

# Service Report

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## Weatherization Program Evaluation

by

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This report has not received a complete technical review by the Energy Information Administration (EIA) and, therefore, should not be represented as an official EIA product.



## FOREWORD

This report presents an evaluation of the average energy savings resulting from the weatherization program for low-income households. It is based on the findings from a systematic study of households that participated in the program in 1981. The study is based on a statistically valid, national sample of households that participated in the program. The sample covers the spectrum of conditions under which the program has been administered.

This study was conducted at the request of the Office of Conservation and Renewable Energy (CE). CE provided the Energy Information Administration (EIA) with complete funding for the project, including sample specification, data collection and analysis of the findings. The study was conducted under EIA's direction by the Response Analysis Corporation (RAC) of Princeton, New Jersey. RAC is also the contractor for the Residential Energy Consumption Survey (RECS), upon which this weatherization study is based. RECS is a national survey of energy use by households conducted by the EIA.

This report contains a full discussion of the findings from the study. It also fully documents the sample selection process, the data collection procedures and the methods of data analysis.

#### CONTACTS

The following information is provided in case questions arise concerning this report:

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The text of this report was prepared by Gerald Peabody (202-252-1125), based on a final report submitted by the Response Analysis Corporation. The Response Analysis Corporation, Princeton, New Jersey, was the data collection agent for the study. Questions concerning the Residential Energy Consumption Survey can be answered by Wendel Thompson on (202-252-1119), who was also the technical supervisor for this study.

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## INTRODUCTION

### The Study in Brief

This report presents the findings of a systematic evaluation of the energy savings resulting from the weatherization assistance program for low-income households. The evaluation is based on a national sample of single-family homes (including mobile homes) selected from those which participated in the weatherization assistance program. The sample covers the gamut of conditions under which the program has been administered by community action agencies in all parts of the United States.

This study is based on a total sample of 1,727 homes, which is statistically representative of all the single-family homes receiving low-income weatherization services in calendar year 1981. The income profile of families with weatherized homes is roughly the same as that for all families with incomes below 125 percent of the poverty level in 1981. The geographic distribution of the sample, however, is strikingly different from the distribution of all U.S. low-income households. More of the homes that were weatherized in 1981 were in the colder weather zones, and fewer were in temperate and warm weather zones. Partly because of this climate difference, these homes consumed significantly higher quantities of energy for home heating, prior to weatherization, than the average for all low-income households.

The analysis of energy savings is based on comparisons of actual utility and fuel dealer bills for electricity, natural gas, fuel oil and kerosene, and liquefied petroleum gas, for the year before weatherization and the year after. Statistical adjustments were made for differences in weather conditions in the 2 years and for other factors to improve the accuracy of the savings estimates.

### Highlights of Findings

1. Weatherized households saved an average of 14 million Btu of energy in the year following weatherization. A range of average savings was obtained by a number of different calculations. The range of average savings per household are:
  - o 9.1 to 9.7 percent of total household energy consumption
  - o 10.4 to 10.9 percent of total household use of the main home heating fuel
  - o 13.1 to 13.7 percent, as an upper bound of savings, of the main home heating fuel used specifically for home heating purposes.
2. Energy savings of weatherized homes were related to the type and cost of weatherization activity. Households receiving the most extensive weatherization services--insulation plus storm windows or doors--saved more than twice as much energy as weatherized homes that were not insulated.

3. The general pattern of post-weatherization energy savings is duplicated in all major subgroups of weatherized homes. Findings are within a percentage point or two of the 10 to 11 percent range for post-weatherization savings in use of main home heating fuel for homes grouped by
  - o main home heating fuel of the household
  - o weather zones
  - o heated square feet
  - o age of householder
  - o race of householder.
4. Annual cost savings for the main home heating fuel, at 1981-1982 prices, average \$71 per weatherized home. Average cost of weatherization services (for materials only) was \$400. Average dollar savings varied roughly in proportion to the cost of the weatherization services.

#### Cautions on Interpreting the Results

The energy savings obtained from a particular conservation improvement can be precisely determined only by measuring energy consumption under identical circumstances before and after the improvement is made. This condition is impossible to meet, however, because conditions are always changing. Weather and energy-use patterns, such as thermostat settings and intensity of use of the home, are two of the factors that are likely to change.

A second variable that adds to the difficulty of evaluating a particular conservation change is that its effectiveness will depend upon the characteristics of the specific house. The effectiveness of attic insulation, for example, will depend upon the amount of heat lost through the roof relative to other sources of heat loss.

A third complexity in evaluating the weatherization program is the wide variation in the types of conservation improvements made and possibly in the quality of installation. The improvements were determined by the house's characteristics and the policies of the local agency conducting the weatherization.

As a result, this study can only provide an estimate of the average effectiveness of the program for a large sample of households. This study does not provide a useful estimate of the savings obtained for a particular house or from a particular improvement. The discussion of the findings elaborates on this point.

A strength of this study is the large sample of weatherized homes included in it. These homes cover the range of circumstances that effect energy use. Consequently, the average savings estimated here can be reliably attributed to the program.

The next chapter of this report gives a general description of the procedures followed in conducting this study and of the characteristics of the households studied. The main findings of the report are discussed in the third chapter. The Appendices provide a complete description of the methodology followed in the study for the more technically inclined reader. The appendices also include additional information on the study, including detailed tables and the questionnaires used for the household interview and those sent to the fuel suppliers.

## METHODOLOGY AND SAMPLE CHARACTERISTICS

### Objective of the Study

The purpose of this study was to provide a systematic, objective evaluation of energy savings from the weatherization assistance program for low-income households.

Low-income persons have been particularly hard hit by rising fuel prices. Their homes are more likely to be poorly insulated, and they are least likely to have the money necessary to make energy-conserving home improvements. The weatherization assistance program is intended to reduce the impact of higher fuel costs on low-income households and generally to assist in the National energy conservation program.

It is estimated that 13 million households are eligible for assistance under the program. Through 1983, approximately 1.4 million homes had received some weatherization assistance through programs of the U.S. Department of Energy (DOE) and its predecessor organizations.

DOE administers the program through six Operations Offices, which review grant applications and State plans, make grant awards, and monitor State programs. The States generally allocate the funds among local governments and organizations, particularly community action agencies, to implement the program.

### Sample Selection and Data Collection

Energy savings were evaluated by obtaining and analyzing actual bills for household energy consumption for pre- and post-weatherization annual periods. Research findings are based on a national sample of single-family homes (including mobile homes) weatherized in calendar year 1981.

- This was not a demonstration project in which an evaluation was based on homes weatherized under ideal conditions in one or a few closely monitored settings. A sample of households was selected from the mainstream of the program. The method of sampling provided assurance that the gamut of conditions under which the program was carried out in 1981 was covered.

Probability sampling procedures were used in all stages of selection of the national sample of households. The starting point was a set of 29 sample areas (counties or groups of counties) well dispersed throughout

the United States. Sample areas were composed of a total of 111 counties, including one or more counties in each of 24 States and the District of Columbia.<sup>1</sup>

In brief, the selection of specific households within sample areas included the following steps:

- o A complete list of community agencies that administered the low-income weatherization program in 1981, in sample counties, was completed from contacts with State energy assistance offices.
- o Each community agency was contacted by mail and telephone to obtain overall information on the total number of homes weatherized in 1981.
- o Systematic random sampling procedures were used to select a sample of homes weatherized in 1981 from the records of each agency. The agencies had no influence on the selection procedure.

High levels of cooperation were obtained from State and community agency officials at each step in the sampling process.

Interviews were completed with a very high proportion of households selected for the study. Altogether, 2,159 single-family homes were selected for inclusion in the data collection phase of the study. Interviews were completed with 1,727 households, which was 91.2 percent of those eligible. Interviewers visited all of the 2,159 homes selected to obtain personal interviews. Of the homes visited, 70 were vacant and 196 others were found to be ineligible for inclusion in the study, primarily because they were no longer occupied by the family who lived in the home at the time of the weatherization activity.

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<sup>1</sup>This study was conducted as an adjunct to the Residential Energy Consumption Survey (RECS). RECS, which has been conducted since 1978, is a comprehensive survey of energy use by a Nationally representative sample of households. The sampling and interview procedures followed in RECS have been used in this study, with appropriate modifications to allow for the special nature of the target population of weatherized homes. The questionnaire used in RECS has also been used in this study, again with modifications necessary due to the special requirements of this study. More complete details about the sampling and interview procedures are given in Appendix B. Further information about RECS and findings from the latest available survey are given in Residential Energy Consumption Survey: Consumption and Expenditures, April 1981 Through March 1982, Energy Information Administration, DOE/EIA-0321, September 1983.

The interviews were conducted in April and May 1983 and averaged about 58 minutes. The interviews included questions on structural features of the house related to energy, such as insulation, doors, and windows; the heating and cooling systems and the fuels used with these systems; household appliances; receipt of government assistance for the cost of heating; and demographic data on household members.

Toward the end of the household interview, the respondent was asked for the names, addresses, and telephone numbers of utility companies and fuel dealers that supplied the household. Respondents were also asked to sign a waiver authorizing data collection directly from companies for utility bills and fuel deliveries for the three-year period from January 1980 through December 1982.

The fuel supplier survey involved collection of data from 574 companies. The survey covered four fuels—electricity, natural gas, fuel oil or kerosene (considered to be a single fuel for purposes of this study), and liquefied petroleum gas (LPG). In many cases more than one dealer had supplied fuel oil or kerosene or LPG to the household, and each of the dealers was contacted.

#### Characteristics of Weatherized Homes

There are similarities and differences between the families in the study and other low-income families living in single-family homes in the United States (Tables 1 and 2).

The similarities include:

- o The income profile of families in weatherized homes is roughly the same as that for all families with income below 125 percent of the poverty level.
- o Weatherized homes are about the same size as other low-income homes, both in terms of number of heated square feet and number of persons in the household.
- o The families are about the same in racial composition.

The most striking difference between weatherized homes and all U.S. low-income homes is in their distribution by weather zones. Far more of the weatherized homes are in the colder weather zones of the United States, and fewer are in the temperate or warm zones (Figure 1).

Figure 1. Weather Zone Differences between Weatherized Homes and All Low-Income Homes in the U.S.

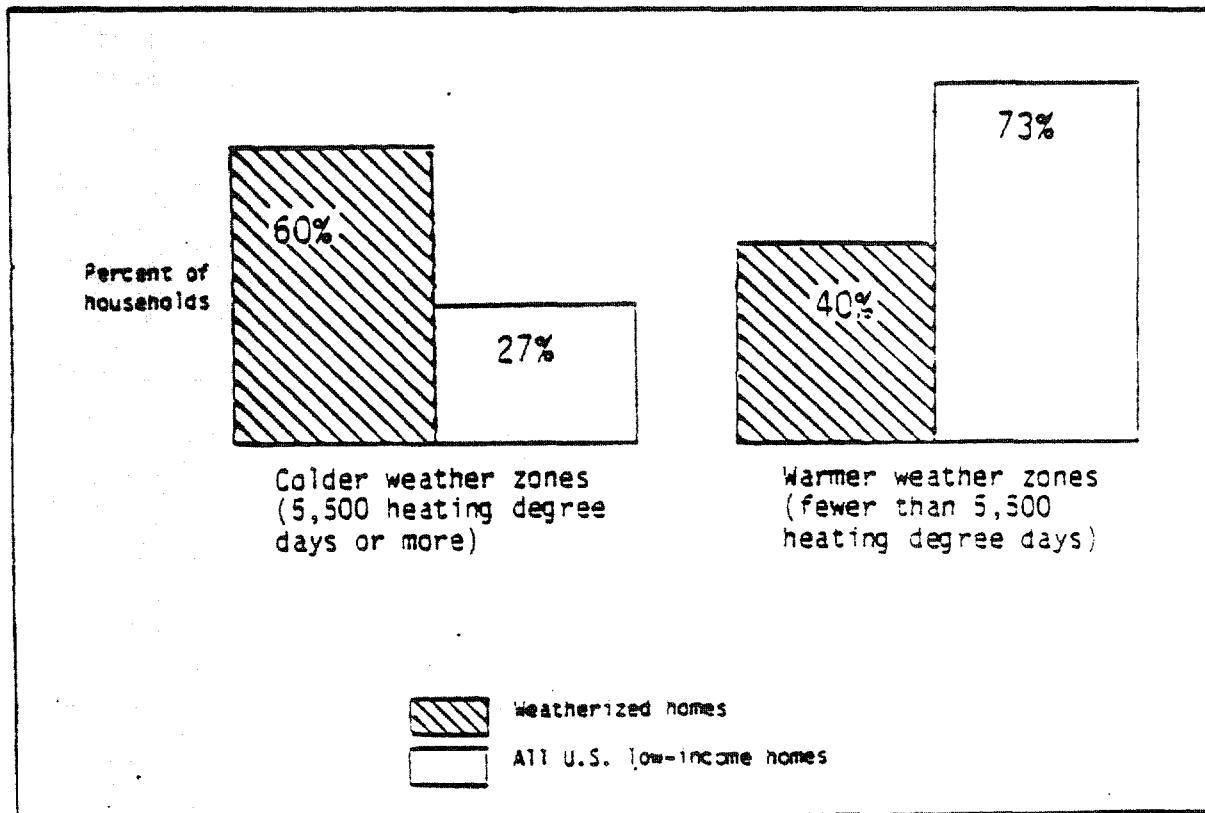


Table 1. Comparisons of Weatherized Homes and All Families Below 125 Percent of Poverty Level Living in Single-Family Homes:  
General Similarities

	All Households Below 125 Percent of Poverty Level (1981 RECS)	Weatherized Households
<b>Family Income**</b>		
Less than \$5,000	58	52
\$5,000 - \$9,999	36	36
\$10,000 or higher	6	12
<b>Heated Square Feet</b>		
Less than 1,000	44	42
1,000 - 1,599	35	32
1,600 or more	21	26
<b>Number of Persons in Household</b>		
1	28	33
2	27	24
3-4	25	26
5 or more	20	17
<b>Race of Householder</b>		
White	77	72
Black	21	25
Other	2	3
Total	100	100

Source: 1981 RECS, Energy Information Administration for all households below 125 percent of poverty level. Data collected for this study shown for weatherized households.

\*\*1980 family income for all households below 125 percent of the poverty level; 1981 family income for weatherized households.

Table 2. Comparisons of Percentage Distribution of Weatherized Homes and All Families Below 125 Percent of the Poverty Level Living in Single-Family Homes by Several Variables

	All Households Below 125 Percent of Poverty Level (1981 RECS)	Weatherized Households
<b>Weather zone</b>		
More than 7,000 heating degree days	11	33
5,500 - 7,000	16	27
4,000 - 5,499	21	19
Less than 4,000	52	21
<b>Houses built</b>		
Before 1940	40	53
1940 - 1964	35	29
1965 or later	25	18
<b>Age of householder</b>		
Under 45	35	27
45 - 59	18	18
60 or older	47	55
<b>Sources of income</b>		
Wages	50	36
Social Security	47	58
Food Stamps	28	39
AFDC	11	15
SSI	11	17
Unemployment	6	7

Source: 1981 RECS, Energy Information Administration, for all households below 125 percent of poverty level. Data collected for this study shown for weatherized households.

This difference is associated at least in part with the weather-zone difference between the two groups of houses. Another important difference is that the average energy consumption of weatherized homes in the pre-weatherization annual period was 30 percent higher than the average for all U.S. low-income homes.

Other noteworthy differences include:

- o Weatherized homes tend to be older (more were built before 1940).
- o Householders in weatherized homes are older (more are over 60).
- o Occupants of weatherized homes are less likely to get at least part of their income from wages or salaries, and more likely to receive benefits from Social Security, food stamps, and other Government assistance programs.

Another important comparison between the sample of weatherized homes considered in this study and the universe of low-income households is their consumption of energy. Since the weatherization program is focused on energy used for home heating, consumption of the main heating fuel is considered.

Table 3 shows total consumption of the main heating fuel for the weatherized houses and for all households from the 1981 RECS with incomes less than 125 percent of the poverty level that live in single-family houses. The time periods for the consumption of the two groups are not the same. The 1981 RECS sample covers consumption for the period April 1981 through March 1982. The period of consumption for the weatherized sample varies from household to household, covering a one-year period beginning a month or so after the weatherization was completed. For most weatherized households, the post-weatherization periods includes most of the 1981-1982 winter that was also included in the 1981 RECS period.

The data in Table 3 indicate that weatherized households consumed an average of 118.8 million Btu, which was 35.5 million Btu, or 40 percent, more than all households in single-family homes and with incomes below 125 percent of the poverty level. This higher consumption level is to be expected since more weatherized homes are located in colder weather zones. For households in weather zones with 5,500 or more heating degree-days, consumption for the main heating fuel is similar for the two groups.

Table 3. Average Total Consumption of Main Heating Fuel per Household for Weatherized Homes and for All Households with Incomes Under 125 Percent of the Poverty Level (Million Btu)

	Weatherized Households	Households Under 125 Percent Poverty in Single-Family Homes (1981 RECS)
Total	118.8	83.3
Weather Zone (HDD)		
Under 5,500	92.0	65.2
5,500 or more	135.6	129.4

Source: 1981 RECS, Energy Information Administration for all households below 125 percent of poverty level. Data collected for this study shown for weatherized households.

## WEATHERIZATION PROGRAM ENERGY SAVINGS

### Analysis of Energy Savings

This study provides estimates of the energy savings obtained from the Weatherization Assistance Program. The savings are estimated from energy consumption data for a one-year period ending shortly before the weatherization was carried out and for a one-year period starting just after the weatherization was completed. The consumption data are based on actual utility company bills and records of fuel deliveries to the weatherized homes. Whenever possible, utility company records were obtained for the three-year period from 1980 through 1982 for homes weatherized some time in 1981.

To estimate the energy savings, adjustments must be made to the raw data on fuel consumption obtained from the utility companies. These adjustments are described in the following sections. First, the data must be annualized to provide consumption figures for precise one-year periods before and after the weatherization. Secondly, the data are adjusted to correct for changes affecting consumption that occurred during the time period of the study that are not related to weatherization. Third, not all the households that were interviewed could be included in the final analysis of energy savings for a variety of reasons. The third section discusses the criteria for selecting the different groups of households that were used to make the final estimates of energy savings.

#### Annualization of Energy Consumption Records

The community agency records usually indicated the month in which the weatherization activity was completed, but not necessarily the exact span of dates in which the work was carried out. Consequently, a set of rules was established for constructing equal length pre- and post-weatherization periods of 1 year. Application of the annualization rules created a buffer zone of about 3 months between the annual periods used in the energy savings analysis. This buffer zone prevented any unusual energy consumption activity, just before, during or just after the accomplished weatherization, from affecting the savings estimates.

The annualization rules followed are discussed fully in Appendix C. Application of these rules give estimates of actual energy consumption for pre- and post-weatherization annual periods. Briefly, the rules for the different fuels are the following.

