistance or Cooling and/or Summer Crisis Assistance, FY 1981 to FY 2020

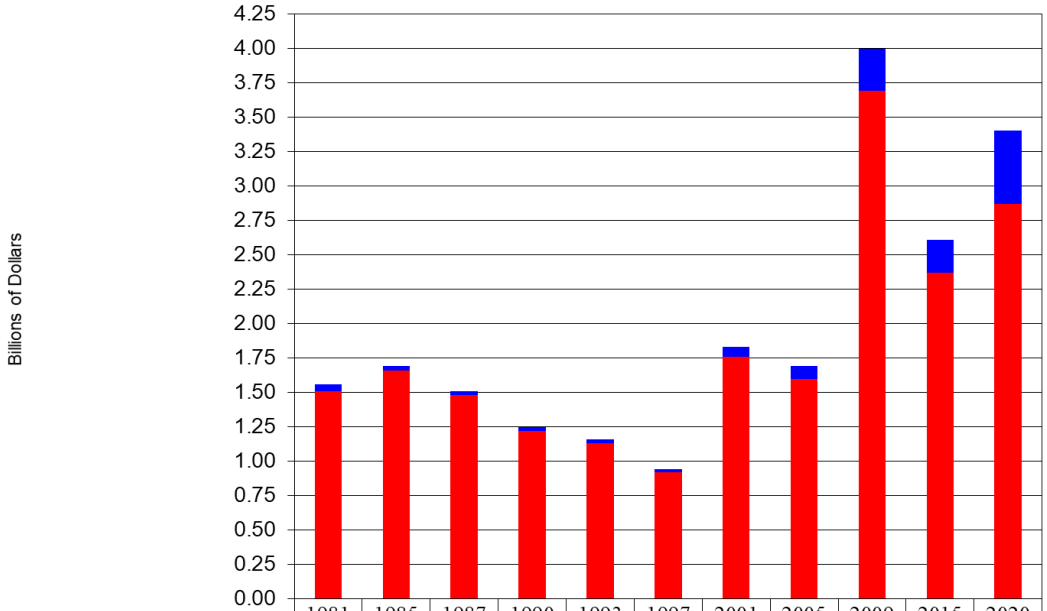


	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Cooling/Crisis	0.4	0.5	0.4	0.4	0.2	0.1	0.3	0.4	0.9	0.8	1.0
Heating/Crisis	7.1	6.8	6.8	5.8	5.6	4.3	4.8	5.3	7.3	6.0	5.2

NOTE: Cooling assistance/summer crisis figures cannot be added to heating assistance/winter crisis figures to generate total assistance + crisis figures for each year because households can receive more than one type of assistance.
SOURCE: HHS Administrative Data – such data for FY 2020 are preliminary; thus, the actual figures may differ.

Figure 2-22, on the following page, shows that the total funds used for fuel assistance benefits have fluctuated over time. For the years shown, funding was highest in FY 2009, when $4.0 billion were used for heating and cooling assistance benefits, and lowest in FY 1997, when $0.94 billion were used for assistance benefits. About $3.40 billion were used for heating and cooling assistance benefits in FY 2020.

