8. Comparisons of RECS Estimates with Other Data

The previous chapters have presented information about sampling errors and various sources of nonsampling errors associated with RECS estimates. Whenever possible, quantitative information about nonsampling errors has been included, based on operating statistics, pretests, methodological experiments, and special evaluation studies in which the accuracy of *individual* responses has been evaluated by reinterviews or other means. The subject of this chapter is a less direct but nevertheless useful source of information about the quality of RECS estimates: comparisons of *aggregate* estimates from RECS with data from other sources believed to be at least roughly comparable with regard to population coverage and definition of variables.

Typically, comparisons of aggregate data from different sources proceed as follows:

- The analyst looks for differences in design that may cause the estimates to differ. These might include different definitions of the target population, different reference dates or periods, and different definitions of the variables to be estimated. If there are reasonable grounds for doing so, the analyst may adjust one or both of the estimates to make them more nearly comparable with each other.

- If one or both estimates are based on probability samples, the analyst develops confidence intervals for differences between the (adjusted) estimates from the two sources.

- If (adjusted) estimates are significantly different, the analyst will look for additional factors that may explain the differences.

When significant differences are observed, it is sometimes not readily apparent which of the estimates is more accurate. Nevertheless, such comparisons are often valuable. In some instances, such comparisons have suggested ways of strengthening the RECS survey design and procedures. Results of the comparisons are presented in RECS publications in the belief that they will help users to understand the strengths and limitations of the survey data and thus to use them more effectively.

Two kinds of comparisons will be discussed. The next section is about comparisons between RECS estimates of end-use consumption and estimates from surveys of fuel suppliers, mostly conducted by EIA, of amounts of energy supplied to the residential sector. The following section covers comparisons of RECS data on housing unit and household characteristics with data from the decennial census and from other household surveys, such as the Current Population Survey, the American Housing Survey and the Consumer Expenditure Survey. Comparisons between RECS estimates and administrative counts of program participants are also presented.

Comparisons of RECS and Supplier Survey Estimates of Consumption

The collection of data from energy suppliers is an important component of RECS. However, the RECS Supplier Survey collects billing data only for households that are in the RECS sample. In addition to conducting surveys of end-use consumption in the residential, commercial, and manufacturing sectors, EIA conducts several surveys of energy suppliers who provide various types of fuels for consumption by these and other sectors of the economy. In EIA's supplier surveys, respondents are asked to provide data on total amounts of fuel supplied to all customers during specified time periods and, to the extent possible, to disaggregate these amounts by class of customer.

There have been several studies comparing estimates of consumption by fuel type from EIA's end-use consumption surveys with supplier survey estimates of amounts supplied to the residential and commercial sectors. Our focus here will be on the comparisons for the residential sector. Results of these comparison studies have been published in several special reports (EIA 1986a, EIA 1990, Miller 1995, Allied Technology Group 1995). For the 1990 and 1993 RECS, comparisons of RECS and EIA supplier survey data have been published in an appendix to the *Consumption and Expenditures* report (EIA 1993a, Appendix C, EIA 1995d, Appendix D).

Three EIA supplier surveys have been the primary basis for the comparisons:

- The *Annual Electric Utility Report*, Form EIA-861 (prior to 1984, Form EIA-826 was used)
- The *Annual Report of Natural and Supplemental Gas Supply and Disposition*, Form EIA-176
- The *Annual Fuel Oil and Kerosene Sales Report*, Form EIA-821

The first two of these annual surveys cover all known suppliers; the third is based on a sample.

Differences in Defining the Residential Sector

Each of the three supplier surveys asks respondents to report separate estimates for several sectors or classes of customers, one of which is the residential sector. However, the supplier survey definitions of the residential sector differ, both conceptually and operationally, from the one that is used in RECS. The electric utilities reporting on Form EIA-861 are allowed to use discretion to determine which of their end-use customers are classified as residential. In practice, the determination is likely to be based on the utilities' rate structures, which, in turn, are based on customers' relative rates of consumption. As noted in a 1990 report:

> The utility specifies how much fuel it supplied to residential, commercial, industrial, and other customers by totaling the quantity supplied under these rate classes. Utilities are not required to maintain records on the economic activities

> of their customers, so their rate structures may not correspond to economic definitions of the end-use sectors. To the extent there is not a one-to-one correspondence between the economic activity of the customers and the rate schedule at which they are billed, there will be a misclassification of end-use sector supply data. (EIA 1990, p.13)

The same report points out that an individual customer's classification--or rate--schedule can vary during the year as its consumption varies. Similar considerations apply to natural gas distribution companies reporting on Form EIA-176. Fuel oil distributors reporting on Form EIA-821 are specifically instructed to exclude farms and large apartment buildings from the residential sector.