For deliveries of fuel oil/kerosene and LPG, a specific set of 12 months was defined for the pre-weatherized annual period and similarly for the post-weatherization annual period. For electricity and natural gas bills, the rules defined annual periods that were usually in the range of 360 to 370 days. An additional adjustment was then made to the first and final billing periods for pre- and post-weatherization years, as required, to standardize each of the annual periods to 365 days.

## Adjustments to Account for Changes in Weather Conditions and Household Composition

It is tempting, but naive, to calculate energy savings by comparing the actual consumption figures for the pre- and post-weatherization periods. This procedure provides meaningful estimates of the energy savings for a one-year period to the weatherization only if the pre- and post-weatherization periods are identical except for the weatherization.

Changes in the weather, in energy use patterns (such as raising or lowering the thermostat setting), in household composition, or in any other factor affecting energy use will also contribute to differences in consumption between the pre- and post-weatherization periods. The changes due to the weatherization must be isolated from these other changes to estimate the effect of the weatherization program.

In general, a household's energy use will change from year to year for a number of reasons related to changes in weather, stock of appliances, thermal integrity of the house and energy-related behavior. Some changes will be relatively small, such as the increased consumption from the purchases of a small electrical appliance, while others may be quite large, such as an increase in consumption for space heating due to a substantially colder winter. In general, it is difficult to determine all the factors that contribute to an observed change in total energy consumption and their relative importance.

For an individual weatherized home, therefore, weatherization will be one of many factors contributing to changes in energy consumption. To estimate the effect of the weatherization alone, it is necessary to account for all the other changes. For a single household, it is difficult (and beyond the scope of this study) to isolate the contribution of one factor, such as the weatherization, to the change in total energy consumption. However, by averaging over a large number of households, many of the factors that lead to change will cancel out, and it is possible to isolate the effects of changes that persist across all households.

The approach followed in this study is to use average consumption for large groups of households to estimate the average effect of weatherization. For this estimate, it is first necessary to adjust for all other factors that lead to systematic changes in consumption among the households in the study. Any change that occurred to all households will not, of course, be canceled out by averaging over the households, so the change must be accounted for in the analysis.

In this study, there were two important changes that require adjustments. Probably the most important is weather, because climate has such a large influence on consumption for home heating. Heating Degree Days (HDD) were, on average, 5 percent higher in the year after weatherization than in the year before. The second factor is household composition. Households were slightly smaller, on the average, in the year after weatherization than in the year before.

A multi-variate statistical procedure has been used to account for the changes in weather and household composition.<sup>1</sup> The procedure adjusts each household's consumption in the pre-weatherization period to correspond to conditions in the post-weatherization period. This adjusted consumption is the amount that would be predicted to be consumed in the post-weatherization period without weatherization under the climate and household composition situation that occurred in the post-weatherization period. The calculated savings for each household is the difference between this predicted consumption and the actual consumption in the post-weatherization period:

$$\text{SAVINGS} = \text{PREDICTED CONSUMPTION} - \text{ACTUAL CONSUMPTION}.$$

This formula is used to calculate the energy savings for the weatherization program for the households in the study. Complete data for estimating consumption were not available from all households selected to be in the study. Before considering the findings from the study, the selection of households used for the energy savings analysis is discussed.

#### Households Used in the Energy Savings Analysis

There were a number of reasons why some households in the study could not be used in the analysis. These reasons pertained chiefly to difficulties in obtaining a complete and accurate record of the household's consumption of its main heating fuel for the more-than-two-year period that would permit an analysis of differences before and after the accomplishment of weatherization. Specific data collection and analysis problems of this type included the following:

- o The household used wood or coal as its main heating fuel. Experience indicated that records on consumption of these fuels could not be obtained with sufficient precision to permit analysis of quantities consumed before and after weatherization.
- o The household switched its main heating fuels some time within the period covered by the study.

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<sup>1</sup>The adjustment procedures are discussed in detail in Appendix C. The approach is based on a multiple regression analysis of end use consumption of data from the RECS, as described in Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use, Energy Information Administration, DOE/EIA-0431, October 1983.

- Records for the household's single main heating fuel--electricity, natural gas, fuel oil/kerosene or LPG--were not available or not complete for the period relevant to the energy savings analysis. This happened in some cases when the household respondent did not sign a waiver that would have permitted us to request consumption records from fuel suppliers. Frequently, fuel suppliers were unwilling or unable to trace records back for the required period of time. The latter reason usually applied to use of fuel oil/kerosene or LPG rather than the use of electricity or natural gas.

In combination, reasons of the types above ruled out of the energy savings analysis 638 (37 percent) of the 1,727 homes for which personal interviews had been completed (Figure 2). This established a base of 1,089 households for which main heating fuel records were judged to be complete and which were included in at least some phases of the analysis of energy savings data.

Within this base of 1,089 households, energy savings data were analyzed in a variety of ways. In one approach to the analysis, all of the 1,089 households were included. In other approaches, one or both of the following groups of households were dropped:

- Households for which complete energy consumption records could not be obtained for fuels other than the main heating fuel. For these households, energy savings could be estimated for the main heating fuel but not for total energy consumption.
- Households for which unusual factors related to energy consumption might either mask or exaggerate differences in fuel use between the pre- and post-weatherization annual period. Households in this group include those who used a significant quantity of wood as a supplemental heating fuel, those for whom some nonhousehold use of a fuel (e.g., for business or farm) was included in their fuel bills, and those with changes in their pattern of fuel use for hot water or air conditioning.

Taken in combination, these factors affected 343 of the 1,089 households in the total base for the energy savings analysis (the combination of groups of households labeled B, C, and D in Table 4). To help judge the way these factors might affect estimates of energy savings, four sets of households were defined:

1. The maximum number of households (1,089) for which main heating fuel estimates were available--Groups A + B + C + D + E in Table 3.
2. A maximum number of households (965) for which total energy consumption estimates were available--Groups A + C + D in Table 3.
3. A minimum number of households (863) for which main heating fuel estimates were available, excluding those with unusual factors that might affect energy savings estimates--Groups A + B + C in Table 3.

Figure 2. Households Included in Study: Total = 1,727

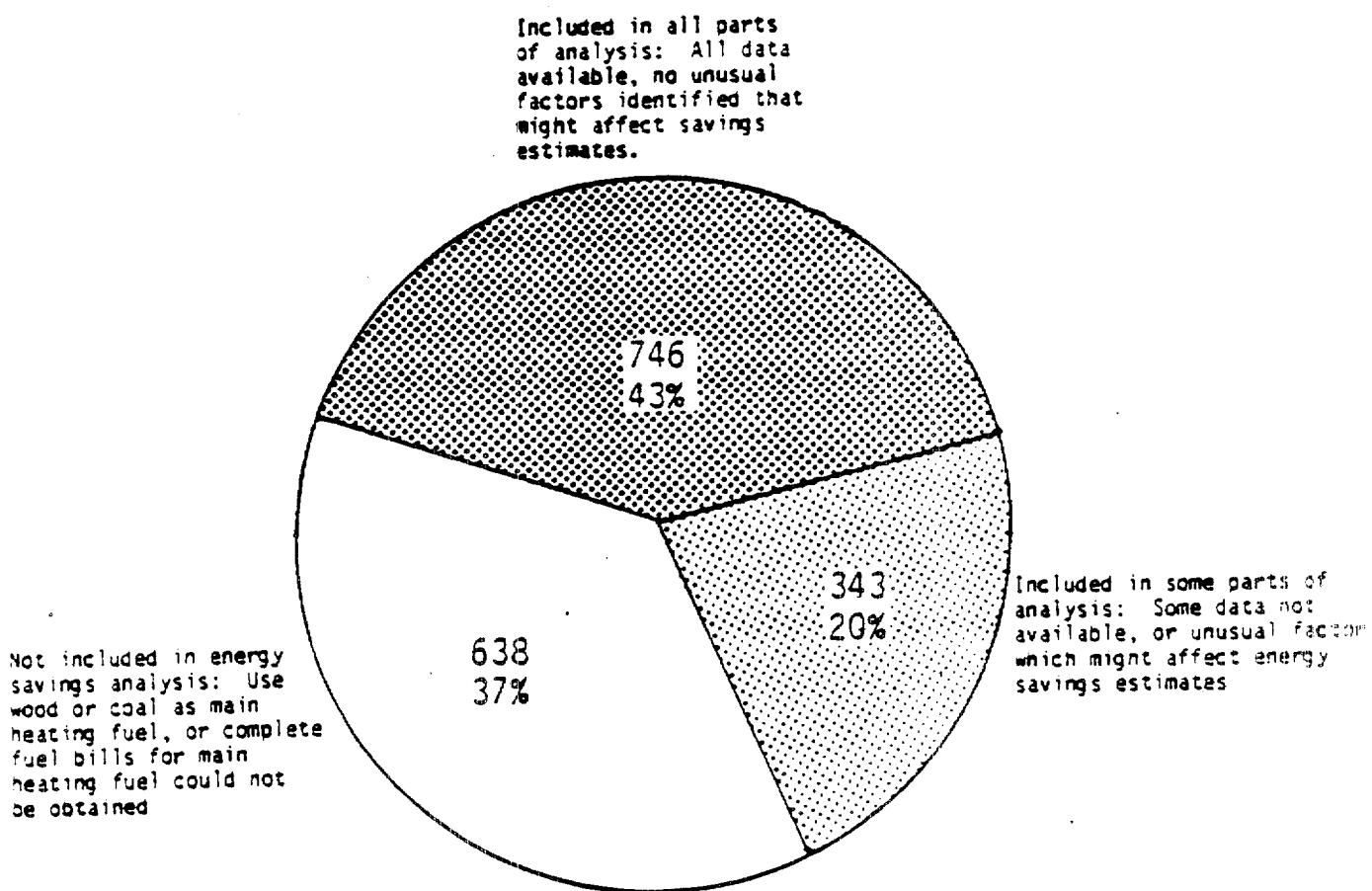


Table 4. Factors Affecting Use of Household Energy Consumption Data  
in Energy Savings Analysis

All Households in Base for Energy Savings Analysis	Complete Data Available for Total Energy Consumption	Complete Data Available for Main Heating Fuel, But Data Missing for at Least One Other Fuel
Total	1,089	965
No unusual factors related to energy consumption	A 840	B 746 94
One or more unusual factors related to energy consumption, but none related to consumption of main heating fuel	C 23	--
One or more unusual factors related to consumption of main heating fuel	D 226	E 196 30

### Main Findings on Savings from Weatherization

Four sets of findings on the savings from the weatherization program are presented. The first is the average savings for all households. Savings are expressed as a percent of total consumption, as a percent of consumption of the fuel used for space heating and as a percent of total space heating consumption. (The latter figure is the most significant since weatherization only affects space heating consumption.)

Second, the savings associated with different types of weatherization activities are examined. Then, the savings from weatherization for different subgroups of the population are considered. Finally, an estimate of the annual cost savings for the first year after the weatherization is complete is presented. This section of the report is concluded with an examination of the distribution of weatherization savings among individual households. The findings are discussed in greater detail in the Appendices.

#### Average Savings Due to Weatherization

Weatherized households saved an average of 14 million Btu of energy in the year following weatherization. Savings are in the range of 10 to 11 percent of use of the main home heating fuel. Average annual energy savings are presented in three ways in Figure 3.

- o Weatherized households saved 9.1 to 9.7 percent of total household energy consumption.  
These figures were based on utility and fuel supplier bills for all household uses of electricity, natural gas, fuel oil/kerosene, and LPG--depending, of course, on which of these fuels were used by the household. Wood or coal, when used as a supplemental heating fuel by the household, were not included in the base for these savings estimates.
- o Weatherized households saved 10.4 to 10.9 percent of total household use of the main home heating fuel.  
Uses of the fuel other than for home heating were usually included in the household bills used to calculate these savings estimates; for example, when natural gas was used as the household's main heating fuel, it was often used for hot water and cooking.
- o Weatherized households saved 13.1 to 13.7 percent, as an upper bound, of savings of the main home heating fuel specifically for home heating purposes.

Calculations of these figures differed from those for the figures above in an important way. Percentage savings for total household consumption and for total use of the main home heating fuel were based on total bills for fuels used by the household (all bills, and the bill for the main home heating fuel, respectively). Calculation of fuel

savings specifically for home heating purposes were necessarily based on a different procedure. A statistical model was used to estimate fractions of each fuel used for specific purposes--home heating, air conditioning (when used by the household), hot water, and other purposes.<sup>2</sup>

When applied in the calculation of fuel savings percentages, the calculations assumed that total savings of the home heating fuel were accounted for specifically by reduced use of the fuel for home heating purposes. The savings range of 13.1 to 13.7 percent must therefore be interpreted as an upper bound of fuel savings specifically for home heating purposes.

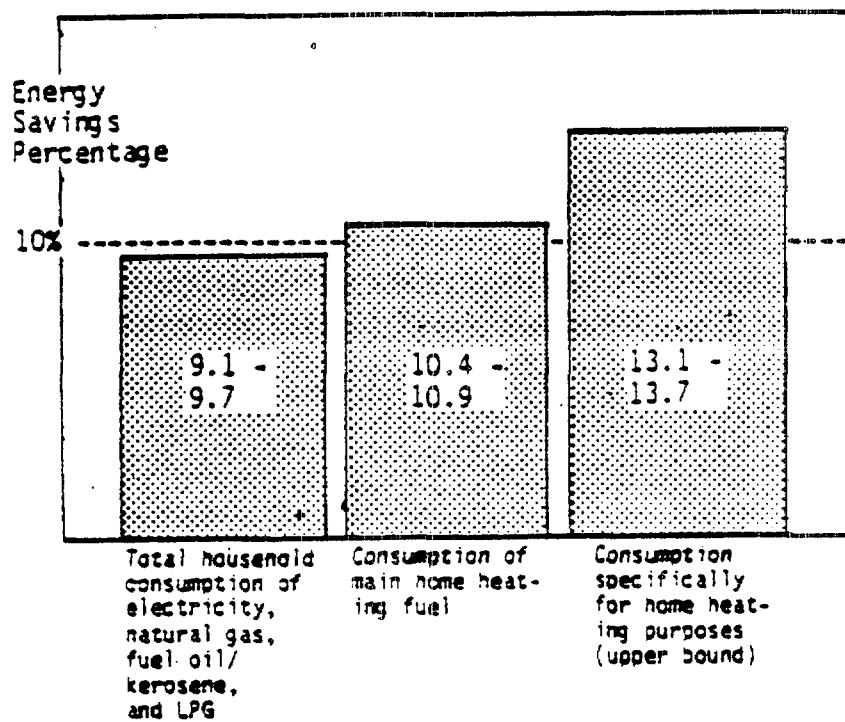
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<sup>2</sup>Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use, Energy Information Administration, DOE/EIA-0431, October 1983. See Appendix C for a discussion of the procedures that were followed to make the estimates of savings for home heating.

Percentages within each bar of Figure 3 show the range of results for four groups of households, defined in terms of completeness of fuel consumption data and other characteristics that might affect pre- and post-weatherization comparisons. The narrow range of percentages (for example, 10.4 to 10.9 percent savings of home heating fuel) demonstrates the relative stability of overall results among sets of households defined in different ways.

Results of one set of calculations are displayed in more detail in Table 5, based on all households for which estimates of total energy consumption (electricity, natural gas, fuel oil/kerosene and LPG) were available for both the pre- and post-weatherization annual periods.

Figure 3. Average Percentage of Energy Savings in Year Following Weatherization



Note on sampling error

The standard error of the percent savings figures shown in Figure 3 and Table 4 is approximately one percentage point. This means that the chances are 2 in 3 that the possible range of error due to sampling alone is no greater than one percentage point, plus or minus, around the percent savings figures observed for this sample of households. The chances are remote, about 1 in 20, that the sampling error is greater than two percentage points.

Table 5. Estimated Average Energy Consumption and Savings per Household for Year After Weatherization

	Total Energy Consumption	Total for Household's Main Heating Fuel	Use of Main Heating Fuel for Space Heat
Predicted consumption, year after weatherization (million Btu)	152.4	132.6	105.5
Actual consumption, year after weatherization (million Btu)	138.4	118.8	91.6
Average Savings (million Btu)	13.9	13.8	13.8
Percent savings	9.1	10.4	13.1

Unless otherwise noted, all remaining findings in this section were based on the sample of 1,965 households for which estimates of total energy consumption were available for both pre- and post-weatherization annual periods.

#### Savings Relative to Weatherization Cost

Energy savings of weatherized households are related to the type and cost of weatherization activity. Households that were insulated and in which storm windows or doors were installed saved most.

Community agencies generally reported multiple types of weatherization services to homes included in the study. The most frequent types of activity were weatherstripping or caulking (about 9 homes out of 10) and attic, wall, or floor insulation (about 8 homes our of 10). Just over half of the homes received storm windows or storm doors.

	<u>Percent of Homes</u>
Weatherstripping or caulking	91
Attic, wall, or floor insulation	81
Storm windows or doors	53
Other services (insulation of hot water heaters, repairs, etc.)	69

There were marked differences in post-weatherization energy savings for households who received different types of weatherization activity. As shown in Table 6, homes that were insulated in the weatherization program saved substantially more energy in the post-weatherization annual period than did homes that were not insulated. For homes that were insulated and in which storm doors or windows were installed, the energy savings were more than double the energy savings of homes that were not insulated. These significant differences in energy savings were observed in absolute number of Btu saved and in the percent savings.

A similar, although less dramatic, difference in energy savings was observed for homes differing in the cost of weatherization activity. Homes that received higher-cost weatherization services started at a higher pre-weatherization level of fuel consumption and experienced more energy savings, both in terms of the absolute number of Btu saved and in their percentage savings.

In terms of, the actual number of Btu saved, in homes for which the cost of weatherization materials<sup>3</sup> was \$400 or more, almost twice as many Btu were saved as in homes for which the cost of materials was less than \$400. The difference for percentage of savings is smaller because the actual amount of energy used by homes receiving higher-cost weatherization activity started at a higher level.

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<sup>3</sup>Most agencies reported costs for materials only because labor costs had not been calculated separately for each home. These findings excluded homes for which cost figures were reported for the total of both materials and labor.

Table 6. Energy Savings Related to Type and Cost of Weatherization Services

	Type of Weatherization Activity			
	Insulation Plus Storm Windows or Doors	Insulation No Storm Windows or Doors	No Insulation	Not Available
Number of homes <sup>a</sup>	402	395	153	15
Predicted consumption, year after weatherization (million Btu)	146.4	121.5	126.3	NA
Actual consumption, year after weatherization (million Btu)	128.6	108.7	119.1	NA
Average savings (million Btu)	17.8	12.8	7.2	NA
Percent savings	12.2	10.5	5.7	NA
	Cost of Weatherization (Materials Only)			
	Under \$400	\$400 or More	Not Available	
Number of homes	320	468	177	
Predicted consumption, year after weatherization (million Btu)	110.6	134.9	NA	
Actual consumption, year after weatherization (million Btu)	101.1	119.1	NA	
Average savings (million Btu)	9.5	15.9	NA	
Percent savings	8.6	11.7	NA	

<sup>a</sup>Figures are the actual number of homes in the sample on which the findings were based. Information needed to determine placement in columns of table was unknown for some households. For those households no data are given (NA).