Figure 2-22. Funds Used for LIEAP/LIHEAP Fuel Assistance, FY 1981 to FY 2020

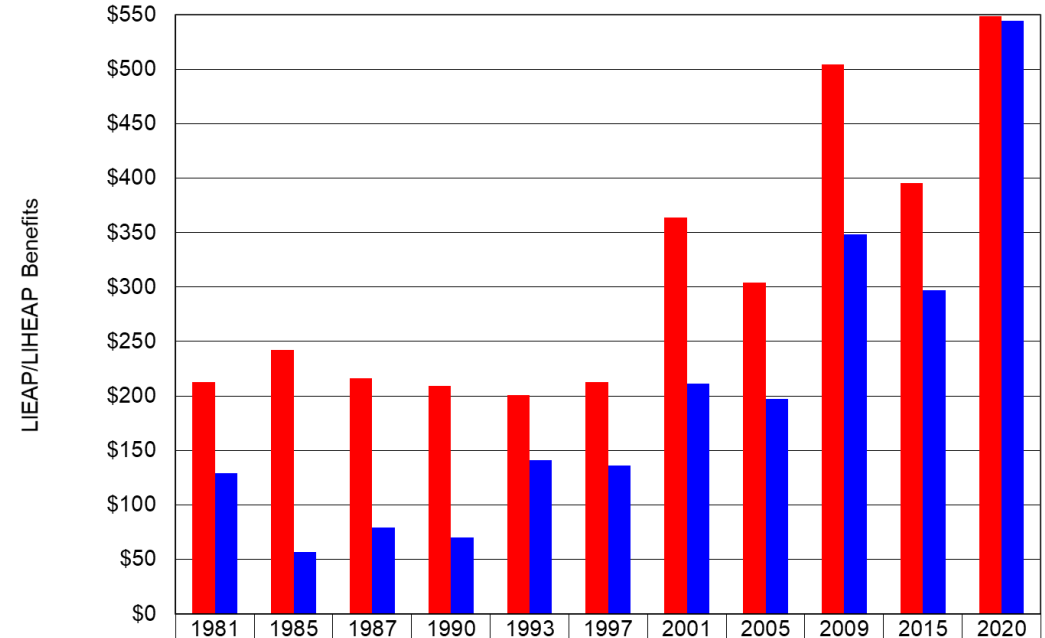


	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Total Fuel Assistance	$1.56	$1.69	$1.51	$1.25	$1.16	$0.94	$1.83	$1.69	$4.00	$2.61	$3.40
Cooling/Crisis	$0.05	$0.03	$0.03	$0.03	$0.03	$0.02	$0.07	$0.09	$0.30	$0.24	$0.54
Heating/Crisis	$1.51	$1.66	$1.48	$1.22	$1.13	$0.92	$1.76	$1.60	$3.69	$2.37	$2.87

SOURCE: HHS Administrative Data — such data for FY 2020 are preliminary; thus, the actual figures may differ.

Figure 2-23 on the following page shows that, for the years shown, mean heating/winter crisis benefits were $213 in FY 1981, grew to $242 in FY 1985, fell back to $213 in 1997, rose to $364 in FY 2001, dropped to $304 in FY 2005, rose substantially to a peak of $504 in FY 2009, then decreased to $396 in 2015. In FY 2020, mean heating/winter crisis benefits rose to $549. Figure 2-24 shows that, after adjusting for inflation, the mean value of benefits has fallen substantially, with a fluctuating resurgence beginning in FY 2001. The mean value of heating and/or winter crisis benefits, in 1981 dollars, fell from $213 in FY 1981 to $140 in FY 2005 but increased substantially to $211 in FY 2009. In FY 2015, the mean value of heating benefits, in 1981 dollars, decreased to $149, but it then rose to $189 in FY 2020. Except for FY 1981, mean cooling benefits, in 1981 dollars, ranged from $49 to $90 through FY 1997, then rose to $107 in FY 2001 before falling to $91 in FY 2005. In FY 2009, mean cooling benefits, in 1981 dollars, increased substantially to $146, decreased to $112 in FY 2015 but saw a considerable increase to $188 in FY 2020. In FY 1993, one state made program changes that significantly increased the mean benefit and decreased the total number of beneficiaries.

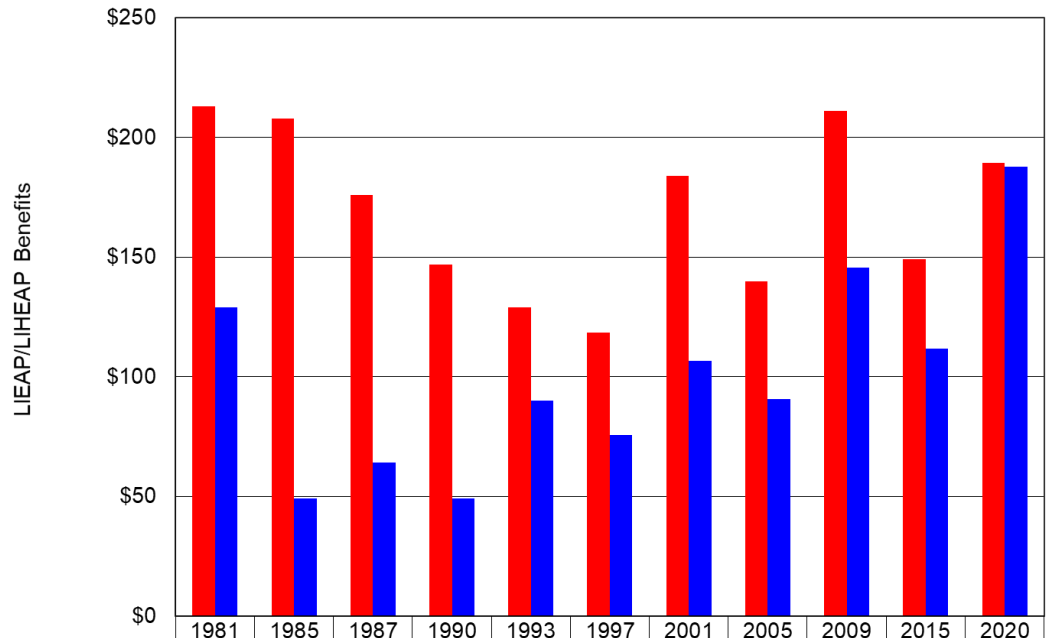
Figure 2-23. Mean Combined LIEAP/LIHEAP Heating and/or Winter Crisis Benefits and Mean Cooling and/or Summer Crisis Benefits, in Nominal Dollars, FY 1981 to FY 2020



	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Heating/Crisis	$213	$242	$216	$209	$201	$213	$364	$304	$504	$396	$549
Cooling /Crisis	$129	$57	$79	$70	$141	$136	$211	$197	$348	$297	$544

SOURCE: HHS Administrative Data — such data for FY 2020 are preliminary; thus, the actual figures may differ.