The difference in their definitions of the residential sector is only one of several ways in which RECS and the three supplier surveys identified above differ with respect to coverage, timing, and definition of data items collected. Consequently, one should not necessarily expect RECS estimates of residential consumption to agree closely with estimates of amounts of fuel supplied from any of the supplier surveys. Differences also occur because of sampling and nonsampling errors in the estimates. Figure 8.1 summarizes the main features of RECS and the supplier surveys that affect the comparisons.

Other Differences in Coverage

RECS coverage, as described in Chapter 3, is limited to U.S. housing units occupied as primary residences. Vacant units and units used seasonally or occasionally as second homes are excluded. Suppliers, on the other hand, are asked to report total amounts supplied to customers, without any exclusions. As shown in Table 3.1, Chapter 3, the vacant and seasonal housing units excluded from RECS have accounted for between 9.2 and 11.5 percent of total U.S. housing units between 1981 and 1993, according to biennial estimates from the Census Bureau's American Housing Survey. Their proportionate share of total residential energy consumption is probably somewhat smaller.

The classification of some master-metered apartments as commercial in the supplier surveys works in the opposite direction--that is, it leads to supplier survey estimates that are lower than the RECS estimates for the residential sector. For electricity and natural gas, the effects of this factor are hard to quantify, because suppliers are not consistent in their classification of apartments. In a study undertaken in the mid-1980's the issue was explored for natural gas by contacting public utility commissions and large utilities in 5 midwestern States--Illinois, Indiana, Michigan, Ohio, and Wisconsin--where there is substantial use of natural gas for heating. Based on limited data that these sources were able to provide, it was estimated that 3.4 percent of natural gas supplied to the residential sector in this 5-State area was being reported in other sectors in the supplier survey (EIA 1986a, Table 59, p.72). For fuel oil, the situation is somewhat clearer, because the supplier survey instructions specifically request that respondents exclude apartments from the residential sector. The 1993 RECS estimated that multifamily housing units accounted for 17 percent of all fuel oil consumed by the residential sector (EIA 1995d, Table 5.2).

Figure 8.1. Sources of Differences Between RECS Estimates of End-Use Consumption and EIA Supply Survey Estimates of Energy Supplied to the Residential Sector

Source	RECS	Supply Surveys[a]
Differences in Coverage		
Occupancy	Vacant and seasonal units excluded.	No exclusions.
Apartments	Included.	May be excluded if commercial rate applies.
Farm and Other Residences with Business Uses	Included in survey, business uses excluded from consumption.	Household may be excluded if commercial rate applies. If included, no basis for eliminating consumption for business uses.
Differences in Timing		
Reference Period	Different from calendar year through 1984.	Calendar year for all surveys.
Storable Fuels	Measures amounts used for metered fuels; amounts supplied for others.	Measure amounts supplied during reference period.
Sampling Error	Estimates of sampling error available.	None for electricity and natural gas. Fuel oil based on sample survey but sampling errors of estimates used in comparisons are not available.

[a]This figure covers the following EIA annual supply surveys: Electricity: Form EIA-861 (Form EIA-826 prior to 1984); Natural Gas: Form EIA-176; Fuel Oil and Kerosene: Form EIA-821.

Some customers of energy suppliers combine residential and nonfarm or farm business uses of fuel in the same account. In RECS, business uses are excluded from estimates of residential consumption on the basis of respondents' answers to questions about the proportion of their total consumption of each fuel that is used for business. For the electricity and natural gas supplier surveys (Forms EIA-861 and EIA-176), respondents are asked to classify consumers who use fuels for both residential and commercial purposes according to their predominant use, so the net effect of such mixed uses is difficult to determine. For the fuel oil supplier survey (Form EIA-821), farms are excluded from the residential sector.

Differences in Timing

Through survey year 1984, the reference period for RECS consumption and expenditures data ran from April of the survey year through March of the following year. Thus, for the 1984 RECS, estimates of consumption were for the 12 months from April 1984 through March 1985. For subsequent survey years, RECS consumption data have been collected for a calendar year. All of the EIA supply surveys collect data on a calendar year basis.

Consequently, for RECS survey years through 1984, one might expect to see consumption/supply survey differences in amounts of heating fuels used/supplied in parts of the country for which heating degree-days for January through March varied appreciably from one year to the next. Comparisons of expenditure data would be most affected in periods when there were rapid fluctuations in energy prices. In a special study of consumption and supply estimates for survey

years 1978 through 1982, procedures were developed to adjust the data by Census division for natural gas and fuel oil from both sources for these differences in timing, as well as for the different treatment of apartments in RECS and the supply surveys. These procedures were successful in reconciling differences for fuel oil, but only partially successful in reconciling differences for natural gas (EIA 1986a, Part 7).