### **Weatherization Savings by Population Subgroups**

The general pattern of post-weatherization energy savings are duplicated in all major subgroups of weatherized homes. Data summarized in Table 7 show savings in the main heating fuel for weatherized homes grouped by

- the main home heating fuel used by the household
- major weather zones
- heated square feet
- age of householder
- race of householder.

In each case, findings were within a percentage point or two of the 10 to 11 percent range for post-weatherization savings in the use of the main heating fuel for all weatherized homes.

Table 7. Average Energy Consumption and Savings per Household of the Main Heating Fuel for the Major Subgroups of Households

	Main Home Heating Fuel			
	Natural Gas	Fuel Oil/ Kerosene	LPG	Electricity <sup>a</sup>
Number of homes	568	183	71	43
Predicted average consumption, year after weatherization (million Btu)	150.2	113.9	80.8	61.0
Actual average consumption, year after weatherization (million Btu)	134.2	102.9	72.6	55.8
Average savings (million Btu)	16.0	11.0	8.2	5.2
Percent savings	10.7	9.7	10.2	8.5

	Heated Square Feet		
	Under 1,000	1,000 or More	Not Available
Number of homes	324	599	42
Predicted average consumption, year after weatherization (million Btu)	104.6	148.1	NA
Actual average consumption, year after weatherization (million Btu)	92.3	133.1	NA
Average savings (million Btu)	12.2	15.0	NA
Percent savings	11.7	10.2	NA

<sup>a</sup>The conversion of kwh of electricity to Btu did not include Btu used in the production of electricity; a conversion factor of 3,412 Btu/kwh was used.

Table 7. Average Energy Consumption and Savings per Household of the Main Heating Fuel for the Major Subgroups of Households  
 (Continued)

	Weather Zones		
	Cold Zones (5,500 or More Heating Degree Days)	Temperate Zones (Fewer than 5,500 Heating Degree Days)	
Number of homes	616	349	
Predicted average consumption, year after weatherization (million Btu)	150.4	104.4	
Actual average consumption, year after weatherization (million Btu)	135.6	92.0	
Average savings (million Btu)	14.8	12.4	
Percent savings	9.8	11.9	
<hr/>			
	Age of Householder		
	Under 65	65 and Over	Not Available
Number of homes	477	485	3
Predicted average consumption, year after weatherization (million Btu)	147.3	119.6	NA
Actual average consumption, year after weatherization (million Btu)	133.3	105.7	NA
Average savings (million Btu)	14.1	13.9	NA
Percent savings	9.5	11.6	NA

Table 7. Average Energy Savings per Household for Major Subgroups of Households (Continued)

	Race of Householder		
	White	Black	Not Available
Number of homes	698	248	19
Predicted average consumption, year after weatherization (million Btu)	121.6	170.3	NA
Actual average consumption, year after weatherization (million Btu)	109.0	151.2	NA
Average savings (million Btu)	12.6	19.2	NA
Percent Savings	10.4	11.2	NA

#### Energy Cost Savings from Weatherization

Annual cost savings for the main home heating fuel at 1981-1982 prices averaged \$71 per weatherized home. Weatherized households paid an average of \$643 for their main home heating fuel in the year following weatherization (including all or most of the winter of 1981-1982). This was \$71 less than the predicted average of \$714 if no weatherization activity had taken place. The figures in Table 8 for percentage of cost saved are close to those shown earlier for percentages of Btu saved for each of the four main heating fuels.

When related to the cost of weatherization materials, dollar savings vary in rough proportion to costs (Table 9). Homes for which costs were \$400 or higher for materials only (average cost for this group is \$510) saved an average of \$88 in the year after weatherization. Homes for which costs were under \$400 (average cost for this group was \$220) saved an average of \$46 in the year after weatherization.

Table 8. Average Cost Savings per Household for the Main Home Heating Fuel of Weatherized Households

	Main Home Heating Fuel				
	All Homes	Natural Gas	Fuel Oil/ Kerosene	LPG	Electricity
Number of homes <sup>a</sup>	959	666	182	71	40
Predicted average consumption, year after weatherization	\$714	\$631	\$1,010	\$656	\$854
Actual average consumption, year after weatherization	\$643	\$568	\$ 912	\$585	\$781
Average savings (million Btu)	\$ 71	\$ 63	\$ 98	\$ 71	\$ 73
Percent savings	9.9	10.0	9.7	10.8	8.5

<sup>a</sup>The number of homes represented in this table is slightly smaller than in Table 6 because energy price data were not available for six households.

Table 9. Average Cost Savings per Household for the Main Home Heating Fuel Related to the Costs of Weatherization Services

	Cost of Weatherization (Materials Only)		
	Under \$400	\$400 or More	Not Available
Number of homes	317	466	182
Predicted cost, year after weatherization	\$627	\$760	NA
Actual Cost, year after weatherization	\$581	\$673	NA
Average savings	\$ 46	\$ 88	NA
Percent Savings	7.3	11.6	NA

#### Distribution of Consumption Changes per Household

The main findings presented in the preceding section were estimates of savings due to weatherization based on the average consumption changes for groups of households. Individual households had consumption changes that varied around the average. The distribution of changes in consumption per household of the main heating fuel is shown in Figure 4.

About 77 percent of weatherized homes used less of their main home heating fuel in the post-weatherization annual period than they did in the pre-weatherization period after adjusting for weather and household composition.<sup>3</sup> The remaining 23 percent of households used more of their main heating fuel. Slightly more than half of weatherized homes (53.8 percent) experienced savings in the range between 0 and 20 percent. There were, as noted above, many reasons apart from weatherization for variation in consumption from one year to the next, even after adjustments had been made for weather differences and differences in household composition. Some households may have changed the pattern of use of their home heating fuel between the pre- and post-weatherization periods. Indicated increases in fuel use may reflect higher thermostat settings for additional comfort or other changes in the way the home was used even by the same number of people.

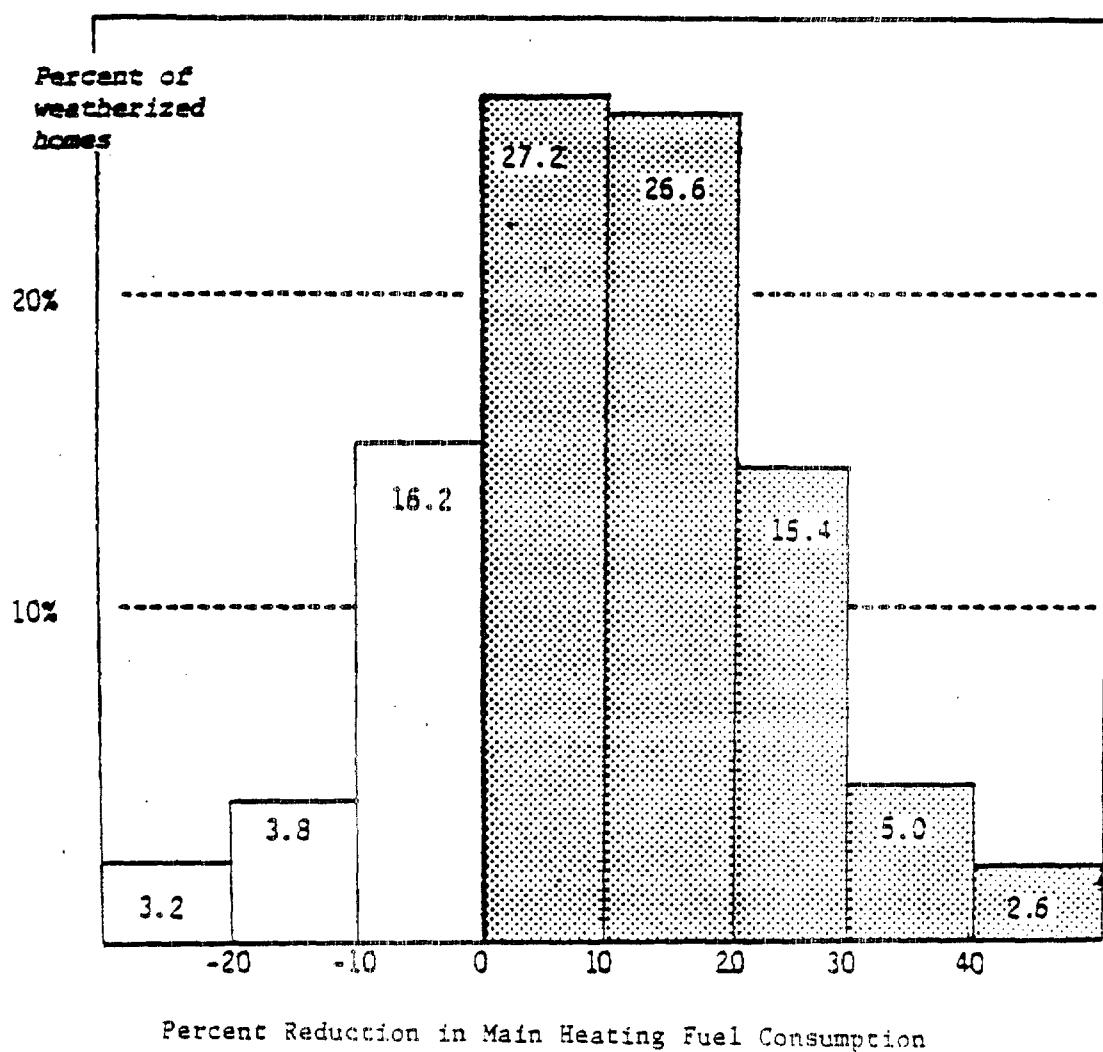
Measurement problems related to fuel consumption or weather patterns may also affect the findings for individual homes. Some fuel bills were based on estimated rather than actual consumption.<sup>4</sup> If the estimates occurred at the beginning or end of an annual period, some fuel consumption may have been inappropriately assigned to an annual period in which it did not occur. The overall weather pattern for an area which included many weatherized homes may not have exactly fit the specific conditions that prevailed for some individual homes. Measurement errors may affect savings estimates for individual homes by a number of percentage points but would be expected to have no more than a trivial effect on overall averages. For those reasons, consumption changes for individual homes were not as useful as overall averages for estimating the effectiveness of the weatherization program.

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<sup>3</sup> These findings were based on homes using natural gas or electricity as their main space heating fuel. In general, consumption of those fuels was established for specific calendar periods between meter readings. Findings for fuel oil/kerosene and LPG included a higher proportion of extreme variations from year to year because delivery records did not exactly match the period during which the fuels were consumed.

<sup>4</sup> "Estimated consumption" in this context refers to estimates made by utility companies for billing purposes when actual meter readings were not available.

Figure 4. Percent Reduction in Main Heating Fuel Consumption of Individual Homes, Natural Gas and Electricity Only



**APPENDIX A**  
**Supplemental Tables**

Table A1. Reasons for Dropping Households from Portions of Energy Savings Analysis

	Households in Study Sample	
	Number	Percent
Total Households in Sample	1,727	100.0
Households dropped from all parts of analysis	<u>638</u>	<u>36.9</u>
Did not live in home for at least 12 months prior to weatherization	49 <sup>a</sup>	2.8
Wood or coal is main heating fuel	201	11.7
Changed main heating fuel during period covered by study	54	3.1
Incomplete or missing consumption data for main heating fuel	334	19.3
Total number of households for which main heating fuel consumption estimates were available (groups A + B + C + D + E in Table 4, page 16)	1,089	63.1
Households with missing or incomplete data for one or more fuels other than main heating fuel (groups B + E in Table 4, page 16)	124	7.2
Households with data available for total energy consumption; one or more unusual factors related to energy consumption (groups C + D in Table 4, page 16)	<u>219</u>	<u>12.7</u>
Data not available for annual period as normally defined for year before and/or after weatherization <sup>b</sup>	61	3.5
Household used one or more cords of wood as supplemental heating fuel in year prior to interview	49	2.8

Table A1. Reasons for Dropping Households from Portions of Energy Savings Analysis (Continued)

	Households in Study Sample	
	Number	Percent
Changes in air conditioning and/or in hot water fuel during period covered by study	50	2.9
Some household fuel bills include nonhousehold uses of energy (farm, business, or nonhousehold recreational uses)	10	0.6
Changes in heated or total square feet during period covered by study	13	0.8
Incomplete or missing square feet measurements	36	2.1
Number of households in all parts of energy savings analysis (group A in Table 4, page 16)	746	43.2

<sup>a</sup>Number of households to which reasons apply are mutually exclusive; i.e., a household dropped for a reason listed closer to the top of the table is not duplicated in the count for a reason listed later in the table.

<sup>b</sup>See technical discussion in Appendix C.

Table A2. Energy Consumption and Savings Estimates for Household Groups Defined by Factors Affecting Energy Consumption Data

	Total Energy Consumption	Main Heating Fuel for Households	Use of Main Heating Fuel for Space Heat
<u>Maximum number of households (1,089) for which main heating fuel estimates were available--Groups A + B + C + D in Table 4, page 16.</u>			
Predicted consumption, year after weatherization (million Btu)	n.a	133.1	106.0
Actual consumption, year after weatherization (million Btu)	-	118.7	91.6
Average savings (million Btu)	-	14.3	14.3
<hr/>			
Percent savings	-	10.8	13.5
<hr/>			
<u>Maximum number of households (965) for which total energy consumption estimates were available--Groups A + C in Table 4.</u>			
Predicted consumption, year after weatherization (million Btu)	152.4	132.6	105.5
Actual consumption, year after weatherization (million Btu)	138.4	118.8	91.6
Average savings (million Btu)	13.9	13.8	13.8
<hr/>			
Percent savings	9.1	10.4	13.1
<hr/>			

Table A2. Energy Consumption and Savings Estimates for Household Groups Defined by Factors Affecting Energy Consumption Data (Continued)

	Total Energy Consumption	Total for Households'	Use of Main Heating Fuel for
		Main Heating Fuel	Space Heat
<u>Minimum number of households (863) for which main heating fuel estimates were available, excluding those with unusual factors that might affect energy savings estimates--Groups A + B in Table 4.</u>			
Predicted consumption, year after weatherization (million Btu)	n.a.	130.1	4.0
Actual consumption, year after weatherization (million Btu)	-	116.5	90.3
Average savings (million Btu)	-	13.6	13.6
Percent savings	9.1	10.5	13.1
<u>Minimum number of households (746) for which total energy consumption estimates were available, excluding those with unusual factors that might affect energy savings estimates--Group A only in Table 4.</u>			
Predicted consumption, year after weatherization (million Btu)	149.4	130.3	103.4
Actual consumption, year after weatherization (million Btu)	135.0	116.1	89.3
Average savings (million Btu)	14.4	14.2	14.2
Percent savings	9.6	10.9	13.7

Table A3. Percent of Households by Percentage of Main Heating Fuel Saved in Individual Homes During Post-Weatherization Period, by Main Heating Fuel

Fuel Savings Percentage	Natural Gas or Electricity	Fuel Oil/Kerosene or LPG
Number in sample	(711)	(254)
Below -20.0	3.2	13.2
-20.0 to -10.1	3.8	5.7
-10.0 to - 0.1	16.2	13.9
0.0 to 9.9	27.2	17.8
10.0 to 19.9	26.6	19.2
20.0 to 29.9	15.4	11.1
30.0 to 39.9	5.0	7.8
40.0 or above	<u>2.6</u>	<u>11.3</u>
Total	100.0	100.0

Note: Natural gas and electricity are metered fuels; actual billing periods were used to estimate savings in the post-weatherization annual period. Fuel oil/kerosene and LPG estimates are based on the time periods during which deliveries were made to households. The amount of fuel actually consumed within an annual period may be different from the amount of fuel delivered to the household during that period, depending on the beginning and end of period inventories of fuel on hand.

### Sampling Error of Energy Savings Estimates

An approximation of the sampling error of observed savings in energy consumption was computed for the percentage savings in consumption of main home heating fuel. The approximation was based on the sample of households ( $n=965$ ) for which estimates of total energy consumption were available for both the pre- and post-weatherization periods. Average percentage savings were computed for each Primary Sampling Unit (PSU) in the national sample for which savings estimates were available for 30 or more households; PSU's with fewer than 30 households were grouped into weather zones as follows:

Less than 4000 HDD

4000 - 5499 HDD

5500 - 7000 HDD

More than 7000 HDD

Sixteen average savings figures were produced in this way: 12 for individual PSU's and 4 for the remaining PSU's in the sample grouped by weather zones. The minimum of 30 households established for computation of the figure for an individual PSU was intended to provide a reasonable level of stability to the computations. The use of PSU's and PSU groups for the computations reflects the actual cluster sampling design. Systematic random procedures were used to select households within each PSU. The selected households in each PSU were the ultimate clusters.

The 16 observations of percentage savings estimates for PSU's and PSU groups were distributed as follows:

<u>Percentage Savings of Main Home Heating Fuel</u>	<u>Number of PSU's or PSU Groups</u>
4.0 - 5.9	1
6.0 - 7.9	1
8.0 - 9.9	4
10.0 - 11.9	6
12.0 - 13.9	1
14.0 - 15.9	2
16.0 - 17.9	0
18.0 - 19.9	<u>1</u>
Total	16
Mean = 10.8	Standard Deviation = 3.4

Computed in this way, the approximate standard error of the average percent savings figure is 0.9 percentage points.

**APPENDIX B**

**Data Collection Procedures**

## DATA COLLECTION PROCEDURES

### Selection of Sample Households

The universe for this study included, with some restrictions, single-family homes (including mobile homes) in the United States for which work under the low-income weatherization assistance program was completed during calendar year 1981. The restrictions to this definition were:

- o homes weatherized under the low cost/no cost provisions of the program (weatherization costs under \$50) were excluded
- o homes in Hawaii were excluded because available records indicated that few, if any, homes had been weatherized under the program
- o homes were excluded from the universe if families occupying the housing unit at the time weatherization work was completed had moved prior to data collection for this study in April and May 1983.