Figure 2-24. Mean Combined LIEAP/LIHEAP Heating and/or Winter Crisis Benefits and Mean Cooling Benefits, in Real 1981 Dollars, FY 1981 to FY 2020



	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Heating/Crisis	$213	$208	$176	$147	$129	$118	$184	$140	$211	$149	$189
Cooling /Crisis	$129	$49	$64	$49	$90	$76	$107	$91	$146	$112	$188

SOURCE: HHS Administrative Data — such data for FY 2020 are preliminary; thus, the actual figures may differ.

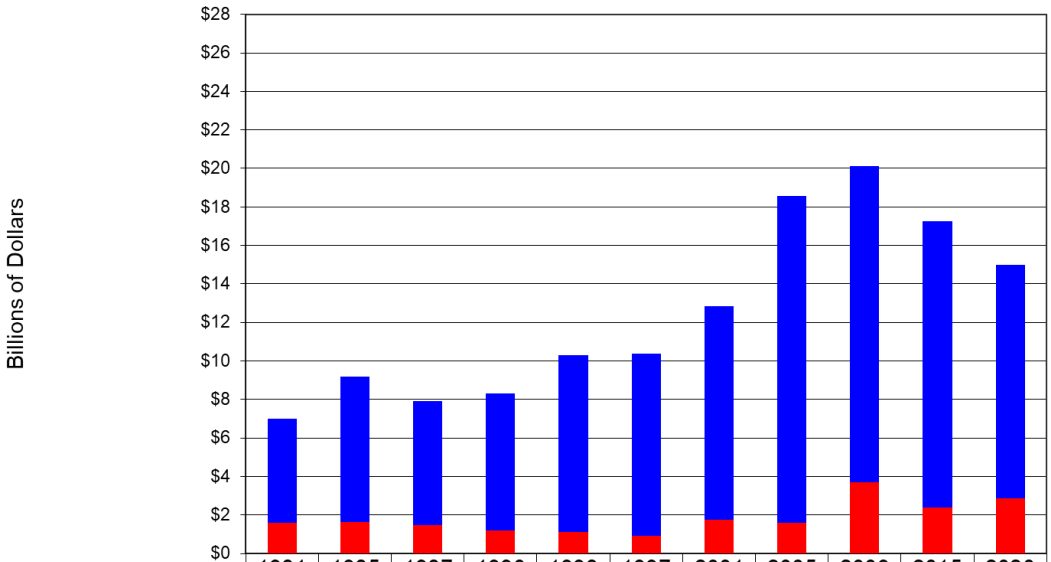
Analysis of LIHEAP benefits

The impact of LIHEAP heating benefits can be examined in at least two ways. Figure 2-25, on the next page, shows the share of the aggregated total of low income home heating costs covered by LIHEAP heating and winter crisis benefits (LIHEAP heating coverage). Figure 2-26, on the following page, shows the reduction in mean group home heating burden because of LIHEAP benefits (LIHEAP burden offset).

Figure 2-25 shows that the LIHEAP heating coverage rate fell from 23 percent in FY 1981 to 19 percent in FY 2020. The decrease in the LIHEAP heating coverage rate is the result of an increase in the size of the heating bill and an increase in the number of households that were income eligible for assistance benefits in FY 2020.

Figure 2-26 shows that the net effect of LIHEAP has been to lower beneficiaries' group home heating burden to levels that are much closer to the levels of the average household. In FY 1981, the gross mean group home heating burden for LIEAP beneficiary households was 8.5 percent, while the net mean group home heating burden (with home heating expenditures taken after deducting LIHEAP benefits) was 2.9 percent. In FY 2020, the gross mean group home heating burden for LIHEAP beneficiaries was 3.4 percent, while the net mean group home heating burden was 0.5 percent. It is interesting to note that, while the gross mean group home heating burden for LIHEAP beneficiaries fell from 8.5 percent in FY 1981 to 4.0 percent in FY 1997, decreases in mean LIHEAP benefits in relation to household income caused the net mean group home heating burden to range between one to two times as high as the gross mean group home heating burden for all households except for FY 2005 when that ratio was more than 3-to-1. In FY 2001, significant increases in the mean heating benefit caused the net mean group home heating burden for LIHEAP beneficiaries to fall to 1.7 percent, however it remained twice as high as the mean group burden for all households. In FY 2005, the mean heating benefit decreased by 16 percent, and net mean group home heating burden almost doubled, increasing by 94 percent. The changes in net mean group heating burden resulted from the combination of a decrease in the mean heating benefit and much higher fuel prices in FY 2005. In FY 2009, the net mean group home heating burden for LIHEAP beneficiaries decreased to 1.4 percent and remained at 1.4 in FY 2015. However, in FY 2020, the net mean group home heating burden for LIHEAP beneficiaries decreased to 0.5 percent, the same as the gross mean group home heating burden for all households. This is because the main heating benefit increased because of increased funding, including the supplemental funds provided by the Coronavirus Aid, Relief, and Economic Security (CARES) Act.