A 1990 study that compared measures obtained from consumption and supply surveys noted that "Since fuels (except electricity) can be stored, the amount of product supplied to a sector in a given period is not necessarily equal to the amount consumed" (EIA 1990, p.2). However, this "storability" factor would not be likely to have significant effects on consumption/supply comparisons for the residential sector. For electricity and natural gas, metered amounts are reported both in RECS and in the relevant supplier surveys. For the other fuels, since it would be impractical for households to report their actual consumption in RECS, deliveries are used as a proxy for consumption. Thus, the RECS data for all fuels are comparable in this regard to those obtained in the supplier surveys.

Sampling and Nonsampling Errors

The RECS estimates of total consumption of each fuel are subject to sampling error, and estimates of their sampling errors have been calculated. The supplier surveys for natural gas and electricity include all known suppliers, so the results of these surveys are not subject to sampling error. The supplier survey for fuel oil and kerosene is based on a sample of distributors, and sampling errors of direct sample estimates have been calculated. However, for the comparisons presented below, the sample survey data have been benchmarked to supply data from a different source, and sampling errors for these benchmarked estimates have not been calculated.

All of the estimates of end-use consumption and amounts supplied are subject to various kinds of coverage, nonresponse, measurement, and data-processing errors. Nonsampling errors of RECS estimates have been discussed at length in Chapters 3 through 7 of this report.

Comparisons of Consumption and Supply Data at the National Level

Table 8.1 shows comparisons of RECS and supplier survey data at the U.S. level for electricity, natural gas, and fuel oil for all RECS survey years except 1979 and 1981. The key item in the table for each year and fuel is the ratio of the supply estimate to the consumption estimate. The ratios differ from 1.000 by more than twice their standard errors for 7 of the 21 yearly comparisons.

Table 8.1. Residential Consumption and Supply of Electricity, Natural Gas, and Fuel Oil: 1978-1993

Consumption & Supply Survey Estimates	1978[a]	1980	1982	1984	1987	1990	1993
				ELECTRICITY			
RECS Consumption (billion kWh)	724	721	710	728	808	888	962
EIA Supply Data (billion kWh)	671	717	730	778	850	924	995
Ratio of Supply to Consumption	0.927	0.994	1.028	1.069*	1.052*	1.041	1.034
Standard Error of Ratio	0.043	0.019	0.029	0.026	0.017	0.027	0.019
				NATURAL GAS			
RECS Consumption (billion ft^3)	5,461	4,840	4,680	4,830	4,687	4,737	5,131
EIA Supply Data (billion ft^3)	4,891	4,752	4,633	4,555	4,315	4,391	4,957
Ratio of Supply to Consumption	0.896*	0.982	0.990	0.943	0.921*	0.927*	0.966
Standard Error of Ratio	0.055	0.038	0.039	0.033	0.034	0.032	0.034
				FUEL OIL[b]			
RECS Consumption (million gallon)[b]	15,802	11,220	8,230	9,080	8,850	7,100	7,380
EIA Supply Data (million gallon)[b]	15,091	10,290	8,274	7,602	8,106	6,050	6,590
Ratio of Supply to Consumption	0.955	0.917	1.005	0.837*	0.916	0.852*	0.893
Standard Error of Ratio[c]	0.075	0.057	0.058	0.054	0.054	0.058	0.062

* = Ratio differs from 1.000 by more than twice its standard error.
[a]Totals for 1978 do not include data for Alaska and Hawaii.
[b]For 1978, 1980, and 1982 includes kerosene.
[c]Underestimate; does not reflect sampling error of supply survey estimate.
kWh = Kilowatthours.
Sources: Consumption: Energy Information Administration, *Consumption and Expenditures* (for years shown); Supply: *State Energy Data* (for years shown).

- For *electricity*, the supplier survey estimates were below the RECS consumption estimates in 1978 and 1980; subsequently they have been moderately higher than the RECS estimates. They were significantly higher than the RECS consumption estimates in 1984 and 1987.

- For *natural gas*, the supply estimates were below the RECS consumption estimates in all years and were significantly lower in three of the seven years.

- For *fuel oil*, the supply estimates were below the RECS consumption estimates in all years except 1982, when the ratio was 1.005. The supply estimates were significantly lower in two of the seven years.