Probability procedures were used at all stages of sample selection. The starting point was a subset of 29 of the 131 PSU's used for the Residential Energy Consumption Surveys (RECS) for 1980 through 1982. To construct the RECS sample, the 3,141 counties and independent cities in the 50 States and the District of Columbia were divided into 1,782 PSU's on the basis of Standard Metropolitan Statistical Areas (SMSA), county and independent city boundary lines, and population characteristics. The PSU's were grouped into 131 strata for the RECS sample and one PSU was selected from each stratum. To select the subset of 29 PSU's for this study, the 131 PSU's were regrouped into 25 master strata based primarily on geographic region and metropolitan or nonmetropolitan status. Probability procedures were then used to select two PSU's from each of four nonmetropolitan master strata outside the South, and to select one PSU from each of the other 21 master strata. Differences in the numbers of PSU's selected from the 25 master strata were intended to reduce the variation in weights that would be needed to produce overall national estimates for the low-income weatherization study.

In one of the original 29 PSU's selected for the study, the only agency implementing the weatherization program during 1981 was unable to provide names of participants. Because of the importance of representing each stratum in the sample, a substitute PSU was drawn from the same master stratum.

The 29 PSU's were the sample areas from which weatherized homes were selected. Sample areas were composed of 111 counties, including one or more counties in each of 24 States and the District of Columbia.

Selection of specific homes within sample areas included the following steps.

- o Starting in late 1982, state energy assistance offices were contacted to compile a complete list of community agencies that administered the low-income weatherization program in 1981 in sample counties.
- o Each community agency was contacted by mail and telephone to obtain overall information on the total number of homes weatherized in 1981.
- o Systematic random sampling procedures were used to select a sample of homes weatherized in 1981 from the records of each agency. This selection procedure was entirely controlled by the EIA contractor.

Of the total of 108 agencies contacted, 96 participated in the study by providing access to their records. Information on weatherized households obtained from these agencies included, when available, the names, addresses, and telephone numbers of residents, types of living quarters (single- or multiple-family), cost of weatherization services, whether costs covered materials only or also included labor, the types of weatherization improvements to the home, and dates of the weatherization work.

Agencies that were unable or unwilling to provide access to their records were generally those who weatherized very few homes in 1981 and in some cases were no longer in existence. Fewer than 5 percent of all homes weatherized in 1981 were accounted for by these nonparticipating agencies.

Procedures for the selection of specific households from agency records were designed to place control of this step in the hands of the research staff carrying out the study. Two procedures were used for the selection of records from agency files:

- o 51 agencies, generally those with fewer than 150 homes weatherized in 1981, were asked to provide information on all homes weatherized during that year
- o 45 agencies were visited and a systematic random sample of weatherized homes were selected from the agency files. This group included 39 agencies who had weatherized 150 or more homes in 1981, plus 6 others who requested assistance in compiling information on weatherized homes from their records.

Approximately 4,500 homes were included in this first selection from agency records. An additional systematic random sampling step reduced the sample to approximately 3,000 homes for which telephone screening contacts were then attempted to check addresses provided by agencies and to determine whether weatherized units were still occupied by families living in the units at the time the weatherization work was completed.

A final sampling step reduced the number of housing units selected for personal contact to 2,159. Homes that could not be contacted by telephone were retained in the sample but were sampled at a lower rate than homes that had been screened by telephone.

#### Household data collection

The 2,159 homes selected in the final sampling step were visited by interviewers during April and May 1983. Interviewers found that 78 units were either no longer used for dwelling purposes, or were not habitable, or were not single-family dwellings. Of the 2,081 remaining housing units, 70 were ineligible due to vacancy and 118 were ineligible because they were no longer occupied by the family who lived in the home at the time of weatherization. Personal interviews were completed during April and May 1983 at 1,727 of the 1,893 eligible units, for a response rate of 91.2 percent.

#### The Interviewers

A total of 102 interviewers completed one or more personal interviews for this study. Each interviewer conducted an average of 17 interviews. The most interviews completed by one interviewer was 44.

Somewhat over half (57) of the interviewers had worked on earlier RECS assignments. Those who had not worked on RECS assignments were trained in one-day regional meetings or, in a few cases, were trained individually by an experienced interviewer or supervisor.

#### The Interview

The average personal interview lasted 58 minutes with 85 percent of the interviews lasting between 35 and 80 minutes. The interview with the householder (or his or her spouse) covered structural features of the house related to energy, such as insulation, doors, and windows; the heating and cooling systems and the fuels used in these systems; use of wood; energy conservation efforts; household appliances; receipt of government assistance for the cost of heatings; and demographic data on household members.

At the end of the interview, respondents were asked to sign a waiver authorizing the contractor to obtain records of energy consumption from the housing unit's energy supplier(s). At this time, the interviewer also measured the dimensions of the housing unit, using a retractable 50-foot metal tape measure, and recorded the dimensions on a rough-drawn diagram of the floor plan.

### Weighting Procedures

Weights were used in developing estimates from the survey data. The weight for each sample household reflects the probability of selection of that household and an additional adjustment to help correct for potential biases arising from the failure to contact all survey units.

The procedure included calculation of a basic assignment weight as follows for each sample household:

$$\text{BASIC ASSIGNMENT WEIGHT} = \text{PSUWT} * \text{NFIRST} * \text{NSECOND} * \text{NTHIRD}$$

$$\text{PSUWT} = \frac{\text{Total 1978 population in stratum group}}{\text{Total 1978 population in PSU}}$$

is the inverse of the probability with which a sample PSU was chosen.

NFIRST is the inverse of the probability of selection in step 1  
(selection of households from agency lists)

NSECOND is the inverse of the probability of selection in step 2  
(selection in central office for inclusion in telephone screening phase)

NTHIRD is the inverse of the probability of selection in step 3  
(selection after phone screening for field interviewer contact)

A nonresponse weight was computed for households in each PSU, separately for those households for which telephone screening contacts were successfully completed and for those households for which telephone screening contacts were not completed.

$$\text{NR WEIGHT} = \frac{\text{Number of eligible households in assigned PSU for field contact}}{\text{Number of completed interviews in PSU}}$$

The final weight for each household was equal to

$$\text{BASIC ASSIGNMENT WEIGHT} * \text{NONRESPONSE WEIGHT}$$

### Fuel Supplier Survey

The overall objective of the fuel supplier survey was to provide data on which to estimate the pre- and post-weatherization fuel consumption and expenditures of the weatherized households. Four utility fuels were covered in the survey--electricity, natural gas, fuel oil, and LPG.\* For each of the fuels, the goal was to obtain complete consumption records for the three-year period January 1, 1980, through December 31, 1982.

Toward the end of the household interview, each household reported for each use of the fuel, whether or not the fuel was paid for by the household, included in the rent, or paid another way. For those households that paid directly, the respondent was asked for the names, addresses and telephone numbers of the fuel companies supplying the household; these respondents were also asked to sign a waiver, authorizing consumption data to be collected from the suppliers.

Altogether the fuel supplier survey included initial contact attempts with 574 companies. The number of companies in the survey supplying each fuel and the total number of households supplied are shown in Table B1.

Table B1. Companies in Fuel Supplier Survey and Number of Households Supplied

Fuel Supplier	Number of Companies <sup>a</sup>	Number of Survey Households Supplied <sup>b</sup>
Electricity . . . . .	97	1,647
Natural Gas . . . . .	56	989
Fuel Oil or Kerosene. . . .	325	485
LPG . . . . . . . . .	132	337

<sup>a</sup>The total number of companies in the survey was 574. Those included 15 that supplied both electricity and natural gas; 1 that supplied natural gas and LPG; and 20 that supplied fuel oil and LPG.

<sup>b</sup>These figures represent the number of households that signed an authorization form and that paid directly to the utility company for all uses of the fuel. Excluded are 6 fuel oil households and 6 LPG households supplied by unknown companies.

\*Households using LPG for outdoor cooking grills only were not included in the LPG data collection; LPG used by these households is excluded from consumption and expenditures estimates.

Data collection for the fuel supplier survey began in May 1983 and continued through August 1983. Procedures for electricity and natural gas companies included at least the following steps:

- o An initial letter from the Administrator of the Energy Information Administration, addressed to the president or other official in the company outlining the general nature of the request for participation. The letter also announced that a telephone contact would be made to determine the name of the person to whose attention the survey materials should be sent. Enclosures in the letter included a printed statement entitled "About the Survey of Households Receiving Low-Income Weatherization Assistance," specimen copies of reporting and authorization forms, and a postage-paid postcard with a check-list of available publications and data tapes.
- o The telephone contact referred to in the initial letter.
- o The mailing of survey materials to the person named as contact person.
- o A follow-up telephone contact a few days later to answer questions or discuss survey procedures as necessary.
- o Completed forms or copies of records returned by mail.
- o A letter from the EIA thanking the company for its effort.

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

Procedures for fuel oil or kerosene and LPG dealers were the same as for electric and natural gas companies up through and including the mailing of survey materials to the company person named as the contact. Those companies, however, often had only one or two households for which information was to be supplied, and data collection was generally completed by telephone. An earlier pretest of the procedure had indicated a somewhat greater likelihood that companies would respond by telephone rather than as a result of a request to complete and return the forms by mail. Companies that chose to return the forms by mail, however, were not discouraged from doing so. After the company returned the information, additional contact with companies and households was sometimes required to identify the correct record in the company files.

#### Energy Consumption Records

The fuel supplier survey was conducted for households that paid their own fuel bills directly to the supplier and authorized access to their records. Households lacking consumption records because they did not pay

bills directly to suppliers are fewer than 2 percent of survey households for each of the four fuels (see Table B2). Between 3 and 5 percent of the households for the four fuels did not sign authorization forms (access to records denied).

Table B2 shows that complete and usable records were much more often received for electricity and natural gas consumption than for use of fuel oil or kerosene and LPG. Some dealers supply fuel oil, kerosene, and LPG on a cash-and-carry basis and simply do not keep records of individual purchases by households, or do so only for a limited period of time. Also, households may change their source of supply for fuel oil, kerosene, and LPG, leading to additional difficulties in reconstructing a record spanning the more than 2 years required for the comparison of pre- and post-weatherization fuel consumption. In some instances, companies who formerly supplied fuel oil, kerosene, or LPG to survey households were no longer in business at the time of data collection for this study.

For electricity and natural gas, the most frequent reason for unusable records was that companies were not able to retrieve information for individual households for the full period needed to compare pre- and post-weatherization fuel consumption. Among the records received from electric and natural gas utility companies and classified as unusable, more than two-thirds were complete for the post-weatherization annual period but not for the year before weatherization.

Table B2. Energy Consumption Records and Missing Data for Survey Households Using Electricity, Natural Gas, Fuel Oil or Kerosene, or LPG (Percentage of Households Using the Fuel)

Survey Households	Electricity	Natural Gas	Fuel Oil or Kerosene	LPG
Total Households Using the Fuel .....	100.0	100.0	100.0	100.0
(Sample Number) .....(1,725)		(1,031)	(514)	(367)
Usable Records Received From Fuel Supplier <sup>a</sup> .....	86.7	80.0	49.2	59.9
Unusable Records Received from Fuel Supplier .....	7.5	14.4	26.3	21.3
Household Pays Directly to Supplier--No Records Available for the Household .....	4.5	4.2	23.3	16.9
Household Not Identified in Company Records .....	1.3	1.6	17.7	10.4
Company Refused to Participate .....	*	*	1.1	0.3
Company Unknown or Not Located .....	*	*	1.2	1.6
Authorization Form Not Signed .....	3.2	2.6	3.3	4.6
Fuel Used Included in Rent or Paid in Other Way .....	1.3	1.4	1.2	1.9

<sup>a</sup>Records were considered usable if they covered a full year segment in both the pre- and post-weatherization annual periods.

<sup>b</sup>Includes households with mixed payment methods: one or more uses of a specified fuel paid directly to a supplier, and other uses included in rent or paid in other way.

\*Represents or rounds to zero.

**APPENDIX C**

**Procedures for Data Adjustment**

## ESTIMATE OF ANNUAL CONSUMPTION FOR THE YEAR BEFORE AND THE YEAR AFTER WEATHERIZATION

The month during which weatherization was completed was known for virtually all housing units in the sample (1717 of 1727 or 99.4 percent). Any comparison of preand post-weatherization fuel consumption that attempts to estimate savings should try to avoid contamination of the estimated before/after change by excluding consumption data for a time interval that immediately surrounds the date of weatherization. By "backing off" in both directions from the month of weatherization to construct the before and after consumption estimates two difficulties are avoided:

- o uncertainty as to the exact period of weatherization activity
- o possible unusual consumption activity just before, during, or just after the accomplished weatherization.

On the other hand, the above objective must be balanced against the difficulty of obtaining actual billing information for a long time span. By "backing off" too much, the billing data simply may not exist for the construction of annualized estimates.

The strategy decided upon for this analysis established a three-month buffer zone centered on the month in which weatherization was completed by backing off one month before and one after. For example, if the weatherization month was June 1981, the period of May through July 1981 was regarded as a buffer zone. Pre-weatherization consumption was then estimated from billing data for the period May 1, 1980 to April 30, 1981, and post-weatherization consumption from data for the period August 1, 1981 to July 31, 1982. It is obvious that exact billing data for these two annual periods were typically unavailable.

The following paragraphs outline the specific rules used to approximate before and after annualized consumption, while observing the three-month buffer zone centered on the weatherization month insofar as possible.

If billing data were deficient to the extent that an approximate "before" annualized consumption over a time interval that respects the three-month buffer was impossible, an approximation over the time interval April 1, 1980 to March 31, 1981, was attempted. Similarly for an "after" consumption an approximation was attempted with April 1, 1981 to March 31, 1982, as the substitute time interval. These alternative standard year intervals were chosen because they reflected the survey periods for RECS.

Data from the continuing national RECS survey are used throughout this analysis. They establish baseline statistics; they furnish models that allow adjustment of the weatherized sample measurements to altered conditions of weather, household demographics, and housing unit characteristics; and they are used in various ways as comparison data from a pseudo control group. For each RECS survey, annualized fuel

consumption is always reported and estimated for the "standard year" April 1 to March 31: RECS1 data is for April 1, 1980 to March 31, 1981, and RECS2 data is for April 1, 1981 to March 31, 1982.

Since the median month of weatherization completed is May 16 to June 15, the typical three-month buffer zone mentioned above is April 16 to July 15, so that the typical "before" and "after" annual periods described above are April 16, 1980 to April 15, 1981, and July 16, 1981 to July 15, 1982, respectively. Very roughly then, the RECS1 standard year may be viewed as a most reasonable approximation to the "before" period that we wish to represent pre-weatherization consumption, and the RECS2 standard year as a less reasonable, but still acceptable, approximation for the "after" period that we wish to represent post-weatherization consumption.\*

#### Rules for Defining Time Segments and Annualized Estimates for Electricity and Utility Gas Bills

Four time segments were defined, each encompassing a period of close to 365 days for which bills were available and subject to the constraint dates shown below. Segments 3 and 4 correspond to the pre- and post-weatherization periods surrounding the three-month buffer zone centered on the weatherization month. Segments 1 and 2 correspond to the RECS1 and RECS2 standard year intervals.\*\*

#### Constraint Dates

	Preferred Beginning or Ending Date	Must Begin on or After	Must End on or Before
Segment 1	Begin 040180	111579	063081
Segment 2	Begin 040181	111580	073082
Segment 3	End WMB-01	111579	WMB-15
Segment 4	Begin WMA2-01	WMA-16	021583

Here and throughout, WMB denotes the month prior to, WMA the month following, and WMA2 second month following the month in which weatherization was completed.

The number of days within the constraint days for which billing data were available (counting the first and last days each as one-half day) were determined first. If less than 330 days of data were available within

\*This logic is silly with respect to individual cases but is correct for aggregated data. Note that, if it is assumed that weatherization leads to consumption savings or at least to no change in consumption for most cases, then any bias introduced by the use of the RECS standard time intervals for a certain percentage of cases is in the direction of a reduced estimate of average savings for the entire group.

\*\*Throughout the analysis, segments 3 and 4 data were used whenever available. Segment 1 or 2 data were used only when segment 3 or 4 data were respectively unavailable. No case was used for any portion of the analysis if either segments 1 and 3 were both unavailable, or segments 2 and 4 were both unavailable.

the constraint period, then no annualized estimates for consumption or cost were attempted or reported for that segment. If 330 to 380 days of data were available within the constraint period, annualized consumption and cost were estimated by scaling all available data to a 365-day period, as described below. If more than 380 days of data were available within the constraint period, a procedure was followed that attempted to reduce the period of available data to the range of 351 to 380 days, while observing the preferred beginning or ending date insofar as possible; the resultant period was then scaled to a 365-day period.

Redefining periods of greater than 380 days:

The exact procedure for accomplishing this depended upon the segment involved.

Segment 1: Within the 381+ days for which bill data were available, the beginning date closest to April 1, 1980, was noted. From that beginning date, the number of days available through the ending date that occurred on or before the final constraint date (June 30, 1981) was determined. If this number of days was greater than 350, bills were cumulated in chronological sequence, starting at the beginning date noted above, until the total days covered just exceeded 350. If this number of days was 350 or less, bills were cumulated in reverse chronological sequence, starting with that bill whose ending date was closest to, but not later than, June 30, 1981, until the total days covered just exceeded 350.

Segment 2: Same procedure as for Segment 1, but with April 1, 1981, as the preferred beginning date, and June 30, 1982, as the final constraint date.

Segment 3: Bills were cumulated in reverse chronological sequence, starting with the bill whose ending date was closest to WM8-01, until the total days covered just exceeded 350.

Segment 4: Bills were cumulated in chronological sequence, starting with the bill whose beginning date was closest to WMA2-01, until the total days covered just exceeded 350.

Scaling to 365-day estimates:

For each case with 330+ days of data available within the constraint period, annualized consumption, cost, and heating and cooling degree days were estimated through adjustment of the appropriate totals for the beginning and ending billing periods. Let  $D = 365 - (\text{elapsed days for the available data span})$ ; if 381+ days were originally available within the constraint period, the available data span refers to the redefined subperiod of 351+ days as described above. Quantity, cost, and degree days for beginning and ending billing periods within the available data span were adjusted by using the multiplier ratios

$$\frac{\text{Actual Days in Billing Period} \times 0.5}{\text{Actual Days in Billing Period}}$$

Adjusted amounts for the beginning and ending periods were added to the actual amounts for intervening periods to yield annualized totals. (Note to reader: throughout this text, the \* in formulas means multiply.)

#### Rules for Defining Time Segments and Annualized Estimates for Fuel Oil/Kerosene and LPG Bills

Four time segments were again defined, each encompassing a period of exactly 365 days.

	Beginning and Ending Dates	Alternative Beginning and Ending Dates
Segment 1	040180 - 033181	none
Segment 2	040181 - 033182	none
Segment 3	WMB-01, 1980 - last day of WM82, 1981	WM-01, 1980 - last day of WMB, 1981
Segment 4	WMA2-01, 1981 - last day of WMA, 1982	WMA-01, 1981 - last day WM, 1982

Each billing record for fuel oil/kerosene or LPG specifies a starting date (always the first day of a month) and an ending date (always the last day of a month). This billing record may be interpreted as a complete record of purchases for the set of months encompassed by the starting and ending dates. Thus, any specified month is either totally covered by, or totally excluded from, the billing period.