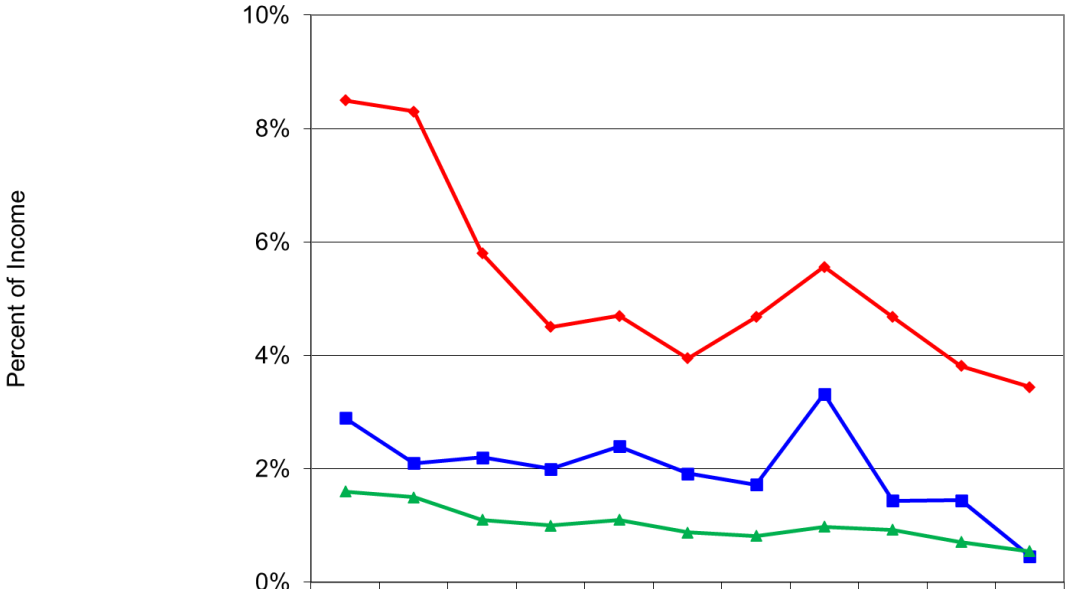
Figure 2-25. Amount and Percentage of Total Home Heating Billed Amounts for LIEAP/LIHEAP Income Eligible Households Covered by LIEAP/LIHEAP Heating and Winter Crisis Benefits, FY 1981 to FY 2020



	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Percent Covered	23%	18%	19%	15%	11%	9%	14%	9%	18%	14%	19%
Total Bill	$7.0	$9.2	$7.9	$8.3	$10.3	$10.4	$12.8	$18.6	$20.1	$17.3	$15.0
Not Assisted	$5.4	$7.6	$6.4	$7.1	$9.2	$9.5	$11.1	$17.0	$16.4	$14.9	$12.1
Assisted	$1.6	$1.6	$1.5	$1.2	$1.1	$0.9	$1.7	$1.6	$3.7	$2.4	$2.9

SOURCE: Assistance number from HHS data and heating bill estimates from RECS — HHS data for FY 2020 are preliminary; thus, the actual figures may differ.
NOTE: The FY 1981 estimate of income eligible households is not directly comparable to those of the other years because the income eligibility guidelines for the FY 1981 program differed from those of other years.

Figure 2-26. Mean Group Home Heating Burden for All Households and LIEAP/LIHEAP Heating and Winter Crisis Beneficiary Households, FY 1981 to FY 2020



	1981	1985	1987	1990	1993	1997	2001	2005	2009	2015	2020
Gross (Recipients)	8.5%	8.3%	5.8%	4.5%	4.7%	4.0%	4.7%	5.6%	4.7%	3.8%	3.4%
Net (Recipients)	2.9%	2.1%	2.2%	2.0%	2.4%	1.9%	1.7%	3.3%	1.4%	1.4%	0.5%
Gross (All Households)	1.6%	1.5%	1.1%	1.0%	1.1%	0.9%	0.8%	1.0%	0.9%	0.7%	0.5%

SOURCE: Mean burden uses heating expenditures from RECS and income from CPS ASEC.
Net Burden = (Mean Expenditures - Mean Benefit) / Mean Income

Appendix A: Home Energy Estimates

Appendix A provides information on how estimates of home energy data were derived from the 2015 Residential Energy Consumption Survey (RECS) and updated for FY 2020. The following topics are covered in this Appendix:

- Description of RECS
- Strengths and limitations of RECS data
- Energy burden

Description of RECS

The RECS is a national household sample survey that provides information on residential energy use. It has been conducted by the Energy Information Administration (EIA) of the U.S. Department of Energy (DOE) since 1978. It is designed to provide reliable data at the national and Census regional levels. The RECS includes information on energy consumption and expenditures, household demographics, housing characteristics, weatherization/conservation practices, home appliances, and type of heating and cooling equipment. Currently, this survey is conducted every four to six years.