The largest *change* in the supply/consumption ratio between RECS survey years was for fuel oil, where the ratio declined from 1.005 in 1982 to 0.837 in 1984. Form EIA-821 was used for the first time in 1984; it succeeded Form EIA-172, which had been used from 1979 through 1982. The statistical procedures and methodologies associated with the new form differed from those used earlier; consequently, the supply estimates for 1984 and subsequent years are not considered directly comparable with those for prior years (EIA 1995g, p. 348).

Table 8.2 compares RECS consumption and supplier survey estimates at the U.S. level for kerosene and LPG for 1990 and 1993. As the table shows, the 1993 RECS consumption estimate for kerosene was significantly below the supplier survey estimate. None of the other three differences was statistically significant.

Table 8.2. Residential Consumption and Supply of Kerosene and LPG: 1990 and 1993

Consumption and Supply Survey Estimates	Kerosene		LPG	
	1990	1993	1990	1993
RECS Consumption (Quadrillion Btu)	.07	.05	.28	.38
Supply Data (Quadrillion Btu)	.06	.08	.36	.40
Difference (RECS - Supply)	.01	-.03*	-.08	-.02
Two Standard Errors (RECS Standard Error)	.02	.01	.06	.07

* = Absolute value of difference exceeds twice its standard error.
Source: Energy Information Administration, *Consumption and Expenditures* (1990 and 1993).

Of the five major fuels, kerosene and LPG are the least frequently used and together accounted for only about 4 percent of total residential consumption in 1993. RECS estimates of their consumption are subject to large relative sampling errors, so that comparisons of consumption and supply estimates cannot determine whether small observed differences are statistically significant. In addition, as was shown in Table 6.5, Chapter 6, for RECS sample households, the proportion of kerosene use derived from supplier billing records was less than 30 percent in 1990 and 1993, compared to much higher proportions for the other four fuels. The primary source of the kerosene supply data is the same as for fuel oil, the *Annual Fuel Oil and Kerosene Sales Report*, Form EIA-821. EIA does not survey suppliers of LPG; the supplier data for LPG appear annually in the *State Energy Data Report* and are based on data provided by the American Petroleum Institute.

Comparisons at the Census Division Level

A 1995 report (Allied Technology Group 1995) compares RECS consumption estimates by Census division with supplier survey estimates for all five major fuels (data for fuel oil and kerosene were combined) for the years 1984, 1987, and 1990. Because of the relatively large sampling errors of RECS estimates at the Census division level, only large estimated differences--generally more than 10 percent of the supply estimate, and often more than 20 percent for smaller divisions and less frequently used fuels--are statistically significant.

The most consistent differences found in this study occurred in the Middle Atlantic Division in the comparisons for fuel oil plus kerosene and for LPG. The data for these comparisons are shown in Table 8.3. For fuel oil plus kerosene (kerosene is only a small part of the total for the two fuels), the Middle Atlantic Division accounts for roughly one-half of total U.S. consumption. The RECS consumption estimates were well above the supplier survey estimates in all three years. As noted above, supplier survey respondents for Form EIA-821 were specifically

instructed to exclude apartments and farms from the residential sector. In 1990, an estimated 24 percent of the consumption of fuel oil in the Middle Atlantic Division was by households that were in buildings with two or more housing units.

Table 8.3. Residential Consumption and Supply of Selected Fuels, Middle Atlantic Division: 1984, 1987, and 1990

Consumption & Supply Survey Estimates	1984	1987	1990
		FUEL OIL AND KEROSENE	
RECS Consumption (trillion Btu)	650	610	513.1
EIA Supply Data (trillion Btu)	410.1	457.0	340.1
Ratio of Consumption to Supply	1.585*	1.335*	1.590*
Standard Error of Ratio[a]	0.178	0.092	0.109
		LPG	
RECS Consumption (trillion Btu)	10	10.0	12.0
Supply Data (trillion Btu)	22.2	26.3	27.3
Ratio of Consumption to Supply	0.450*	0.380*	0.440*
Standard Error of Ratio	0.171	0.122	0.198

* = Ratio differs from 1.000 by more than twice its standard error.
[a]Underestimate; does not reflect sampling error of supplier survey estimate.
Source: Allied Technology Group, *Revised Analysis Report: Comparison of Data from Energy Consumption and Supply Surveys* (March 1995).