For each of the four segments, we determined whether the billing record was complete for at least the 365-day period spanned by the beginning and ending dates for that segment. If not, no annualized estimates for consumption or cost were attempted or reported for that segment. If completed consumption and cost were summed for all deliveries occurring within the 365-day period; and heating degree days were summed for this same 365-day period.

If, for Segments 3 or 4, the billing period was incomplete for the year period spanned by the beginning and ending dates for that segment, we determined whether the billing record was, nevertheless, complete for the period spanned by the alternative beginning and ending dates. If now complete, consumption, cost, and heating degree days were summed over this alternate period.

## POST-WEATHERIZATION ADJUSTMENTS AND DEVELOPMENT OF END-USE FRACTIONS

The most basic component of any analysis must surely involve a comparison of annualized consumption in the pre- and post-weatherization periods. A naive and tempting estimate of percent savings is simply

$$\text{SAVINGS} = \frac{\text{pre-weatherization consumption} - \text{post-weatherization consumption}}{\text{pre-weatherization consumption}}$$

The problem with this approach, however, is immediately obvious. No account is taken of the fact that weather conditions and household composition can and do vary from year to year.

The winter heating requirements for a given housing unit can easily vary by as much as ± 10 to 15 percent for successive years (using heating degree days, say, as the index of space heating fuel consumption). A household with pre-weatherization consumption equal to post-weatherization consumption would show SAVINGS = 0 according to the simple estimate above. It is quite likely, however, that if space heating requirements for this case accounted for more than 50 percent of overall consumption, and if heating requirements were 10+ percent greater for the post-weatherization year, the household had, in fact, conserved at the 4 to 7 percent level. Even at the aggregated level, the shift in average heating requirements from pre- to post-weatherization periods was at the +3 percent to +6 percent level: this suggested that the above estimate for SAVINGS would be a biased underestimate by several percentage points.

The number of persons in a household directly affects overall energy consumption in several measurable ways, particularly through the demand for hot water and the intensity of minor appliance usage. The above estimate for SAVINGS takes no account of shifts in household size, so that both individual and aggregate estimates would still manifest bias even if conditions of weather were assumed comparable. The bias would, of course, be smaller here because the energy requirements for hot water and minor appliance usage represent a much smaller fraction of the total energy requirements than those for space heating. Weatherized units show an average 3 to 4 percent decline in number of persons and a 7 percent increase in the number of single-person households in the post-weatherization period. Altogether this would yield an overestimate for SAVINGS.

To take these factors into account, the estimate of percent savings is expressed in the form

$$\text{SAVINGS} = \frac{(\text{predicted post-weatherization consumption} - \text{post-weatherization consumption})}{\text{predicted post-weatherization consumption}}$$

where predicted post-weatherization consumption is an adjustment in the actual pre-weatherization consumption. The adjustment takes into account at least the changes of weather and household composition between the pre- and post-weatherization periods. Predicted post-weatherization consumption should be thought of as a predicted consumption for the "after" period, assuming that no weatherization had occurred.

Among all energy requirements, those for space heating dominate. An estimate of percent savings for space heating has been constructed in the form

$$\text{HEAT SAVINGS} = \frac{(\text{predicted post-weatherization consumption for space heating} - \text{post-weatherization consumption for space heating})}{\text{predicted post-weatherization consumption for space heating}}$$

Prediction models for consumption were developed for each fuel, and a method was devised for disaggregating total consumption into its end-use components.\* The modeling sequence and results and the method for fractionalization are summarized below.

#### Models for Predicted Post-Weatherization Consumption

Regression consumption models were developed using RECS1 and RECS2 housing units for which approximately full-year data were available and acceptable. Separate models were developed for the four fuels: electricity, utility gas, fuel oil/kerosene, and LPG. These are end-use models that furnish individual household forecasts composed of separately interpretable components that reflect the major end uses of a fuel for heating, cooling, hot water, and general appliance usage.

Not all RECS1 and RECS2 cases were used in the regression modeling. For each of the four fuels, any household satisfying at least one of the following conditions was designated as unacceptable for regression analysis:

- o the household did not use the fuel
- o the household was interviewed by mail and not personally
- o any one of the main space heating fuels, secondary space heating fuels, or water heating fuels was imputed

\*The methodology for disaggregating total consumption into its end use components is described in Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use, Energy Information Administration, DOE/EIA-0431, October 1983.

- o the fuel was a main heating fuel and square footage data were imputed
- o the fuel had some nonresidential use(s)
- o full-year actual consumption data covering all uses of the fuel were not available (at least 330 days of actual data were required when the fuel was electricity or utility gas).

Those cases remaining after the above exclusions were not all used in modeling, however. Because the aim was to create prediction equations and end-use decompositions for the weatherized sample, the RECS cases were further restricted by controlling living-quarters type, income, and, to a lesser extent, geography, thereby ensuring that the resulting RECS consumption models would have a more valid application to the weatherization sample. These restrictions included:

- o deletion of all RECS multifamily housing unit types
- o deletion of any RECS case with household income of \$15,000 or more
- o deletion of any RECS case whose RECS Sample Intersection (i.e., Census Division and DOE Region intersection) was not represented within the Weatherization Survey.

The model equations are given below, together with relevant variable descriptions. The strategy for modeling consumption was not the same for all fuels. There were separate models for electricity for each structure type. For the other fuels, all structure types were modeled simultaneously, with an allowance for differentiation of structure types by inclusion of dummy variables for each of the nonsingle family detached types.

The sample size n gives the combined number of RECS1 and RECS2 cases used. The dependent variables are KWH for electricity, gallons for fuel oil/kerosene, and therms for both utility gas and LPG.\*

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\*For justification and more detailed explanation of variable definitions and the modeling strategy, see

- (a) "Imputing residential energy consumption for RECS2: model equations and procedural summary," Response Analysis technical report, March 1983; and
- (b) Regression Analysis of Energy Consumption by End Use, op. cit.

ELECTRICITY (SINGLE FAMILY DETACHED)

$$N = 2007 \quad R^2 = .635$$

PRED = 667 + .974\*ELNDX + 66\*HELWHT + 69.8\*WATER  
 + 2.18\*HEATUSE + 107.5\*HTXDD + .24\*HTXDD2 - .15\*HTXWOD  
 - .42\*HTXYHS - .36\*HTXINC  
 + 36\*COLROOM + 1.28\*COLKINC + 5\*COLUSEC  
 + MAX(1198\*HSBNMELH - 12.7\*HSELXDD,0).

ELECTRICITY (SINGLE FAMILY ATTACHED)

$$N = 114 \quad R^2 = .726$$

PRED = - 235 + 1.042\*ELNDX - 199.4\*HELWHT + 137.5\*WATER  
 + .57\*( + 2.18\*HEATUSE + 107.5\*HTXDD + .24\*HTXDD2  
 - .15\*HTXWOD - .42\*HTXYHS - .36\*HTXINC)  
 + .643\*( + 36\*COLROOM + 1.28\*COLKINC + 5\*COLUSEC)  
 + 1.86\*( + MAX(1198\*HSBNMELH - 12.7\*HSELXDD,0) ).

ELECTRICITY (MOBILE HOME)

$$N = 226 \quad R^2 = .571$$

PRED = 997 + 1.077\*ELNDX + 811.8\*HELWHT + 36\*WATER  
 + 1.122\*( + 2.18\*HEATUSE + 107.5\*HTXDD - .24\*HTXDD2  
 - .15\*HTXWOD - .42\*HTXYHS - .36\*HTXINC)  
 + 1.189\*( + 36\*COLROOM + 1.28\*COLKINC + 5\*COLUSEC) .

UTILITY (PIPED) GAS

$$N = 1265 \quad R^2 = .651$$

PRED = .944\*UGASNDX + 73\*HUGASWHT + 5.12\*WATER  
 + 92.6 - 169\*HHTYP223A  
 + 12\*KMHHTH20 - 49\*KMHTSH + .59\*SLOPH20 + .45\*SLOPFA  
 + .38\*SLOPSH + 14\*HTXDD - .05\*HTXDD2 - .053\*HTXYHS  
 + .0022\*HTXAGE - .094\*HTXSEC .002\*HTXSTM  
 + MAX( - 185\*HAVEAC - 2.25\*COOLUSE + 12.37\*COLROOM,0)  
 + 260\*HSBNMUGH .

FUEL OIL / KEROSENE

$$N = 279 \quad R^2 = .616$$

PRED = 211\*HFOWHT + .54\*WATER  
 + 354 - 32\*HHTYP11 + 409\*KMHHTH20 - 156\*KMHTSH  
 + .101\*SLOPH20 + .323\*SLOPFA + .55\*SLOPSH  
 - .044\*HTXYHS + .004\*HTXAGE - .0049\*HTXWOD - .0014\*HTXSTM  
 - 165\*HSBNMF0H .

LPG

$$N = 342 \quad R^2 = .724$$

$$\begin{aligned} \text{PRED} = & .4*\text{LPNDX} + 45*\text{HLPWHT} + 3.77*\text{WATER} \\ & + 57 - 15*\text{HHTYP11} + 186*\text{KMHTH20} - 50*\text{KMHTSH} + .25*\text{HEATUSE} \\ & + 16.1*\text{HTXDD} - .105*\text{HTXDD2} - .05*\text{HTXYHS} - .05*\text{HTXSEC} \end{aligned}$$

Composite and Index Variables:

(1) Heating variables.

The fundamental variable is HEATUSE. If the fuel in question was used as the main heating fuel, then HEATUSE = HEATED\*HDD65/100, where HEATED = heated area of the home and HDD65 = heating degree days (in 100s) to base 65 degrees; otherwise, HEATUSE = 0.

If the fuel was used as a secondary but not main heating fuel, an appropriate dummy variable (HSBNMELH, HSBNMUGH, HSBNMFOH, or HSBNMLPH) was set to 1. For a given fuel, the following variables may assume nonzero values only if that fuel was the main heating fuel:

$\text{HTXDD} = \text{HDD65}; \quad \text{HTXDD2} = \text{HDD65}^{**2};$   
 $\text{HTXYHS} = \text{HEATUSE} * (\text{AGEBLDG} - 3)$ , where AGEBLDG is a slightly recoded version of the year-built variable;  
 $\text{HTXAGE} = \text{HEATUSE} * (\text{HHAGE} - 50)$ , where HHAGE is the respondent's age;  
 $\text{HTXSEC} = \text{HEATUSE} * \text{SECFUEL}$ , where the temporary dummy variable SECFUEL = 1 if a fuel other than the main heating fuel and wood was used as a secondary heating fuel;  
 $\text{HTXWOD} = \text{HEATUSE} * (\text{WOODCORD})$ , where WOODCORD = number of cords of wood used (in tenth of cords and truncated at 60) as a secondary heating fuel;  
 $\text{HTXINC} = \text{HEATUSE} * (\text{INCOME} - 14);$   
 $\text{HTXSTM} = \text{HEATUSE} * (\text{PCTSTORM})$ , where PCTSTORM = the percent of (doors + windows) that were insulated;  
KMHTH20 is a dummy variable, = 1 if the main heating equipment used a steam or hot water delivery system;  
KMHTFA is a dummy variable, = 1 if the main heating equipment was a central warm air furnace;  
KMHTSH is a dummy variable, = 1 if the main heating equipment was neither of the above;  
 $\text{SLOPH20} = \text{HEATUSE} * \text{KMHTH20}; \quad \text{SLOPFA} = \text{HEATUSE} * \text{KMHTFA};$   
 $\text{SLOPSH} = \text{HEATUSE} * \text{KMHTSH};$   
 $\text{HSELXDD} = \text{HSBNMELH} * \text{HDD65}.$

(2) Water variables.

The fundamental variable is WATER, an index that multiplies the number of household members by a weighted combination of terms for personal, clothes washing, and dishwashing use of hot water. If the fuel in question was used as the water heating fuel, then  $\text{WATER} = \text{NHSLDMEM} * (7.10 + 2.65 * \min(\text{WASHER}, 1) + 7.62 * \text{DISHWASH})$ , where WASHER, WRINGER, and DISHWASH are dummy variables denoting ownership. In order to account for regional variability in energy consumption for water heating that results from differences in the mean annual temperature of water delivered to households, we redefined the above to  $\text{WATER} = (1/83) * (83 + (\text{HDD65} - 50)/2.5) * \text{WATER}$ . Finally, HELWHT, HUGASWHT, HFOWHT, and HLPWHT are dummy variables, = 1 whenever the respective fuel was used as the water heating fuel.

(3) Appliance indices.

The appliance indices (ELNDX, UGASNDX, and LPNDX) used engineering estimates for various minor appliances, sometimes weighting these by the number of household members (e.g., oven, range, washer, dryer, dishwasher, and lighting) and sometimes not (e.g., refrigerator, freezer, [de]humidifier, furnace fan, and television[s]). For utility gas and LPG, the only appliances used to construct an index were oven, range, refrigerator, and dryer. No further details are sketched here.

(4) Cooling variables.

The variable names and computations are similar for electricity and utility gas.

If the air conditioning fuel was electricity, then

$\text{COLROOM} = \text{NROOMAC} * \text{CDD65}$ , where NROOMAC = number of rooms air conditioned;  
 $\text{COLUSEC} = \text{FROOMAC} * \text{HEATED} * \text{CDD65}/100$  if central air existed  
where FROOMAC = the fraction of rooms air conditioned; and  
 $\text{COLXINC} = \text{COLROOM} * (\text{INCOME} - 14)$ .

If the air conditioning fuel was utility gas, then COLROOM was defined as above; COOLUSE was defined by the formula for COLUSEC above; and HAVEAC is a dummy variable, = 1 if CDO65 was nonzero.

If both fuels were used for air conditioning, COLROOM and COOLUSE were redefined as 50% of their above values.

(5) Living quarters type codes.

Two dummy variables appear;

HHTYP11 = 1 for mobile homes; and

HHTP223A = 1 for single-family attached homes  
that used utility gas as the main heating fuel.

**Implementing Adjustment and Disaggregation**

For each weatherization sample household, the low-income RECS models described above were used for each fuel to adjust pre-weatherized annual consumption to a predicted post-weatherized annual consumption. The predicted value should be viewed as an adjusted version of pre-weatherized consumption that has been adjusted to account for the different conditions of weather and possibly different number of household members that prevailed during the "after" weatherization year, but otherwise assuming that no weatherization had, in fact, occurred.

The computational formula for adjustment was simply

$$\text{predicted post-weatherization consumption} = (\text{PREDA}/\text{PREDB}) * (\text{actual pre-weatherization consumption})$$

PREDB and PREDA are the RECS model prediction equations evaluated for the given housing unit and given fuel and using either the weather and household composition data appropriate to the pre-weatherization period (PREDB) or the post-weatherization period (PREDA).\*

Suppose, for example, that a given weatherization case used LPG for cooking, space heating, and hot water. The ratio term for adjusting pre-weatherized consumption of LPG was (PREDA/PREDB) where

$$\begin{aligned}\text{PREDB} = & .4*\text{LPNDX1} + 45*\text{HLPWHT} + 3.77*\text{WATER1} \\ & + 57 - 15*\text{HHTYP11} + 186*\text{KMHTH20} - 50*\text{KMHTSH} + .25*\text{HEATUSE1} \\ & + 16.1*\text{HTXDD1} - .105*\text{HTXDD21} - .05*\text{HTXYHS1} - .05*\text{HTKSEC1} \\ & - .012*\text{HTXWOD1} + 157*\text{HSBNMLPH}.\end{aligned}$$

$$\begin{aligned}\text{PREDA} = & .4*\text{LPNDX2} + 45*\text{HLPWHT} + 3.77*\text{WATER2} \\ & + 57 - 15*\text{HHTYP11} + 186*\text{KMHTH20} - 50*\text{KMHTSH} + .25*\text{HEATUSE2} \\ & + 16.1*\text{HTXDD2} - .105*\text{HTXDD22} - .05*\text{HTXYHS2} - .05*\text{HTXSEC2} \\ & - .012*\text{HTXWOD2} + 157*\text{HSBNMLPH}.\end{aligned}$$

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\*It will be observed later that, while PREDA forecasts actual post-weatherization consumption rather closely, PREDB seriously underestimates pre-weatherization consumption. This does not detract in any major way from the efficiency of the ratio adjustment given above.

In the PREDB equation LPNDX1, WATER1, and the heating variables--HEATUSE1, . . . , HTXWOD1--denote the appliance index, water index, and heating variables which were evaluated using the number of residents reported to have lived there during 1981 and using heating degree days from the "before" period. Whereas, in the PREDA equation, LPNDX2, WATER2, and HEATUSE2, . . . , HTXWOD2 denote those same variables evaluated using the number of residents reported at the time of interview and using heating degree days from the "after" period. Some variables are the same in both versions: they represent dummy variables for living quarters type (HHTYP11), heating equipment type (KMHTH20 and KMHTSH), and secondary heating fuel (HSBNMLPH), which are assumed to have remained constant throughout.

In general, then, heating degree day adjustments affect heating variables and the water index; cooling degree day adjustments affect cooling variables; and household composition changes affect both the appliance indices and the water index. Adjustments were effected, separately, for each fuel used by a weatherization household. Adjusted total consumption was then simply calculated as the sum of the separately adjusted individual fuel totals. The SAVINGS estimates discussed earlier were then calculated on both an individual fuel and an aggregated fuel basis.

Earlier it was mentioned that space heating requirements dominate overall energy consumption. It was therefore desirable that HEAT SAVINGS also be estimated. The estimate chosen was constructed as follows:

- (1) Let PRED denote the predicted post-weatherization consumption as given above.
- (2) The fraction of total consumption due to primary space heating was estimated as  $FRHEAT = (\text{sum of terms from PREDA relevant to primary heating})/\text{PREDA}$ .
- (3) The portion of PRED attributable to space heating was estimated as  $PREDHEAT = FRHEAT * PRED$ .  
The portion of PRED not attributable to space heating was therefore estimated as  $PREDREST = (1 - FRHEAT) * PRED$ .
- (4) Let REAL denote the actual post-weatherization consumption.  
The portion of REAL not attributable to space heating was estimated as  $REALREST = PREDREST$ .  
  
The portion of REAL attributable to space heating was estimated then as  $REALHEAT = REAL - REALREST = REAL - PREDREST$ .

(5) The estimated percent savings in primary space heating was  
HEAT SAVINGS = (PREDHEAT - REALHEAT)/PREDHEAT, which by  
substitution from (3) and (4) yields

$$(*) \text{ HEAT SAVINGS} = (\text{PRED} - \text{REAL})/\text{PREDHEAT} .$$

The final estimate (\*) has both a simple form and easy interpretation. It says basically that all of the estimated savings (i.e., PRED - REAL) are due to savings in primary space heating and that no savings occur with respect to any other end use. (This assumption occurs at step (4), where it is estimated that REALREST = PREDREST.) Additionally, it is assumed that FRHEAT, the disaggregated fraction of total consumption due to primary space heating as estimated from the PREDA equation, may actually be applied to PRED to yield PREDHEAT (cf. step (3)). This is an important assumption: that information gained from PREDA (a prediction model from low-income non-weatherized cases) can be used to decompose information from PRED (an adjusted estimate of pre-weatherized consumption for a weatherized case).