The survey consists of three parts:

- EIA interviews households for information about which fuels are used, how fuels are used, energy-using appliances, structural features, energy-efficiency measures taken, demographic characteristics of the household, heating interruptions, and receipt of energy assistance.
- EIA interviews rental agents for households whose rent includes some portion of their energy bill. This information augments information from those households that may not be knowledgeable about the fuels used for space heating or water heating.
- After obtaining permission from respondents, EIA mails questionnaires to their energy suppliers to collect the actual billing data on energy consumption and expenditures. This fuel supplier survey eliminates the inaccuracy of self-reported data. When a household does not consent or when fuel consumption records are unusable or nonexistent, regression analysis is used to impute missing data.[19]

The 2015 RECS is the fourteenth survey in the series of surveys.[20] For the 2015 RECS, 5,686 households were interviewed, including 321 verified LIHEAP beneficiary households. For the figures in this report, 2015 RECS consumption and expenditure data were updated using price and weather data to represent consumption and expenditures for FY 2020.

Strengths and Limitations of RECS Data

The RECS provides the most recent, comprehensive data on home energy consumption and expenditures. The strengths of using RECS to derive home energy estimates are as follows:

[19] Regression analysis is a statistical tool for evaluating the relationship of one or more independent variables to a single continuous dependent variable. Formulas developed from regression analysis are used to predict the value of the dependent variable under varying conditions of the independent variable(s).
[20] For more information about the RECS sample design, see EIA's RECS webpage: https://www.eia.gov/consumption/residential/about.php

- RECS uses a representative national household sample, providing statistically reliable estimates for all, non-low income, and low income households.
- The RECS includes usage data for all residential fuels. [In the 2015 RECS, heating fuel categories for fuel oil and kerosene were combined, whereas in the 2009 RECS, these heating fuel categories were presented separately.]
- Energy suppliers provide information on actual residential energy consumption and expenditures of RECS sample households to eliminate the inaccuracy of self-reported data.
- Regression analyses of RECS data provide estimates of the amounts of fuels going to various end uses, including home heating and cooling.

While the updated 2015 RECS data provide the most current and comprehensive data on residential energy use by low income households, several significant limitations must be addressed:[21]

- The 2015 RECS data for calendar year 2015 were updated to FY 2020 (October 1, 2019 to September 30, 2020), using procedures that adjust the 2015 data to reflect the weather and fuel prices for FY 2020. These procedures are comparable to those used for the FY 1986 – FY 2019 annual *LIHEAP Reports to Congress*. However, the reader should exercise caution in comparing the data in this report with data in annual *LIHEAP Reports to Congress* prior to FY 1986, in which consumption and expenditure data were estimated from the RECS year (April 1 to March 31).
- EIA introduced significant methodological changes in the 2015 RECS, including changes to end-use modeling procedures, particularly for electricity usage, and changes to the income categories used to collect income information from respondents. The less detailed income information that was collected compared to prior iterations of the RECS makes it difficult to accurately characterize which households are low income versus which households are not. Therefore, readers should use caution when comparing this report to prior versions, which utilized prior iterations of the RECS.
- For some variables, disaggregation of data into subgroups at the regional level results in estimates made from a small number of sample cases. This is particularly true of the LIHEAP beneficiary households and the fuel oil/kerosene and liquefied petroleum gas and kerosene heating subgroups. This affects the reliability of the estimates.
- The household is a basic reporting unit for RECS and LIHEAP. RECS defines a household as all individuals living in a housing unit, whether related or not, who (1) share a common direct access entry to the unit from outside the building or from a hallway, and (2) do not normally eat their meals with members of other units in the building. A household does not include temporary visitors or household members away at college or in the military. LIHEAP defines a household as one or more individuals living together as an economic unit who purchase energy in common or make undesignated payments for energy in their rent. Some variation in the count of households, particularly those containing renters or boarders, may result from the difference in definitions.
- The Current Population Survey Annual Social and Economic Supplement (CPS ASEC), conducted by the Bureau of the Census, provides, at national and regional levels, data on total household income as a specific dollar amount. CPS's larger sample size and method of collecting income data result in more accurate income data than RECS income data. Therefore, the 2020

[21] Information about the quality of RECS data is available from the EIA website: *RECS Methodology*, Energy Information Administration.

CPS ASEC is used to develop estimates of the number of low income households. In addition, mean income statistics from the CPS ASEC are used in the calculation of group energy burden for this report.[22]

- Because income information was collected in less detail in the 2015 RECS, households were classified in the 2015 RECS as eligible or ineligible for LIHEAP based on whether their income was above or below the approximate. This differs from prior versions of this report based on the 2009 RECS, where the income information that was collected was sufficient to classify households as eligible or ineligible for LIHEAP based on the federal maximum statutory income eligibility criteria (the greater of 150 percent of U.S. Department of Health and Human Services (HHS) Poverty Guidelines or 60 percent of the state median income). The change in the income categories in the 2015 RECS likely results in an undercounting of LIHEAP income eligible households; therefore, households identified as LIHEAP beneficiaries in the 2015 RECS, but not classified as income eligible based on their income category, were reclassified as income eligible for LIHEAP based on having received LIHEAP assistance during the time period of the 2015 RECS.