Table 8.4. Estimates of Electricity Consumption per Residential Unit from RECS and the Edison Electric Institute (EEI): 1970-1984

Year	RECS (kWh per household)	EEI (kWh per customer)	Ratio RECS/EEI
1970		7.066	
1971		7.380	
1972		7.691	
1973	8.530[a]	8.079	1.06
1974		7.907	
1975	8.630[a]	8.176	1.06
1976		8.360	
1977		8.693	
1978	9.450	8.849	1.07
1979	9.150	8.843	1.03
1980	8.840	9.025	0.98
1981	8.750	8.825	0.99
1982	8.480	8.743	0.97
1983		8.814	
1984	8.440	8.978	0.94

[a]Data from predecessor surveys to RECS that were conducted by the Washington Center for Metropolitan Studies.
Sources: Energy Information Administration, *Consumption and Expenditures* (1984); EEI data are from the *Statistical Yearbook of the Electric Utility Industry*.

For LPG, total consumption was much smaller, and the Middle Atlantic Division accounts for less than 5 percent of total U.S. consumption. The RECS consumption estimates were consistently below the supply estimates, which are based on data provided by the American Petroleum Institute.

Supplier Data from Non-EIA Sources

The *Consumption and Expenditures* report for 1984 includes a comparison of RECS estimates of average electricity consumption per household with a data series on average residential electricity consumption per customer compiled by the Edison Electric Institute (EEI) (EIA 1987a, pp. 288-89). The data from the two sources are shown in Table 8.4. The EEI data were based on quarterly surveys of investor-owned utilities, Tennessee Valley Authority distributors, some State and Federal projects, and large municipal utilities, supplemented by data from secondary sources to complete the coverage (EIA 1989c, pp. 24-25). It is likely that many of the factors that were relevant to comparisons of data on total residential consumption of electricity from RECS and EIA's supplier surveys (including sampling error of the RECS estimates) would also contribute to differences between the RECS and EEI data series. One additional factor might be differences in the denominators. For RECS, the denominator is always a single household; for EEI, some of the customer accounts may have included more than one household.

Given these differences in the sources of data, the differences between the two sets of estimates are relatively small. However, there is a clearly evident trend for the ratio of the two series to decline between 1978 and 1984. The EEI estimates were relatively stable during this period, at the same time that the RECS estimates of consumption per household declined by about 10 percent.

Comparisons of RECS Data on Housing Unit and Household Characteristics with Data from Other Sources

Data items identical or roughly comparable to those included in RECS have been collected in several surveys conducted by other agencies, especially the Census Bureau. The existence of such comparable items does not mean there is unnecessary overlap among the statistical programs. The surveys in question and the decennial census have purposes that are quite different from those of RECS. RECS provides in-depth information about residential energy consumption and expenditures, whereas the Census Bureau's American Housing Survey covers a broad array of characteristics of the nation's housing stock and provides more detailed data for subnational areas. The Decennial Housing Census provides small-area data for a few basic housing items. Some data that are potentially comparable to RECS estimates are also provided by administrative data systems, such as those established for the Food Stamp and Low-Income Home Energy Assistance (LIHEAP) Programs. The comparisons discussed in this section are organized by data source, starting with the American Housing Survey, continuing with other surveys and the Housing Census, and concluding with administrative record sources.

The American Housing Survey: Comparisons with NIECS

Prior to 1980, the American Housing Survey (AHS) was conducted annually and was called the Annual Housing Survey. The most systematic comparison of RECS and AHS data, undertaken by the University of California's Energy Research Group, used data from the 1978 RECS (NIECS) and the 1978 AHS (Blumstein *et al*., 1982). There were 18 variables that were essentially the same in both surveys:

Year structure built	Have thermostat
Main heating equipment type	Have air-conditioning
Main heating fuel	Have hot running water
Cooking fuel	Have roof insulation
Household income	Have storm windows
Property value	Have storm doors
Tenancy type	Have complete plumbing
Water heating fuel	Number of AC units
Number of household members	Number of rooms

Some additional variables were similar but provided data for different time periods in the two surveys.

When the comparisons were made, estimates of sampling errors were only available for a few of the NIECS variables, so it was often not possible to determine which of the NIECS/AHS differences were statistically significant. Unlike the AHS, the NIECS did not cover Alaska and Hawaii, but the study report does not mention whether the AHS data were adjusted to take account of this difference in coverage. For a few of the variables compared, the AHS estimates included vacant units, which were excluded from NIECS. Some highlights of the comparisons were:

- At both the national and regional levels, there was a clear tendency for the NIECS family income distribution to show a higher proportion of families in the upper income categories. This tendency was especially pronounced in the South region, which showed the following distribution:

1977 family income class	Percent of families	
	NIECS	AHS
Below $5,000	14.7	20.9
$5,000 - 9,999	22.0	22.5
$10,000 and over	62.3	56.5

  However, in the comparisons of RECS and CPS income data, presented later in this section, the difference was in the opposite direction. The CPS uses more detailed income questions than either RECS or the American Housing Survey.