A good way to put these assumptions to perspective, and thus to evaluate the estimate (\*), is to examine the accuracy of the average predictions PREDB and PREDA, as summarized in Table C1.

Table C1. Comparison of Actual Average Annual Pre- and Post-Weatherization Consumption with Predicted Consumption for Different Fuels

	ELECTRICITY n=1496	UTILITY GAS n= 828	FUEL OIL/KEROSENE n= 257	LPG n=223
QUANTITYB	6473	1402	844	452
PRED <sub>B</sub>	6609	-2.1%	+14.7%	+21.3%
PRED <sub>A</sub>	6215	1222	696	417
PRED <sub>D</sub>	6468	1284	742	405
PRED	6352	1249	694	418
	1430	848	348	452
ELECTRICITY				
	Appliances Only	Air Conditioner Only	Water Only	Air Conditioner and Water
	n=699	n=346	n=279	n=124
QUANTITYB	4808	6044	8068	9089
PRED <sub>B</sub>	4968	-3.2%	- 1.1%	- 1.6%
PRED <sub>A</sub>	4734	6110	8196	9499
PRED <sub>D</sub>	4906	-3.5%	- 2.1%	- 2.8%
PRED	4753	5725	7849	8471
SAVINGS	5851	5812	8073	9170
	+.4%	+1.5%	+1.65%	+2.8%

In Table C1, QUANTITYB and QUANTITYA are the actual pre- and post-weatherization annual consumption averages. PREDB, PREDA, and PRED have their customary meaning and are given as averages. The percentages indicated give the excess (+%) or deficiency (-%) of QUANTITYB(A) with respect to PREDB(A). For each fuel, the only weatherized cases excluded from this summary are those for which either Segments 1 and 3 were both unavailable or Segments 2 and 4 were both unavailable (cf., rules for defining segments). SAVINGS is defined as above.

The most striking feature of this table is the degree to which the RECS model PREDB severely underestimates consumption in the "before" period and then (using PREDA) rather closely forecasts consumption in the "after" period. The weatherization sample households were clearly overconsumers (except for electricity) before their weatherization, whereas, after weatherization, their consumption pattern is approximately in line with that of all low-income non-weatherized households.

If we look at the averages for electricity, overall and broken down into four large end-use categories that exclude cases where electricity was the primary space heating fuel, we see that PREDB and PREDA furnish forecasts that are generally very accurate, with a slight tendency toward overprediction. There is no suggestion of overconsumption here, either before or after. This roughly, but reasonably, suggests that most of the serious overconsumption noticed above was due overwhelmingly to excessive consumption for space heating.

Finally, note that the estimates for SAVINGS for the four end-use subgroups for electricity are all positive and suggest that, although probably "smallish," real savings from end uses other than primary space heating do occur.

All of the above suggests the following:

- (1) The numerator of our estimate HEAT SAVINGS is an overestimate of actual savings in fuel use as a primary heating fuel.
- (2) FRHEAT is a good estimate of the fraction of QUANTITYA (= actual post-weatherization consumption) due to primary space heating, but it is likely an underestimate of the fraction of PRED (= adjusted pre-weatherization consumption) due to primary space heating because PRED reflects the serious overconsumption of the "before" period that is in great part due to excessive primary space heating. Thus PREDHEAT = FRHEAT\*PRED is likely an underestimate of adjusted pre-weatherization consumption for space heating.
- (3) Together (1) and (2) imply that the estimate HEAT SAVINGS furnishes an upper bound for percent savings for space heating.
- (4) For all fuels except electricity, SAVINGS itself may reasonably be thought of as a lower bound for percent savings for space heating. This is because fuel use for space heating dominates (averaging at least two-thirds of all fuel use for any of these three fuels): it would require unlikely high levels of percent savings for the other end uses to reduce percent savings for space heating more than 1 or 2 percentage points below SAVINGS itself.

**APPENDIX D**

**Analysis of Weatherization Savings by Means of  
Matched Comparisons Using 1980 and 1981 RECS**

ANALYSIS OF WEATHERIZATION SAVINGS BY MEANS OF  
MATCHED COMPARISONS USING 1980 and 1981 RECS\*

Overall Strategy

It was impossible to construct a single control group comprised of RECS cases, because the RECS1 and RECS2 samples consist of different groups of households. Although RECS 3 utility data have recently become available, so that a control group selected from cases that appeared in both RECS1 and RECS3 is theoretically possible, such a procedure would suffer from several defects:

- o The reduced number of cases available for selection to the control group would seriously degrade the efficiency of the matching procedure as described below (less than half of each RECS3 sample would be in the overlap and therefore available for matching).
- o RECS3 consumption data is for the period April 1, 1982 through March 31, 1983, which is roughly one year later than the one year consumption period just following completion of the weatherization work (whereas the RECS2 consumption period coincides much more nearly with the post-year period for weatherization households). This means that RECS3 consumption data would require adjustment that accounts for RECS2/RECS3 changes that occurred independently of climate changes, switches of fuel(s) and equipment, etc.

Matching Strategy

Although details varied slightly for the two fuels, the overall criteria for matching and sequence of matching operations followed these general guidelines.

- (A) The following matches were always required:
  - o Main heating fuel
  - o Main water heating fuel = main heating fuel? (Yes or No)
  - o living quarters type (mobile homes matched mobile homes, and single family units matched single family units).
- (B) Given (A), each weatherized case was matched with a cluster of cases from the RECS File. (There were separate and independent matches using RECS1 and then RECS2). The cluster contained cases with comparable values of

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\*References in the text to RECS1 and RECS2 are to the RECS for 1980 and 1981, respectively.

- o POVRATIO = POVERTY LINE RATIO = INCOME/(100 percent POVERTY LEVEL for the given family size);
  - o Predicted consumption = a regression model predicted value of consumption for that fuel that was the main heating fuel;
  - o Climate/Degree Days: Usually AIA Zone, but especially for AIA zone =5 (Cooling Degree Days greater than 2000); overriding of AIA zone was allowed by comparable heating degree days.
  - o Heating equipment type (hot water, steam, forced air, and all other types).\*
- (C) Given (A) and (B), each weatherized case typically had a cluster of "comparable" cases as potential matches. The requirements for "comparable" were adjusted in (3) to ensure that at least 80 percent of the weatherized cases received at least one match from each of the RECS samples. Within this cluster, the best match was chosen by minimizing distance functions that took into account:
- o The variables mentioned in (B)
  - o Year moved into home
  - o Number of persons living in the housing unit
  - o Use of a supplementary heating fuel (Yes or No).
- The number of matches for any RECS case to different weatherized cases was controlled.
- (D) No RECS case was allowed as a potential match unless:
- o Complete annual utility data for the relevant fuel was available, with all uses paid for by the household

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\*This was used as a matching variable only when the main heating fuel was utility gas.

- o It was a household interview
- o There was no non-residential fuel use
- o Square footage data was good
- o No relevant fuel use was imputed
- o Income was known and less than 160 percent of poverty level.

No weatherized case was matched to or used for analysis if income was not known. Other exclusions are given in the analytic strategy.

#### Analytic Strategy

The matching strategy was designed to furnish approximate control groups of RECS cases. From the pool of RECS cases available as potential matches to the weatherized cases, some were never selected and many were selected several times. In effect, the matching procedure was a formal mechanism for reweighting the pool of RECS cases to "look more like the weatherized sample" on important distributions like living quarters type, income, predicted consumption, AIA zone, and number of persons. It is natural then, to expect that the changes in consumption between the matched (reweighted) RECS1 and RECS2 groups may serve as a baseline for evaluating before/after weatherization sample savings.

Whether it is called it matching or reweighting, the construction of RECS pseudo-control groups as described above was undoubtedly the most subjective component in this weatherization analysis. The matching strategy required multiple choices at two levels:

- (1) Variables to be matched on, and
- (2) Relative importance of the matching variables used.

Every effort has been made to make reasonable choices for the above based upon the accumulated experience with related consumption models for the RECS surveys. Nevertheless, the estimates tabulated below, particularly for baseline savings between the RECS control groups, should be interpreted cautiously. The estimates for weatherization savings relative to control group savings need support and interpretation from the other modes of analysis.

Some examples of the effect of matching, where utility gas is both the main heating and water fuel are shown in Table D1.

Table D1. Average of Selected Variables for Weatherized Sample  
and for RECS Cases Before and After Match Weighting

	Variables Averages		
	HEATUSE	HHAGE	AGEBLDG
Weatherized Sample	800 "Before" 840 "After"	60.5	1.92
RECS1 potential matches (unweighted)	603	56.0	2.32
RECS1 matched cases (unweighted)	765	59.2	2.08
RECS2 potential matches (unweighted)	590	54.8	2.61
RECS2 matched cases (unweighted)	836	59.1	1.95

Two additional steps were required before consumption savings could be computed by means of matched comparisons.

(1) Exclusion of weatherized cases that had great potential for confounding the final results. Weatherized cases were deleted whenever at least one of the following conditions prevailed:

- o Income was unknown
- o There had been a switch in the main heating fuel
- o There had been a switch in the main water heating fuel that involved that fuel that was the main heating fuel
- o Square foot data was incomplete
- o The number of total or heated square feet had changed since September, 1980
- o The main heating fuel was reported as partially used for non-residential purposes
- o Utility gas was the main heating fuel, and also used for air conditioning
- o Fuel oil/kerosene was the main heating fuel, and also used for cooking
- o At least one cord of wood was burned
- o Segment 4 consumption data was unavailable and/or both segment 1 and segment 3 data were unavailable.

This appears to be a lengthy list of exclusions, but, excepting the last condition, missing income accounted for most of the deletions, with switches in main heating or water heating fuels accounting for most of the rest.

(2) Post-Stratification Adjustments and Standardization. The conditions of weather, household demographics and housing unit characteristics obtained for the weatherized group during the period prior to weatherization were adopted as the "standard conditions." The low-income RECS consumption models previously described were used to decompose individual household consumption into its end-use components. The end-use components were then adjusted by using ratios of the form

$$\frac{\text{Average "Standard Conditions"}}{\text{Average Conditions for Group in Question}}$$

and the adjusted end-use components were then recombined into a total. This procedure was used for the three groups that required standardization: the weatherized sample when considering post-weatherization data, and the RECS1 and RECS2 matching groups. Post-stratification adjustments for the variables HEAGE (respondent's age) and AGEBLDG (Year Built), using the same ratio technique, were applied to the RECS groups.

These adjustments are illustrated for cases that used fuel oil/kerosene as the primary space heating fuel. Cases were sorted by water heating fuel and heating equipment type, and the subgroup averages in Table D2 were used to construct the adjustment ratios.

Table D2. Subgroup Averages Used to Construct Adjustment Ratios

Subgroup	WEATHERIZATION SAMPLE (weighted averages)						RECS1 CONTROLS				RECS2 CONTROLS			
	Pre-Weatherization			Post-Weatherization			(weighted averages using the matching weatherization case weights)							
	"Standard Conditions"													
Subgroup	HEATUSE	WATER	AGEBLDG	HHAGE	HEATUSE	WATER	HEATUSE	WATER	AGEBLDG	HHAGE	HEATUSE	WATER	AGEBLDG	HHAGE
<b>NON FO/KER H2O</b>														
Water, Steam and Forced Air	947	0	2.36	60.1	960	0	997	0	3.10	61.0	1086	0	2.66	60.8
Space Heaters	513	0	2.28	71.2	522	0	495	0	2.28	66.4	514	0	1.79	71.5
<b>FO/KER H2O</b>	<b>1045</b>	<b>35.1</b>	<b>1.44</b>	<b>59.9</b>	<b>1052</b>	<b>32.2</b>	<b>1375</b>	<b>42.5</b>	<b>1.04</b>	<b>63.7</b>	<b>955</b>	<b>32.8</b>	<b>2.67</b>	<b>62.5</b>

Two particular applications of the adjustment procedure are shown below.

(A) Adjustment for a weatherized case in the post-weatherization segment. Assume, say, that this case used fuel oil as the hot water fuel and had forced air equipment. The low-income RECS consumption model is

$$\begin{aligned} \text{PRED} = & (211*\text{HFOWHT} + .54*\text{WATER}) + \\ & (354 - 32*\text{HHTYP11} + 409*\text{KMHTH20} - 156*\text{KMHTSH} \\ & + .101*\text{SLOPH20} + .323*\text{SLOPFA} + .55*\text{SLOPSH} \\ & - .044*\text{HTXYHS} + .004*\text{HTXAGE} - .0049*\text{HTXWOD} \\ & - .0014*\text{HTXSTM}), \end{aligned}$$

where all terms are evaluated using number of residents and degree day information appropriate to the post-weatherization segment. Let  $\text{FOQTY}$  denote actual consumption in the post-weatherization segment. The adjusted post-weatherization consumption,  $\text{FOQTYA}$ , was then calculated as

$$\begin{aligned} \text{FOQTYA} = & ((211*\text{HFOWHT} + .54*\text{WWW}*\text{WATER})/\text{PRED} \\ & + ((354 - 32*\text{HHTYP11} + 409*\text{KMHTH20} - 156*\text{KMHTSH}) \\ & + \text{HHH}*(.101*\text{SLOPH20} + .323*\text{SLOPFA} + .55*\text{SLOPSH} \\ & - .044*\text{HTXYHS} - .0049*\text{HTXWOD} \\ & + .004*\text{HTXAGE} - .0014*\text{HTXSTM})/\text{PRED})*\text{FOQTY} \end{aligned}$$

where  $\text{WWW} = 35.1/32.2 = 1.090$  and  $\text{HHH} = 1045/1052 = .9933$  denote the water index and HEATUSE adjustment ratio factors constructed from the above table.

Rationale: First note that  $F + (211*\text{HFOWHT} + .54*\text{WATER})/\text{PRED}$  is the estimated fraction of total fuel oil use for hot water, so that  $((211*\text{HFOWHT} + .54*\text{WATER})/\text{PRED})*\text{FOQTY}$  is the estimated fuel oil consumption for hot water for this household. Next note that  $I = (211*\text{HFOWHT} + .54*1.09*\text{WATER})/(211*\text{HFOWHT} + .54*\text{WATER})$  may be interpreted as the estimated fractional increase in fuel oil use for hot water for this household it is assumed that the overall group ratio  $\text{WWW} = 1.09$  for the water index applies uniformly to all households within that group. Finally then,

$$I*F*\text{FOQTY} = ((211*\text{HFOWHT} + .54*1.09*\text{WATER})/\text{PRED})*\text{FOQTY}$$

is the estimated adjusted fuel oil consumption for hot water for this household in the post-weatherization segment, adjusted in the sense that the water index has been modified for the given household in such a way that the overall water index now coincides with the "standard conditions" water index. This explains the first of the two major terms constituting  $\text{FOQTYA}$ .

An estimated adjusted consumption for space heating in the post-weatherization segment was constructed using similar logic. The two adjusted end use estimates were added to yield the total adjusted post-weatherization consumption.

(3) Adjustment for a RECS1 matched case. Assume as above that this case used fuel oil for hot water and has forced air equipment. PRED and FOQTY denote the consumption predicted by the regression model and the actual consumption, respectively. FOQTYA was then calculated as

$$\begin{aligned} \text{FOQTYA} = & ((211*\text{HFOWHT} + .54*\text{WWW}*\text{WATER})/\text{PRED} \\ & + ((354 - 32*\text{HHTYP11} + 409*\text{KMHTH20} - 156*\text{KMHSH}) \\ & * \text{HHH} * (.101*\text{SLOPH20} + .323*\text{SLOPFA} + .55*\text{SLOPSH} \\ & - .044*\text{HEATUSE} * (\text{MMM}*\text{AGEBLDG}-3) - .0049*\text{HTXWOD} \\ & + .004*\text{HEATUSE} * (\text{NNN}*\text{HHAGE}-50) - .0014*\text{HTXSTM})) \\ & / \text{PRED}) * \text{FOQTY} \end{aligned}$$

where now WWW = 35.1/42.5, HHH = 1045/1375, MMM = 1.44/1.04 and NNN = 59.9/63.7. Here MMM and NNN denote the AGEBLDG and HHAGE adjustment ratio factors, and all ratio factors were constructed from the above table. The only new feature here is the post-stratification adjustment for the AGEBLDG and HHAGE variables, from RECS averages to "standard conditions" averages.

The adjustment procedures for utility gas was similar. Two additional adjustment ratios were required: one for UGASNDX, the appliance index, and one for HDD65, because the variable heating degree days is explicitly used in the consumption model for utility gas. In addition, utility gas hot water users were further classified by heating equipment types, and separate averages and ratio adjustments were computed for these subgroups.

Note finally that the ratio adjustment factors are always approximately 1 for standardization of the post-weatherization segment data, but are frequently greatly different from 1 for the RECS control groups. This was expected: the RECS matched cases represent different households from those weatherized cases used to establish the "standard conditions", and the matching strategy was necessarily imperfect. The adjustment procedure may therefore be viewed as a secondary effort to correct inequities that existed after the original matching.

Adjusted consumption, FOQTYA and UGQTYA, was used for all subsequent analysis. Tables XX and YY summarize and compare weatherization and control group savings for fuel oil/kerosene and utility gas.

Table D3. Fuel Oil/Kerosene Consumption (in Gallons) for Weatherization Cases and Matched RECS Cases

Initial Counts: 47 RECS1, 56 RECS2 and 376 weatherized cases were available for matching.

Matches: 328 weatherized cases had both a RECS1 and RECS2 match; 42 RECS1 and 49 RECS2 cases were used. The final weatherization subgroup that could be used consisted of 158 cases.

Weatherization Cases

Subgroup	Pre-Weatherization Quantity "Standard Conditions"	Post-Weatherization FOQTYA	Savings	#Cases
All	821	752	8.3%	158
NON FO/KER H2O	740	678	8.4%	119
Water, Steam and Forced Air	788	732	7.1%	102
Space Heaters	540	457	15.5%	17
FO/KER H2O	1166	1070	8.3%	39

Matched RECS Control Cases

Subgroup	RECS1 FOQTYA	RECS2 FOQTYA	Savings	#Cases
All	694*	709	-2.2%	158
NON FO/KER H2O	622*	621	.2%	119
Water, Steam and Forced Air	663	658	.7% R1=106* R2=102	
Space Heaters	454	465	-2.5% R1=13* R2=17	
FO/KER H2O	1003	1092	-8.8%	39

\*The RECS1 control group had a slightly higher percentage of water, steam, and forced air equipment among NON FO/KER water users than the weatherized group. Thus weatherization sample case weights were applied in such a way that the flagged estimates here reweighted the RECS control group to the distribution of heating equipment that obtained for the weatherized sample it was matched to.