- As with prior versions of this report, the estimates of households classified as income eligible for LIHEAP do not include households whose incomes may have exceeded the statutory income standards but who would be eligible to receive LIHEAP benefits because they (1) were categorically eligible for LIHEAP under Section 2605 (b)(2)(A) of the LIHEAP Act, 42 U.S.C. § 8624(b)(2)(A); (2) became income ineligible for LIHEAP at the time of the survey; or (3) were deemed eligible for LIHEAP based on incorrectly reported income. However, the tabulations of LIHEAP households also include survey respondents who were identified as LIHEAP beneficiaries from state LIHEAP administrative data but who reported incomes higher than the maximum statutory income in the RECS survey.

Average Home Energy Consumption and Expenditures

Average heating and cooling consumption and expenditure estimates for FY 2020 were calculated at the national level for low income households (defined in this report as households with income at or below 150 percent of poverty guidelines) of LIHEAP beneficiary households verified in the 2015 RECS. The heating and cooling estimates were updated for each 2015 RECS sample case using FY 2020 heating degree days, cooling degree days, and price inflators applied to the original expenditure data, as well as the multiple regression formula developed from the 2015 RECS. Home energy consumption and expenditure data were developed by aggregating and averaging home heating and cooling estimates for the sample cases that represented low income households and LIHEAP beneficiary households.

Energy Burden

Energy burden is an important statistic for policymakers who are considering the need for energy assistance. Energy burden can be defined broadly as the burden placed on household incomes by the cost of residential energy. However, there are different ways to compute energy burden and different interpretations of the energy burden statistics. The purpose of this section is to examine alternative energy burden statistics and discuss the interpretation of each.[23]

[22] Note that household-level energy and income data from RECS are used to calculate mean and median individual energy burden.

[23] More detailed information is available in the Division of Energy Assistance's (DEA's) technical report, *Characterizing the Impact of Energy Expenditures on Low Income Households: An Analysis of Alternative Energy Burden Statistics,* (November 1994).

Different "measures of central tendency" can be used to describe energy burden. The most used measures are the mean and the median. As previously noted, the mean or average is computed as the sum of all values divided by the number of values. The median is computed as the value that is at the center of the distribution of values (i.e., 50 percent of the values are greater than the median and 50 percent are less).

Computational Procedures

There are two ways to compute mean energy burden for households.[24] The first is the "mean individual" approach, and the second is the "mean group" approach. While these approaches appear to be similar, they give quite different values.

Using the "mean individual burden" approach, energy burden is computed as follows:

1. First, the ratio of energy expenditures to annual income for each household in a specified population is computed.

2. Then, the mean of these energy burden ratios is computed for the population.[25] For example, consider the situation where there are four households with energy burdens of 4, 5, 7, and 8 percent.

3. The mean of these energy burdens is calculated by adding the percentages (24 percentage points) and dividing by the number of households (four households), resulting in a mean individual burden of 6 percent.

Using the "mean group burden" approach, energy burden is computed as follows:

1. First, total annual energy expenditures for households and total annual income for households in a specified population are computed.

2. Then, the ratio of total energy expenditures to total income is computed for the specified population. For example, consider the situation where a group consists of four households that have a total income of $100,000 and a total energy bill of $4,000.