- A similar tendency was noted for the distribution of property values for owner-occupied housing units.

- The proportion of households with one member was smaller for NIECS (18.8 percent) than for the AHS (22.2 percent).

The general conclusion of the study was that for most variables there was reasonably good agreement between the NIECS and AHS estimates.

The American Housing Survey: Other Comparisons

The *Consumption and Expenditures* report for 1993 (EIA 1995d) includes a comparison of the distributions of occupied housing units by year built, as estimated from the 1993 RECS and the 1993 AHS. The results are shown in Table 8.5. The two distributions are in reasonably good agreement, but the proportion of units built between 1970 and 1979 as estimated by RECS was significantly below the corresponding AHS estimate.

The Current Population Survey (CPS)

As explained in Chapter 7, Section 7.1, estimated household counts from the annual March supplement to the CPS are used to derive the benchmark values for the stage two ratio adjustments that are part of the RECS estimation procedure. Hence, for the categories used as benchmarks, RECS and CPS estimates are in close agreement. For the first 5 survey years, 12 control totals were used, defined by the four Census regions and three location categories -- central city, remainder of metropolitan statistical area, and nonmetropolitan. However, comparisons of RECS and CPS estimates of the number of households by number of persons for 1980, 1981, and 1982 showed that the proportion of single-person households in RECS was consistently low for both owners and renters (Response Analysis Corporation 1983).

Consequently, for the 1984 RECS stage 2 ratio-estimation procedure, additional benchmark categories were introduced for one-person households occupied by males, one-person households occupied by females, and all other households.

Data on household income are also collected annually in the March supplement to CPS. The CPS procedures for collecting data on income are more elaborate than those used in RECS. The RECS questionnaire asks respondents whether or not any *family members* had income in each of several categories (earnings, self-employment, Social Security, etc.) and then asks them to assign their total *family* income to one of a large number of income class intervals. Income of persons living in the household who are not members of the family is supposed to be excluded. The CPS questionnaire calls for actual dollar amounts in each of several income categories separately for each *household* member age 15 and over. The time references also differ: RECS asks for income in the 12 months preceding the interview date (generally in the fall of the year), whereas the March CPS asks for income in the prior calendar year.

Table 8.5. RECS/AHS Comparisons of Occupied Housing Units by Year Built: 1993

Year of Construction	Percent of Housing Units[a]		
	AHS	RECS	RECS - AHS
1939 or earlier	21.0	21.0	0.1
1940 to 1949	8.0	7.1	-0.8
1950 to 1959	13.0	13.5	0.5
1960 to 1969	15.2	15.5	0.3
1970 to 1979	22.0	18.8	-3.2[b]
1980 to 1984	7.6	8.8	1.2
1985 to 1989	8.4	9.1	0.7
1990 to 1993	4.8	6.1	1.2

[a]Percents may not add to 100.0 due to rounding.
[b]Difference is statistically significant at the 95 percent confidence level.
Source: Energy Information Administration, *Consumption and Expenditures* (1993), Appendix B.

Detailed comparisons of RECS and CPS income data for 1980, 1984, and 1990 were undertaken by Response Analysis Corporation (1994) as part of an analysis of alternative measures of energy burden--that is, the share of income used to pay energy bills. Estimates of median income for the 3 years were as follows:

Year	RECS	CPS	Percent difference (RECS - CPS)/RECS
1980	$16,172	$17,434	-7.8
1984	$19,488	$22,200	-13.9
1990	$26,364	$29,306	-11.2

The values shown for CPS represent total income of all household members. For 1990, it was possible to calculate median *family* income for CPS; that value, $27,915, was closer to the RECS estimate, the difference being -5.9 percent of the RECS value.

Table 8.6 shows comparisons of RECS and CPS income distributions for 1989 and 1990. The RECS distributions are based on family income and the CPS distributions are based on household income. Compared to RECS, the CPS distributions place a significantly higher proportion of households in the two top income classes. The differences might have been smaller if the CPS distributions had been based on family income, excluding nonfamily members in the sample households.