Table D4. Utility Gas Consumption (In Terms) for Weatherization Cases and Matched RECS1 Cases

Initial Counts: 237 RECS1, 350 RECS2 and 786 weatherization cases were available for matching.

Matches: 693 weatherized cases had both a RECS1 and RECS2 match; 163 RECS1 and 197 RECS2 cases were used. The final weatherization subgroup that could be used consisted of 482 cases.

Weatherization Cases

Subgroup	Pre-Weatherization		Post-Weatherization		Savings	#Cases
	Quantity	"Standard Conditions"	UGQTYA			
All	1432		1263		11.8%	482
Utility Gas H2O	1468		1294		11.8%	438
Water, Steam and Forced Air	1731		1535		11.3%	310
Space Heaters	995		862		13.3%	128
Non Utility Gas H2O	1132		1002		11.5%	44

Matched RECS Control Cases

Subgroup	RECS1 UGQTYA	RECS2 UGQTYA	Savings	#Cases
All	1307*	1258*	3.9%	482
Utility Gas H2O	1338	1272	4.8%	438
Water, Steam and Forced Air	1470	1437	2.2%	310
Space Heaters	1099	977	11.1%	128
Non Utility Gas H2O	1054*	1138*	-8.0%	44

\*The RECS control groups had a slightly higher percentage of water, steam and forced air equipment among utility gas H2O users than the weatherized group. Thus weatherization sample case weights were applied in such a way that the flagged estimates here reweighted the RECS control groups to distribution of heating equipment that obtained for the weatherized sample they were matched to.

APPENDIX E  
Survey Materials

**Listing of Survey Materials**

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ITEM 1. HOUSEHOLD SURVEY MATERIALS

Advance letter to households from U.S. Department of Energy



Department of Energy  
Washington, D.C. 20585

April 1983

Dear Resident:

The U.S. Department of Energy needs your help. An interviewer will be calling at your home in the next week or so to ask questions about your household's energy use. Your household was picked randomly as part of a scientific sample of households in the United States. This survey will provide important information on current trends in energy use and help those planning for our energy future.

The survey is being done under the Federal Energy Administration Act of 1974 (Public Law 93-275). The survey is voluntary, and your participation is very important to the success of the study. The information you provide and your identity will be held confidential in accordance with the provisions of the Privacy Act of 1974. (See the statement on the other side of this letter for further details on the Privacy Act.)

The Department of Energy will not know the names of individuals providing information. For that reason, if you have any questions about the survey, please call Dawn Day, Response Analysis Corporation, Princeton, New Jersey. Call collect at (609) 921-3333.

We very much appreciate your cooperation. If you wish to contact someone at the Department of Energy about the survey, please call Wendel Thompson. Dr. Thompson can be reached on (202) 252-1119.

Sincerely,

A handwritten signature in black ink, appearing to read "J. Erich Ewered".

J. Erich Ewered  
Administrator  
Energy Information Administration

wa

ITEM 2. HOUSEHOLD SURVEY MATERIALS  
Privacy Act Notice

PRIVACY ACT NOTICE

This residential energy survey is being conducted by the Response Analysis Corporation for the U.S. Department of Energy. It is authorized under Section 52 of the Federal Energy Administration Act of 1974 (Public Law 93-275).

The purpose of this survey is to collect residential energy consumption information to be used by the Department of Energy to perform statistical analyses that will provide a basis for the development of U.S. energy policies.

As part of this survey, we are requesting permission from you to obtain your fuel consumption data from your utility companies. Response Analysis, or other designee of the U.S. Department of Energy, will need to maintain your name in order to collect information from your utility companies.

Once the data about fuel consumption have been linked with the information describing your household and we have concluded our planned visits to your household, all information identifying the data with your name and address will be destroyed.

The Department of Energy will receive only statistical information; no individually identifiable data will be provided to the Department of Energy.

Your participation in this survey is voluntary.

F-4421

ITEM 3. HOUSEHOLD SURVEY MATERIALS  
Housing Unit Record Sheet -- front

Response Analysis Corporation  
Princeton, New Jersey  
033183 F-4480

OMB NO. 1905-0093  
Expires May 31, 1983  
EIA 457A

WEATHERIZATION STUDY  
HOUSING UNIT RECORD SHEET

Preliminary telephone contact  
[ ] WAS [ ] WAS NOT  
completed for this household

INTRODUCTION

Hello, I'm \_\_\_\_\_ from Response Analysis, a survey organization in Princeton, New Jersey. We are working on a national survey for the U.S. Department of Energy. May I speak to \_\_\_\_\_?

\*ASK TO SPEAK TO PERSON NAMED ON LABEL, OR SPOUSE/PARTNER.

IF FAMILY NAMED ON LABEL NO LONGER LIVES AT THIS ADDRESS, MARK HERE [ ] AND DO NOT COMPLETE AN INTERVIEW IN THIS HOUSING UNIT. ALSO MARK RESULT OF CONTACT AT THIS HOUSING UNIT ON BACK OF THIS PAGE.

SEE INSTRUCTIONS FOR INTERVIEWERS, PAGES 8-9 FOR ADDITIONAL INFORMATION ON PERSONS ELIGIBLE TO BE INTERVIEWED.

CONTINUE WITH PERSON NAMED ON LABEL, OR OTHER ELIGIBLE RESPONDENT.

We would like to ask some questions about your home, about heating and air-conditioning, and related topics.

HAND PRIVACY ACT NOTICE TO RESPONDENT. This notice explains that information about your household is protected by The Privacy Act of 1974 and will remain confidential.

CONTINUE WITH INTERVIEW

1 INTERVIEWER OBSERVATION OF TYPE OF LIVING QUARTERS

MARK BOX BELOW:

- 11  MOBILE HOME OR TRAILER
- 21  ONE-FAMILY HOUSE--DETACHED
- 22  ONE-FAMILY HOUSE--ATTACHED ON ONE SIDE (SEMI-DETACHED)
- 23  ONE-FAMILY HOUSE--ATTACHED ON TWO SIDES

99  HOUSE OR BUILDING WITH TWO OR MORE HOUSING UNITS

 DO NOT COMPLETE INTERVIEW.

DESCRIBE TYPE OF STRUCTURE OR BUILDING:

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SEE INSTRUCTIONS FOR INTERVIEWERS, PAGES 8-10.

ITEM 3. HOUSEHOLD SURVEY MATERIALS  
Housing Unit Record Sheet -- back

(2) RECORD OF VISITS TO HOUSING UNIT

Visit number	Time of day (include AM or PM)	Date	Day of Week	Result or Comments
1				
2				
3				
4				

(3) USE THIS SPACE FOR ADDITIONAL NOTES OR COMMENTS ABOUT VISITS TO THIS HOUSEHOLD.  
DESCRIBE FULLY IF REFUSAL OR OTHER NONINTERVIEW.

(4) THIS ITEM APPLICABLE ONLY IF FAMILY NAMED ON LABEL  
NO LONGER LIVES IN THIS HOUSING UNIT

NAME AND PHONE NUMBER OF CURRENT HOUSEHOLDER (OR ONE OF THE HOUSEHOLDERS)

Name \_\_\_\_\_ Phone number \_\_\_\_\_  
Area Code ( ) \_\_\_\_\_

(5) INTERVIEWER'S NAME AND I.D. NUMBER

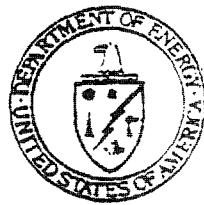
Interviewer \_\_\_\_\_ I.D. number \_\_\_\_\_

OMB No. 1905-0093 • EIA 457B  
Expires May 31, 1983

This survey is voluntary and authorized under the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. Information about specific households will be kept strictly confidential. The data will be summarized within large groupings for statistical purposes.

## Residential Energy Consumption Survey

### WEATHERIZATION STUDY



Energy Information Administration

U.S. Department of Energy

Location # _____	111-116
Housing Unit # _____	117-118

ITEM 4. HOUSEHOLD SURVEY MATERIALS

Household questionnaire -- page 1

AM  
PM

TIME INTERVIEW STARTED

W

1. In what year did your family move into this (house/apartment)?

- 01 [ ] BEFORE 1940  
02 [ ] 1940-1949  
03 [ ] 1950-1959  
04 [ ] 1960-1964  
05 [ ] 1965-1969  
06 [ ] 1970-1974  
07 [ ] 1975-1979  
08 [ ] 1980  
09 [ ] 1981  
10 [ ] 1982  
11 [ ] 1983

121-122

-- ASK Q. 2

IF "1980" OR LATER, ASK:

2. In which month did you move in?  
(SPECIFY MONTH AND ENTER LAST DIGIT OF YEAR.)

MONTH: [ ]

123-124

YEAR: [ ] 198

3. In what year was this (house/building) built?  
Just your estimate.

- 01 [ ] BEFORE 1940  
02 [ ] 1940-1949  
03 [ ] 1950-1959  
04 [ ] 1960-1964  
05 [ ] 1965-1969  
06 [ ] 1970-1974  
07 [ ] 1975-1979  
08 [ ] 1980  
09 [ ] 1981  
10 [ ] 1982  
11 [ ] 1983  
12 [ ] 1984  
13 [ ] 1985  
14 [ ] 1986

125-125

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 2

4. Altogether (counting all areas that are used as year-round living space), how many rooms do you have in your living quarters? Do not count bathrooms, unheated porches, foyers, or hallways. (SEE INSTRUCTION BELOW.)

NUMBER OF ROOMS:

127-128

5. How many complete bathrooms and how many half-bathrooms do you have? (A complete bathroom is a room with a flush toilet, bathtub or shower, and a sink/washbasin with running water. A half-bath has at least a flush toilet or bathtub or shower, but does not have all the facilities for a complete bathroom.)

NUMBER OF COMPLETE BATHROOMS:

129

NONE

NUMBER OF HALF BATHROOMS:

130

NONE

**INTERVIEWER INSTRUCTIONS:**

Q. 4 -- Generally count any room as long as it is a comfortable place to rest, read, study, etc., year-round.

Do not count laundry rooms, unfinished attics or basements, open porches, or unfinished space used for storage.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 3

HAND RESPONDENT EXHIBIT 6/7

6. What is the main fuel used for heating your home?  
(SEE INSTRUCTION BELOW)

Q. 6 MAIN FUEL (MARK ONLY ONE)	Q. 7 MARK ALL THAT APPLY	131- 132
---	-----------------------------------	-------------

GAS FROM UNDERGROUND PIPES SERVING THE NEIGHBORHOOD . . . . .	01 <input type="checkbox"/>	133
LPG GAS (BOTTLED OR TANK GAS) . . . . .	02 <input type="checkbox"/>	134
FUEL OIL . . . . .	03 <input type="checkbox"/>	135
KEROSENE OR COAL OIL . . . . .	04 <input type="checkbox"/>	136
ELECTRICITY . . . . .	05 <input type="checkbox"/>	137
COAL OR COKE . . . . .	06 <input type="checkbox"/>	138
WOOD . . . . .	07 <input type="checkbox"/>	139
SOLAR COLLECTORS . . . . .	08 <input type="checkbox"/>	140
OTHER (SPECIFY): _____	21 <input type="checkbox"/>	141
DON'T KNOW . . . . .	26 <input type="checkbox"/>	142
NO HEATING FUEL USED -- TAKE BACK EXHIBIT 6/7; SKIP TO Q. 27 . . . . .	30 <input type="checkbox"/>	

NO ADDITIONAL FUEL . . . . .  143

7. What other fuels, if any, are used to heat your home --  
including those that are used to provide heat just  
occasionally?

MARK ALL THAT APPLY \_\_\_\_\_  
(IF NONE, MARK "NO ADDITIONAL FUEL")

8a. You mentioned that your main heating fuel is (SEE Q. 6).  
Has that been the main heating fuel here in your home  
since January 1980?

YES -- TAKE BACK  
EXHIBIT 6/7  
SKIP TO Q. 9

NO

(IF "NO," ASK:

8b. In what month and year did your present home heat-  
ing fuel come into use (just approximately)?

MONTH:

YEAR:

8c. What was the main home heating fuel before that?

PREVIOUS HOME  
HEATING FUEL:

TAKE BACK EXHIBIT 6/7

**INTERVIEWER INSTRUCTIONS:**

Q. 6 -- If two or more heating fuels are used, the main heating fuel is one that provides most of the heat for the home.

Q. 6-7 -- If household recently converted to a different fuel, or is in the process of conversion, mark answer for fuel(s) in use for winter of 1982-1983.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 4

TURN TO EXHIBIT 9/10

9. Returning now to your present home heating situation,  
what is the main heating equipment used with your  
main heating fuel?

	Q. 9 MAIN EQUIPMENT (MARK ONLY ONE)	Q. 10 MARK ALL THAT APPLY	145- 146
HOT WATER PIPES RUNNING THROUGH A SLAB FLOOR (RADIANT HEATING) . . .	01[ ]	[ ]	147
STEAM OR HOT WATER SYSTEM WITH RADIATORS OR CONVECTORS . . . . .	02[ ]	[ ]	148
CENTRAL WARM-AIR FURNACE WITH DUCTS TO INDIVIDUAL ROOMS (DO NOT COUNT HEAT PUMP HERE) . . . . .	03[ ]	[ ]	149
HEAT PUMP . . . . .	04[ ]	[ ]	150
BUILT-IN ELECTRIC UNITS (PERMANENTLY INSTALLED IN WALL, CEILING, OR BASEBOARD) . . . . .	05[ ]	[ ]	151
FLOOR, WALL, OR PIPELESS FURNACE . . . . .	06[ ]	[ ]	152
ROOM HEATER BURNING GAS, OIL, KEROSENE (NOT PORTABLE) . . . . .	07[ ]	[ ]	153
HEATING STOVE BURNING WOOD, COAL, COKE . . . . .	08[ ]	[ ]	154
FIREPLACE(S) . . . . .	09[ ]	[ ]	155
PORTABLE ELECTRIC HEATER(S) . . . . .	10[ ]	[ ]	156
PORTABLE KEROSENE HEATER(S) . . . . .	11[ ]	[ ]	157
COOKING STOVE, RANGE, OR OVEN (USED TO HEAT HOME, AS WELL AS FOR COOKING) . . . . .	12[ ]	[ ]	158
OTHER (SPECIFY): _____	21[ ]	[ ]	159
DON'T KNOW . . . . .	36[ ]	[ ]	160
NO ADDITIONAL EQUIPMENT . . . . .	13[ ]	[ ]	161

10. What other types of equipment, if any, are used to heat  
your home -- including those that are used to provide  
heat just occasionally? MARK ALL THAT APPLY  
(IF NONE, MARK "NO ADDITIONAL EQUIPMENT")

IF "CENTRAL WARM-AIR FURNACE" MENTIONED IN Q. 9 OR Q. 10, ASK:

11. For the central warm-air furnace, is the warm  
air forced through the ducts by a fan?  
1 [ ] YES  
0 [ ] NO  
6 [ ] DON'T KNOW

IF "HEATING STOVE BURNING WOOD, COAL, COKE" MENTIONED IN Q. 9 OR Q. 10, ASK:

- 12.\* Is the heating stove airtight?  
1 [ ] YES  
0 [ ] NO  
6 [ ] DON'T KNOW

TAKE BACK EXHIBIT 9/10

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 5

14. Has any wood been burned in your home in the past 12 months?

YES 165  
 NO -- SKIP TO Q. 21

IF "YES," HAND RESPONDENT EXHIBIT 15, AND ASK:

15. This exhibit illustrates about one cord of wood. Did your household burn less than this amount, or about this amount or more?

LESS THAN ONE CORD -- ASK Q. 16  
 ONE CORD OR MORE -- SKIP TO Q. 17

IF "LESS THAN ONE CORD," TURN TO EXHIBIT 16, AND ASK:

16. Which of these is most nearly the amount of wood burned in your household in the past 12 months?

A FEW LOGS OR SCRAPS OF WOOD  
 1/4 TO 1/3 OF A CORD  
 1/2 CORD (ABOUT ONE PICK-UP TRUCK OF WOOD)  
 OVER 1/2 CORD BUT LESS THAN A FULL CORD 167

TAKE BACK EXHIBIT 16; SKIP TO Q. 21

IF "ONE CORD OR MORE" ON Q. 15, TURN TO EXHIBIT 17, AND ASK:

17.\* This exhibit shows wood piles of different sizes. Just using these as general reference points, about how many cords of wood did you burn in your household in the past 12 months? (SEE INSTRUCTION BELOW.)

NUMBER OF CORDS:  168-170

TAKE BACK EXHIBIT 17; GO TO Q. 21

INTERVIEWER INSTRUCTIONS:

Q. 17 -- Exhibit 17 is intended only for general reference. Probe for respondent's best estimate of number of cords burned -- this, of course, will ordinarily be a number different from the specific quantities shown on the exhibit. Record answer to nearest cord, or cord plus fraction, as given by respondent (for example: 1, 1-1/2, 4, 10, 12, and so on).

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 5

207-208:02

21. At what temperature do you usually keep your home during the day in the wintertime when someone is at home? (SEE INSTRUCTION BELOW.)

DEGREES FAHRENHEIT 211-212

95  HEAT TURNED OFF

22. At what temperature do you usually keep your home during the day in the wintertime when no one is at home? (SEE INSTRUCTION BELOW.)

DEGREES FAHRENHEIT 213-214

95  HEAT TURNED OFF

23. At what temperature do you usually keep your home during sleeping hours in the wintertime? (SEE INSTRUCTION BELOW.)

DEGREES FAHRENHEIT 215-216

95  HEAT TURNED OFF

24. Do you have a thermostat that can be used to adjust the temperature in your home during the heating season?

YES -- SKIP TO Q. 26 217  
 NO

IF "NO", HAND RESPONDENT EXHIBIT 25 AND ASK:

25. Please look at this list and tell me the ways, if any, you use to adjust the temperature in your home during the heating season. MARK ALL THAT APPLY.

OPENING AND CLOSING WINDOWS OR DOORS . . . . .	<input type="checkbox"/>	218
OPENING AND CLOSING HOT AIR VENTS . . . . .	<input type="checkbox"/>	219
TURN HEATER ON OR OFF (UP OR DOWN) . . . . .	<input type="checkbox"/>	220
TURN RADIATORS OR CONVECTORS ON OR OFF . . . . .	<input type="checkbox"/>	221
ADJUST DRAFT OR AMOUNT OF FUEL FOR WOOD OR COAL FIRE . . . . .	<input type="checkbox"/>	222
USE COOKING STOVE, OVEN, OR RANGE TO HEAT HOME . . . . .	<input type="checkbox"/>	223
OTHER (SPECIFY): _____	<input type="checkbox"/>	224
NO WAY TO ADJUST THE TEMPERATURE . . . . .	<input type="checkbox"/>	225

HAND RESPONDENT EXHIBIT 26

26. During the past winter was your home without heat for one or more days for any of these reasons? (INTERVIEWER: READ AND MARK "YES," OR "NO," FOR EACH ITEM.)