3. Dividing the $4,000 in total energy bills by $100,000 in total income results in a mean group burden of 4 percent.

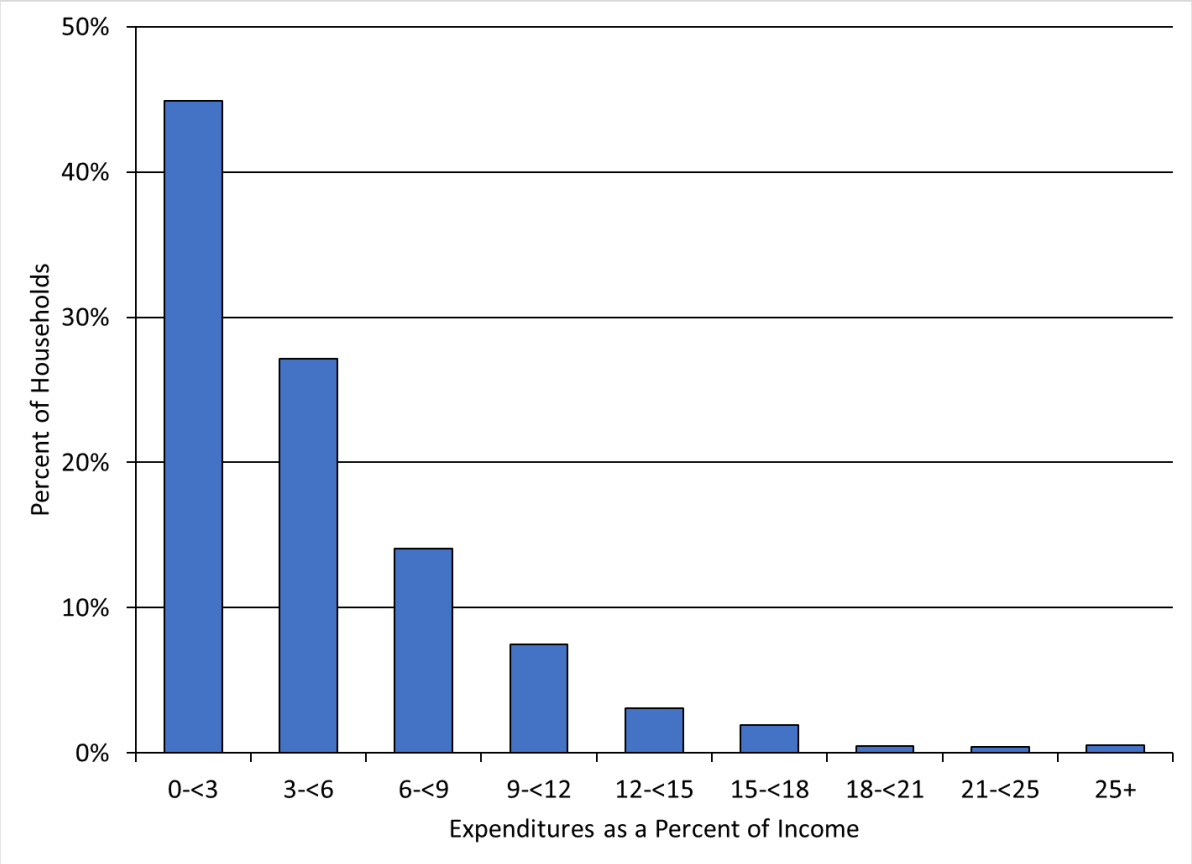
According to the 2015 RECS, the mean residential energy burden for all LIHEAP federally eligible households, in 2015, using the first approach (mean individual burden) was 11.6 percent. Using the energy bill estimates from the 2015 RECS and income estimates from the 2015 CPS ASEC, the mean residential energy burden under the second approach (mean group burden) was 8.4 percent. The disparity between the two statistics is because the lowest income households spend a greater share of their income on residential energy than do higher income households.[26] If the relationship between income and residential energy expenditures is linear (i.e., a 10 percent increase in income is associated with a 10 percent increase in residential energy expenditures), the two statistics would be equal. However, since several low income households spend a large share of their income on energy, the relationship between income and residential energy expenditures is not linear (i.e., a 10 percent increase in income is

[24] The mean is the sum of all values divided by the number of values. The mean is also referred to as the average.
[25] For some households, residential energy expenditures appear to exceed income. Older adult households living on their savings are an example of such households. In calculating mean individual burden, the energy burden figures for such households have been limited to 100 percent.
[26] For example, 2015 RECS households with incomes of $20,000 or less had average residential energy expenditures of $1,423, while those with incomes between $40,000 and $59,999 had average residential energy expenditures of $1,781. Thus, households which had more than twice as much income spent only 25 percent more on energy.

associated with a considerably smaller increase in energy expenditures). Therefore, there is a difference between the two statistics.

In the discussion of computational procedures, the "mean individual burden" was examined. It is also possible to look at the "median individual burden." As noted above for LIHEAP income eligible households, the mean residential energy burden computed as the "mean individual burden" was 11.6 percent. The median of the distribution of residential energy burdens from the 2015 RECS survey was 9.7 percent. The disparity between these two statistics is the result of the skewed distribution of energy burden ratios. Figure A-1 demonstrates a skewed distribution of LIHEAP income eligible households by home energy (heating and cooling) burden.

Figure A-1. Distribution of LIHEAP Income Eligible Households by Home Energy Burden, 2015



Data Files

The data files used to make estimates of energy burden also have some impact on the statistic. The RECS data file is the only reliable source of national information on energy expenditures. However, the income reported on the RECS is known to be deficient in several ways. First, it is generally true that income is underreported on household surveys. Second, the RECS collects income data less precisely through the use of income intervals. Finally, the CPS ASEC collects income more precisely by asking a series of detailed questions on income than the RECS does and also has a larger sample size than the RECS.

Historically, the income collection procedures in the RECS has resulted in categorizing more households as income eligible for LIHEAP than the CPS ASEC. However, given the limitations with how the income information was collected in the 2015 RECS, the procedures to classify households in the 2015 RECS as income eligible for LIHEAP result in too few households being categorized as low income.

Based on the 2015 RECS, 33.5 million households were estimated to be LIHEAP income eligible households in 2015. Based on the 2015 CPS ASEC, the estimate of LIHEAP income eligible households for 2015 was 38.3 million households.

Data Interpretations

The statistic used to describe energy burden depends on the question being asked. Each statistic offers some data on energy burden while not telling the whole story by itself.