Table 8.6. RECS/CPS Family Income Comparisons: 1987 and 1990

Income Category[a]	Percent of Households[b]			
	1987		1990	
	RECS	CPS	RECS	CPS
Less than $5,000	6.8	6.9	5.6	5.2
$5,000 to 9,999	12.7	11.5	11.4	9.7
$10,000 to 14,999	13.9	10.6	12.1	9.5
$15,000 to 19,999	10.0	10.0	9.0	8.8
$20,000 to 24,999	9.7	9.2	9.6	8.9
$25,000 to 34,999	17.9	16.1	16.2	15.8
$35,000 to 49,999	14.8	17.2	17.8	17.5
$50,000 and over	14.3	18.5	18.4	24.7

[a]Income of family members for RECS, household members for CPS.
[b]Percents may not add to 100.0 due to rounding.
Sources: Energy Information Administration, *Housing Characteristics* (1987), Appendix C; *Consumption and Expenditures* (1990), Appendix C.

The Decennial Housing Census

Most housing characteristics that appeared in both the 1980 RECS and the 1980 Census of Housing were in reasonably good agreement. One exception was the number of households using wood as their main heating fuel (Carlson 1985). Estimates from the two sources were as follows:

Data Source	Households Using Wood as Main Heating Fuel	
	Estimate	Two Standard Errors
RECS (Nov. 1980)	4,700,000	800,000
Census (April 1980)	2,575,560	7,060

The 1980 Annual Housing Survey estimated that 1,377,000 housing units (± 101,000) used wood as their main heating fuel in 1980. However, unlike the RECS and Housing Census inquiries on main heating fuel, which were quite similar, the AHS inquiry did not provide a separate response category for wood.

Possible reasons for the difference between the RECS and Housing Census estimates include:

- Timing. According to RECS estimates, the proportion of households using wood as their main heating fuel rose steadily from 2.5 percent in 1978 to 6.4 percent in 1981. As noted above, the reference date for the 1980 RECS was 7 months later than the Census date.

- The RECS questionnaire gave greater emphasis to the use of wood as a fuel. It had several specific questions about wood, covering all types of uses and amounts used. Questions about secondary heating fuels and equipment were included. Wood is often used in conjunction with other heating fuels.

The Consumer Expenditure Survey (CES)

Since 1980, the CES, which is conducted by the Census Bureau for the Bureau of Labor Statistics, has provided annual estimates of household expenditures in a large number of categories, including natural gas, electricity, and fuel oil. Branch (1994) has compared CES estimates of expenditures for these fuels with RECS estimates for 1984, 1987, and 1990. The results are shown in Table 8.7. There was an apparent error that affected the published ratios for electricity and the total for all major fuels for 1987; the values shown in the table differ from those published by Branch.

The CES estimates of expenditures on electricity were above the RECS estimates for all 3 years. Because electricity accounts for more than half of the total for the three fuels combined, the CES estimates of totals for all major fuels also exceed the RECS estimates in each year. The publication that was the source of the CES estimates does not provide sampling errors but, based on the RECS sampling errors, the 1984 and 1987 ratios for electricity are clearly significantly different from 1.00 at the 95-percent confidence level. The ratios shown for the other fuels and for electricity in 1990 are probably not significantly different from 1.00.

The RECS estimates used for these comparisons were estimates of consumption of each fuel by households that paid for all of their uses of that fuel. Branch states that this population "... more closely matches the population covered in CE estimates for energy expenditures," but does not explain what differences, if any, there are. The CES estimates used for the comparisons were adjusted to eliminate energy expenditures associated with vacation properties.

Other factors that might be associated with differences in the two sets of estimates include:

- CES estimates are for the calendar year in each of the 3 years. The RECS estimates for 1984 covered the period from April 1984 through March 1985.

- CES estimates may include some expenditures by households that do not pay for all of their uses of a particular fuel. These households were excluded from the RECS estimates that were used for the comparisons.

- Military households on post are included in RECS but not in the CES.

- For 1984 and 1987, the CES fuel oil expenditures were compared with RECS expenditures for fuel oil and kerosene combined.

- About 15 percent of households use budget plans to pay their suppliers; these plans allow them to spread their costs more evenly over the year. RECS consumption estimates are based on amounts actually supplied, whereas CES estimates are based on amounts paid.

Table 8.7. Comparison of Aggregate Expenditures for Selected Fuels, Consumer Expenditure Survey (CES) and RECS: 1984, 1987, and 1990

Expenditure Category	CES[a] (in billions)			RECS (in billions)			Ratio: CES/RECS		
	1984	1987	1990	1984	1987	1990	1984	1987	1990
Natural Gas	$26.5	$21.8	$23.8	$25.0	$21.7	$23.3	1.06	1.00	1.02
Electricity	58.0	64.7	73.0	51.8	58.5	68.6	1.12	1.11	1.06
Fuel Oil[b]	7.4	5.4	6.2	7.4	5.8	6.5	1.00	0.93	0.95
Major Household Fuels, Total	91.9	91.9	103.0	84.3	86.0	98.4	1.09	1.07	1.05

[a]CES estimates were adjusted to exclude expenditures for owned or rented vacation property.
[b]For 1984 and 1987, RECS estimates for fuel oil include estimates for kerosene.
Sources: Branch, *The Consumer Expenditure Survey: A Comparative Analysis* (1994); Energy Information Administration, *Consumption and Expenditures* (for years shown).