The key difference between "mean individual burden" and "mean group burden" is that the first statistic focuses on the experience of individual households and the second on the experience of a group of households. The "mean individual burden" furnishes more information on how individual households are affected by energy burden (i.e., it computes a mean by using each household's burden). The "mean group burden" furnishes more information on group burden (i.e., it computes the share of all income earned by LIHEAP income eligible households that goes to pay for energy). Both statistics are useful, though the individual burden statistic puts more emphasis on the experience of individual households, and the group burden puts more emphasis on the share of group income that is used for energy.

The key difference between the "mean individual burden" and the "median individual burden" is that the first statistic furnishes information on all LIHEAP income eligible households at the expense of overstating what is happening to the "average" LIHEAP income eligible household. The second statistic furnishes information on the "average" LIHEAP income eligible household at the expense of disregarding what is happening to households at either end of the distribution.

The best way to furnish information on energy burden is to use all available statistics. For example, it would be informative to show the "mean individual burden," the "median individual burden," and the "distribution of individual energy burdens," for all LIHEAP income eligible households, to indicate how individual households are affected by energy costs. In addition, it would be useful to show the "mean group burden" to indicate what share of income is going to pay energy bills for the group as a whole.

However, when doing an analysis of energy burden among several groups of households, it is very difficult to present the entire spectrum of available statistics. Thus, we usually limit the analysis to a comparison of one statistic between groups. In general, if only one statistic is used, either the "mean individual burden" or the "mean group burden" is preferred, since a mean is a more complete statistic than is a median. The choice between the two means is dictated by which of the following types of analysis is being conducted.

- If funding levels are being examined, the group burden is probably more useful. This statistic furnishes information on the size of the energy bill of LIHEAP income eligible households and the portion of income for this group that is spent on energy. Using this statistic allows direct examination of the relationship between the total energy bill and total LIHEAP funding.

- If targeting decisions are being examined, the mean or median individual burden is probably more useful. These statistics furnish information on the distribution of burdens among households in a group. Using these statistics helps to target those groups where a significant number of households have high energy burdens.

All three energy burden statistics are presented in this report's figures to fully inform the reader.

Projecting Energy Consumption and Expenditures

Projections were developed using microsimulation techniques that adjusted consumption and energy expenditures for changes in weather and prices. Consumption amounts for each household were adjusted for changes in heating and cooling degree days. Projected expenditures for each household were estimated as a function of projected consumption changes and actual changes in fuel prices. To make these projections, it was assumed that households did not change their energy use behavior (that is, their tendency to seek a specific indoor temperature) because of weather, price, or other changes.

Consumption projections utilized end use consumption estimates that were developed with the 2015 RECS data. These estimates were based on models for each fuel, using households that had actual (not imputed) consumption records for the fuel. The models used nonlinear estimation techniques to estimate parameters that described the relationship of consumption to end uses, housing characteristics, weather, and demographics.

To develop consumption projections, heating and cooling end use estimates for Calendar Year 2015 were adjusted for weather differences between 2015 and Fiscal Year 2020. The following equation was applied to each household in the microsimulation data file.

FY 2020 Projected Btus = (2015 estimated heat use * HDD change) +

(2015 estimated cooling use * CDD change) +

(2015 estimated water heat use + 2015 estimated appliance use)

Expenditure projections were a function of projected changes in consumption and actual changes in prices. The following equations were used.

Preliminary Expenditures = 2015 Expenditures * (FY 2020 Projected Usage/2015 Actual Usage)

Final Expenditures = Preliminary Expenditures * Price Change[27]

Table A-1 shows the national price factors that were used. The price factors show the actual change in the average price of a fuel from calendar year 2015 to FY 2020. For example, electricity prices increased by about 3.6 percent from 2015 to FY 2020.

Table A-1. National Price Factors for FY 2020

Fuel	Price Factors for FY 2020 Projections
Electricity	1.0358
Natural gas	1.0185
Fuel oil / kerosene	1.0113
Liquefied petroleum gas (LPG)	0.8842

[27] Price factors were developed using price data obtained from the Energy Information Administration for electricity, natural gas, and LPG, and the BLS Consumer Price Index for fuel oil. Consumption data were obtained from the Energy Information Administration for all fuels. Electricity price data used for calculating price factors are from the *Monthly Energy Review*, January 2021, and electricity consumption data is from the *Electric Power Monthly*, January 2021. Natural gas price and consumption data used for calculating price factors are from the *Monthly Energy Review*, January 2021. Fuel oil/kerosene price data for calculating prices factors are from the U.S. City Average, Fuel Oil #2, Consumer Price Index of the Bureau of Labor Statistics, Series ID APU000072511. LPG price data were obtained from the Energy Information Administration website. Fuel oil/kerosene and LPG consumption data are from the *Monthly Energy Review*, January 2021.

Expenditure data were adjusted using national price factors for FY 2020. Earlier *Notebooks* used state-level price factor data. For FY 1993/1994, state-level data did not vary much from the national average for electricity and natural gas. For electricity, price changes varied between 0.3 percent and 1.2 percent; the national average was 0.8 percent. For natural gas, price changes varied between 1.7 percent and 2.8 percent; the national average was 2 percent. Expenditure projections using national price data do not appear to be significantly different from those obtained using state-level price data.