Comparisons of RECS and Administrative Data

As part of its income inquiry, RECS asks respondents about receipt of food stamps. In the 1981 and 1982 surveys, they were asked about receipt during the calendar year prior to the survey; subsequently they have been asked about receipt during the 12 months prior to the survey interview. Since most interviews take place in the fall of the survey year, the latter approach is roughly equivalent to asking about receipt during the fiscal year that runs from October of the year preceding the survey year to September of the survey year.

Table 8.8 shows the results of a comparison, for selected survey years, of RECS estimates of the number of households receiving food stamps with counts based on records maintained by the Agriculture Department's Food and Nutrition Service, which administers the Food Stamp Program (Thompson 1994b). Estimates from RECS were below the program counts for all years shown and, except for the 1982 and 1984 RECS, the survey estimates were significantly lower.

Table 8.8. Comparison of Number of Households Receiving Food Stamps, RECS Estimates and Program Counts: Selected Years

Year Food Stamps Received[a]	Number of Households (000)		Ratio: RECS/USDA
	RECS	USDA	
1980	6,777	7,718	0.88*
1981	6,724	7,249	0.93
FY 1984	7,348	7,580	0.97
FY 1987	5,568	7,122	0.78*
FY 1990	6,010	7,787	0.77*

[a]The 1981 and 1982 RECS asked about receipt of food stamps during the prior calendar year. Subsequent surveys asked about receipt during the past 12 months, which is roughly equivalent to the fiscal year because interviewing is done in the fall.

* = Ratio differs from 1.00 by more than twice its standard error.

Sources: Energy Information Administration, RECS: Survey data for 1981, 1982, 1984, 1987, and 1990; USDA: Food and Nutrition Service, Public Information Data Bank and National Data Bank, January 1993.

A similar comparison with program data has been made for RECS estimates of the number of households receiving assistance under the Low-Income Home Energy Assistance Program, which was authorized by 1981 legislation and is currently administered by the Administration for Children and Families, Department of Health and Human Services (Thompson 1994b). The results of the comparison, which is based on assistance for home heating costs only, are shown in Table 8.9. In this instance, the RECS estimates are significantly below the program counts for all years. For the 3 years shown in both tables, the observed ratio of RECS estimates to program counts was lower for energy assistance than it was for food stamps.

These findings for RECS are consistent with experience from other household surveys which have attempted to collect data on income recipiency from public income transfer programs. Comparisons with administrative data for 1983 and 1984 showed that the Census Bureau's Survey of Income and Program Participation, which uses a considerably more detailed set of income questions, was identifying about 90 percent of the households receiving food stamps and that a somewhat smaller proportion of the total amounts disbursed was being reported. For calendar 1983, the Current Population Survey estimate of the total value of food stamps received was about 71 percent of the figure provided by the Food and Nutrition Service (Jabine 1990, Table 10.1).

Possible reasons for such underreporting in surveys include respondent reluctance to report receipt of welfare payments, respondent misclassification of the source of income, and survey undercoverage of low-income households. Differences in the frequency and method of receipt may affect the level of reporting. Households receive food stamps every month and take them or a debit card to the store where they buy their food. Energy assistance, on the other hand, is received once a year and the payment may be sent directly to a utility with only a notice to the household recipient (Thompson 1994b, p.6).

Table 8.9. Comparison of Number of Households Receiving Low-Income Home Energy Assistance, RECS Estimates, and Program Counts: Selected Years

Year Heating Assistance Recevied[a]	Number of Households (000)		Ratio: RECS/HHS
	RECS	HHS	
FY 1982	3,908	5,990	0.65*
FY 1984	5,293	6,444	0.82*
FY 1987	4,770	6,495	0.73*
FY 1990	4,156	5,460	0.76*

[a]The RECS questionnaire asks about receipt of LIHEAP assistance during the fiscal year preceding the survey interview.

* = Ratio differs from 1.00 more than twice its standard error.

Sources: Energy Information Administration, RECS: Survey data for 1982, 1984, 1987, and 1990; HHS: Low Income Home Energy Assistance Program reports to Congress for the fiscal years shown.