Unable to pay for fuel or utilities . . . . .	<input type="checkbox"/> YES	<input type="checkbox"/> NO	226
Landlord did not provide heat . . . . .	<input type="checkbox"/> YES	<input type="checkbox"/> NO	227
Heating system broken or under repair . . . . .	<input type="checkbox"/> YES	<input type="checkbox"/> NO	228
No fuel available . . . . .	<input type="checkbox"/> YES	<input type="checkbox"/> NO	229
Other (Specify): _____	<input type="checkbox"/> YES	<input type="checkbox"/> NO	230

TAKE BACK EXHIBIT 26

**INTERVIEWER INSTRUCTIONS:**

Q. 21-23 -- If respondent keeps different sections of the house at different temperatures, we want to know the temperature in the part of the house where the people are. If, for example, the heat is turned off upstairs during the day because the family is downstairs, we want the downstairs temperature.

If respondent doesn't know temperature, but does know thermostat setting, record thermostat setting. Otherwise, probe for best estimate.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 7

HAND RESPONDENT EXHIBIT 27/29

27. Which fuel is used most for heating water (other than just for cooking purposes)?

- 01  GAS FROM UNDERGROUND PIPES SERVING THE NEIGHBORHOOD  
02  LPG GAS (BOTTLED OR TANK GAS)  
03  FUEL OIL  
04  KEROSENE OR COAL OIL  
05  ELECTRICITY  
06  COAL OR COKE  
07  WOOD  
08  SOLAR COLLECTORS  
21  OTHER (SPECIFY): \_\_\_\_\_

231-232

00  NO FUEL USED -- TAKE BACK EXHIBIT 27/29; SKIP TO Q. 32

96  DON'T KNOW

28. In addition to your main fuel, do you use any other fuel for heating water (other than just for cooking purposes)?

- 1  YES  
2  NO -- SKIP TO Q. 30

233

IF "YES," ASK:

29. What is the additional fuel?

- 01  GAS FROM UNDERGROUND PIPES SERVING THE NEIGHBORHOOD  
02  LPG GAS (BOTTLED OR TANK GAS)  
03  FUEL OIL  
04  KEROSENE OR COAL OIL  
05  ELECTRICITY  
06  COAL OR COKE  
07  WOOD  
08  SOLAR COLLECTORS  
21  OTHER (SPECIFY): \_\_\_\_\_

234-235

- 96  DON'T KNOW

30. Do you have hot running water in your home?

- 1  YES  
0  NO

236

31a. You mentioned that the fuel you use most for heating water is (SEE Q. 27). Has that been the main water heating fuel here in your home since January 1980?

- 1  YES -- SKIP TO Q. 32  
0  NO

IF "NO," ASK

31b. In what month and year did your present water heating fuel come into use (just approximately)?

MONTH: \_\_\_\_\_

YEAR: \_\_\_\_\_

31c. What was the main water heating fuel before that?

PREVIOUS WATER HEATING FUEL: \_\_\_\_\_

TAKE BACK EXHIBIT 27/29

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 8

32. Do you have air-conditioning equipment, either a central system or individual window or wall units? (MARK ALL THAT APPLY.)

YES, CENTRAL SYSTEM  
 YES, INDIVIDUAL (WINDOW/WALL) UNITS  
 NO -- SKIP TO Q. 37d

238

239

IF "INDIVIDUAL (WINDOW/WALL) UNITS"  
ON Q. 32, ASK:

33. How many individual window or wall units do you have?

NUMBER OF UNITS: \_\_\_\_\_

240-243

IF "CENTRAL SYSTEM" ON Q. 32, ASK:

- 34.\* Does the central air-conditioning system use gas from underground pipes, LPG, or electricity?

GAS FROM UNDERGROUND PIPES SERVING THE NEIGHBORHOOD  
 LPG GAS (BOTTLED OR TANK GAS)  
 ELECTRICITY  
 DON'T KNOW

242

36. How many rooms in your (house/apartment) can be cooled by your air-conditioning? Do not count bathrooms, hallways, foyers, or enclosed porches.

NUMBER OF ROOMS: \_\_\_\_\_  
95  ENTIRE HOUSE OR APARTMENT

244-245

HAND RESPONDENT EXHIBIT 37

37. Which of the statements on this exhibit best describes the way you used your air conditioner(s) last summer? (MARK ONLY ONE.)

DID NOT USE AT ALL  
 TURNED ON ONLY A FEW DAYS OR NIGHTS WHEN REALLY NEEDED  
 TURNED ON QUITE A BIT  
 TURNED ON JUST ABOUT ALL SUMMER  
 OTHER (SPECIFY): \_\_\_\_\_

246

TAKE BACK EXHIBIT 37

IF "YES," ON Q. 32, ASK:

- 37a. Have you used the same air conditioning equipment in your home since January 1980?

YES -- SKIP TO Q. 38  
 NO

IF "NO," ASK

- 37b. In what month and year did your present air conditioning equipment come into use (just approximately)?

MONTH: \_\_\_\_\_

YEAR: \_\_\_\_\_

- 37c. Did you have air conditioning equipment before that time?

YES -- SKIP TO Q. 38  
 NO

IF "NO," ON Q. 32, ASK:

- 37d. Have you used any air conditioning equipment here in your home since January 1980?

YES  
 NO -- SKIP TO Q. 38

IF "YES," ASK:

- 37e. In what month and year did you stop using the air conditioning equipment (just approximately)?

MONTH: \_\_\_\_\_

YEAR: \_\_\_\_\_

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 9

38. How many doors do you have in your home that go from a heated area to the outside or to an unheated area? (SEE INSTRUCTION BELOW.) NUMBER OF DOORS: 247 248  
[] NONE -- SKIP TO Q. 44

HAND RESPONDENT EXHIBIT 39

39. Please look at this exhibit of different kinds of doors. How many of each of these types of doors do you have?

Q. 39 NUMBER OF DOORS	Q. 40 NUMBER WITH STORM DOOR OR INSULATING GLASS	Q. 41 NUMBER STORM/ INSULATING DOORS PUT IN SINCE SEPT. 1, 1980	Q. 42	Q. 43 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT
a. Sliding glass doors  [ <input type="checkbox"/> ] NONE 249	  [ <input type="checkbox"/> ] NONE 250	  [ <input type="checkbox"/> ] NONE 251	MONTH: _____ YEAR: 198_____ [ <input type="checkbox"/> ] IN PROCESS 252-253	2 3 4 5 6 7 8 9 0 (SPECIFY): _____
b. Other doors to the outside  [ <input type="checkbox"/> ] NONE 281	  [ <input type="checkbox"/> ] NONE 282	  [ <input type="checkbox"/> ] NONE 283	MONTH: _____ YEAR: 198_____ [ <input type="checkbox"/> ] IN PROCESS 284-287	1 2 3 4 5 6 7 8 9 0 (SPECIFY): _____

TAKE BACK EXHIBIT 39

FOR EACH TYPE OF DOOR FOR WHICH ANSWER IS "ONE OR MORE," ASK:

40. (Does/How many of) the door(s) have (a storm door/storm doors) or insulating glass?

FOR EACH TYPE OF STORM DOOR OR DOOR WITH INSULATING GLASS, ASK:

41. How many of the (storm/insulated glass) doors were put in your home since September 1, 1980?

IF ONE OR MORE, ASK:

42. In what month and year did you get (it/them)? \_\_\_\_\_

HAND RESPONDENT EXHIBIT 43/48

43. Which of these were most important in your decision to install (storm/insulated glass) door(s)?

CIRCLE NUMBERS FOR ALL REASONS THAT APPLY

TAKE BACK EXHIBIT 43/48

**INTERVIEWER INSTRUCTIONS:**

Q. 38-39 -- Count each pair of sliding glass doors as one door. Include doors that go to an unheated porch or garage. Do not include doors to a heated hallway in an apartment building, doors that are permanently sealed shut, or doors to an unheated attic or basement.

**REASONS FOR Q. 43**

- 1 FOR COMFORT
- 2 TO SAVE HEATING AND/OR COOLING COSTS
- 3 TO TAKE THE COST AS A CREDIT ON INCOME TAX RETURN
- 4 TO TAKE ADVANTAGE OF GOVERNMENT MONEY OR LOW-COST GOVERNMENT LOANS FOR IMPROVEMENTS
- 5 DID THIS BECAUSE HE/WE DOING OTHER HOME IMPROVEMENTS AT SAME TIME
- 6 RECOMMENDED BY FRIEND OR RELATIVE
- 7 RECOMMENDED BY PROFESSIONAL ENERGY ADVISOR (ENERGY AUDITOR OR EXPERT)
- 8 READ OR READ ABOUT BENEFITS ON MAGAZINE OR NEWSPAPER
- 9 REPLACEMENT OF BROKEN OR DEFECTIVE ITEM
- 10 OTHER REASON (SPECIFY)

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 10

107-308-03

44. How many windows do you have in your home? Please include basement, attic, garage, and porch windows only if these areas are heated. (SEE INSTRUCTION BELOW.)

Q. 44 NUMBER OF WINDOWS	Q. 45 NUMBER WITH STORM WINDOWS OR INSULATING GLASS	Q. 46 NUMBER STORM WINDOWS PUT IN SINCE SEPT. 1, 1980	Q. 47	Q. 48 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT
[ ] NONE J22-J22	[ ] NONE J23-J24	[ ] NONE J25-J26	MONTH: _____ YEAR: 198 ____ [ ] IN PROCESS J27-J28	J21-J25 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____

45. How many of the windows have storm windows or insulating glass? (SEE INSTRUCTION BELOW.)

IF ONE OR MORE WINDOWS WITH STORM  
WINDOWS OR INSULATING GLASS, ASK:

46. How many of the storm windows or windows with insulating glass were put in your home since September 1, 1980?

IF ONE OR MORE, ASK:

47. In what month and year were they put in? \_\_\_\_\_

HAND RESPONDENT EXHIBIT 43/48

48. Which of these were most important in your decision to install (storm windows/windows with insulating glass)? CIRCLE NUMBERS FOR ALL REASONS THAT APPLY.

TAKE BACK EXHIBIT 43/48

**INTERVIEWER INSTRUCTIONS:**

Q. 44 -- Each window that opens separately should be counted as one window. Also count windows that are fixed in place. Do not include windows (glass panels) in doors.

Q. 45 -- Windows made of double glass and other types of insulating glass count the same as storm windows.

**REASONS FOR Q. 48**

- 1 FOR COMFORT
- 2 TO SAVE HEATING AND/OR COOLING COSTS
- 3 TO TAKE THE COST AS A CREDIT OR  
INCOME TAX RETURN
- 4 TO TAKE ADVANTAGE OF GOVERNMENT MONEY OR  
LOW-COST GOVERNMENT LOANS FOR IMPROVEMENTS
- 5 DID THIS BECAUSE WE WERE DOING OTHER  
HOME IMPROVEMENTS AT SAME TIME
- 6 RECOMMENDED BY FRIEND OR RELATIVE
- 7 RECOMMENDED BY PROFESSIONAL ENERGY  
ADVISOR (ENERGY AUDITOR OR EXPERT)
- 8 HEARD OR READ ABOUT BENEFITS ON  
RADIO OR TV, MAGAZINE OR NEWSPAPER
- 9 REPLACEMENT OF BROKEN OR DEFECTIVE ITEM
- 10 OTHER REASON (SPECIFY)

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 11

[IF ONE-FAMILY HOUSE OR MOBILE HOME, ASK Q. 49ff. IF 2 OR MORE UNITS IN BUILDING, SKIP TO Q. 75 ON PAGE '8]

49. Do you have insulation in all, or some, or none of the outside walls of your home?

- 1 [ ] ALL  
2 [ ] SOME  
3 [ ] NONE  
4 [ ] DON'T KNOW

J28

50. Do you have roof or ceiling insulation?

- 1 [ ] YES  
2 [ ] NO -- SKIP TO Q. 54  
3 [ ] DON'T KNOW -- SKIP TO Q. 54

J27

IF "YES," HAND RESPONDENT EXHIBIT 51 AND ASK:

51. About how much of the roof or ceiling area is insulated?

- 1 [ ] VERY LITTLE (LESS THAN 5%)  
2 [ ] 1/4 (.6 - 33%)  
3 [ ] 1/2 (.34 - 56%)  
4 [ ] 3/4 (.67 - 95%)  
5 [ ] ALL (.96 - 100%)

J29

TURN TO EXHIBIT 52

52. This exhibit shows different kinds of insulation. Please tell me whether or not you have each one in your roof or ceiling area.

a. SATT/BLANKET	1 [ ] YES 0 [ ] NO 6 [ ] DON'T KNOW	[ ] DON'T KNOW J30-J31
b. LOOSE PARTICLES/LOOSE FILL	1 [ ] YES 0 [ ] NO 6 [ ] DON'T KNOW	[ ] DON'T KNOW J32 J33-J34
c. FIRM FOAM/FIRM PLASTIC	1 [ ] YES 0 [ ] NO 6 [ ] DON'T KNOW	[ ] DON'T KNOW J35 J36-J37
d. SPRAYED-IN FOAM	1 [ ] YES 0 [ ] NO 6 [ ] DON'T KNOW	[ ] DON'T KNOW J38 J39-J40
e. OTHER (SPECIFY):	1 [ ] YES 0 [ ] NO 6 [ ] DON'T KNOW	[ ] DON'T KNOW J41 J42-J43

FOR EACH "YES," ASK:

53. About how many inches of (INSULATION TYPE) do you have in your roof or ceiling area?

TAKE BACK EXHIBIT 52

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 12

**CONTINUE IF ONE-FAMILY HOUSE OR MOBILE HOME. IF 2 OR MORE UNITS IN BUILDING, SKIP TO Q. 75**

**HAND RESPONDENT EXHIBIT 54**

54. Please look at this list and tell me which items, if any, have been added or installed in your home since September 1, 1980.

Q. 54	Q. 55	Q. 56 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT
a. Roof or ceiling insulation		349-353
<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 344	MONTH: _____ YEAR: 198 _____ <input type="checkbox"/> IN PROCESS 345-348	1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
b. Insulation in the outside walls		350-353
<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 354	MONTH: _____ YEAR: 198 _____ <input type="checkbox"/> IN PROCESS 355-358	1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
c. Insulation in the basement or crawl space below floor of house		359-373
<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 364	MONTH: _____ YEAR: 198 _____ <input type="checkbox"/> IN PROCESS 365-368	1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____

**TAKE BACK EXHIBIT 54**

FOR EACH "YES," OR "IN PROCESS" ANSWER, ASK:

55. In what month and year was the work completed? (SEE  
INSTRUCTION BELOW.)

**HAND RESPONDENT EXHIBIT 56**

56. Which of these were most important in your decision to add/install the insulation? CIRCLE NUMBERS FOR ALL REASONS THAT APPLY

**TAKE BACK EXHIBIT 56**

**INTERVIEWER INSTRUCTIONS:**

Q. 54 -- Mark "Yes," "No," or "In Process," for each item. Count as "In Process" any work started but not yet completed. Do not count changes made before this household moved in.

Q. 55 -- If household has done item more than once, write down the most recent date.

**REASONS FOR Q. 56**

- 1 FOR COMFORT
- 2 TO SAVE HEATING AND/OR COOLING COSTS
- 3 TO TAKE THE COST AS A CREDIT ON INCOME TAX RETURN
- 4 TO TAKE ADVANTAGE OF GOVERNMENT MONEY OR LOW-COST GOVERNMENT LOANS FOR IMPROVEMENTS
- 5 DID THIS BECAUSE WE WERE DOING OTHER HOME IMPROVEMENTS AT SAME TIME
- 6 RECOMMENDED BY FRIEND OR RELATIVE
- 7 RECOMMENDED BY PROFESSIONAL ENERGY ADVISOR (ENERGY AUDITOR OR EXPERT)
- 8 HEARD OR READ ABOUT BENEFITS (ON RADIO OR TV, MAGAZINE OR NEWSPAPERS)
- 9 REPLACEMENT OF BROKEN OR DEFECTIVE ITEM
- 10 OTHER REASON (SPECIFY)

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 13

CONTINUE IF ONE-FAMILY HOUSE OR MOBILE HOME. IF 2 OR MORE UNITS IN BUILDING, SKIP TO Q. 75

HAND RESPONDENT EXHIBIT 57

57. Have any of these been added or installed in your home since September 1, 1980?

407-408:04

	Q. 57	Q. 58	Q. 59	Q. 60	Q. 61 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT
a. A replacement or additional home heating system or furnace	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 422	<input type="checkbox"/> REPLACEMENT <input type="checkbox"/> ADDITIONAL 423	<input type="checkbox"/> SAME FUEL <input type="checkbox"/> DIFFERENT FUEL 423	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS 424-427	428-422 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
b. A replacement or additional hot water heater, boiler, or tank	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 423	<input type="checkbox"/> REPLACEMENT <input type="checkbox"/> ADDITIONAL 424	<input type="checkbox"/> SAME FUEL <input type="checkbox"/> DIFFERENT FUEL 425	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS 425-429	430-434 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
c. A replacement or additional central air-conditioning system	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS 433	<input type="checkbox"/> REPLACEMENT <input type="checkbox"/> ADDITIONAL 436	<input type="checkbox"/> SAME FUEL <input type="checkbox"/> DIFFERENT FUEL 437	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS 438-441	442-446 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____

TAKE BACK EXHIBIT 57

FOR EACH "YES", OR "IN PROCESS", ON Q. 57, ASK:

58. Was this a replacement or an additional system? \_\_\_\_\_

59. Does it use the same fuel or different fuel than the one you had before? \_\_\_\_\_

60. In what month and year was the work completed? \_\_\_\_\_

HAND RESPONDENT EXHIBIT 58

61. Which of these were most important in your decision to replace/add the new system? CIRCLE NUMBERS FOR ALL REASONS THAT APPLY

TAKE BACK EXHIBIT 58

IF "YES," OR "IN PROCESS," ON Q. 57a, b, or c. ASK:

62. Has/have the replacement/additional system(s) included the use of active solar energy or wind energy devices?

YES      447  
 NO

IF "YES," ASK:

63. Please describe the new system.

448-  
449

REASONS FOR Q. 61

- 1 FOR COMFORT
- 2 TO SAVE HEATING AND/OR COOLING COSTS
- 3 TO TAKE THE COST AS A CREDIT ON INCOME TAX RETURN
- 4 TO TAKE ADVANTAGE OF GOVERNMENT MONEY OR LOW-COST GOVERNMENT LOANS FOR IMPROVEMENTS
- 5 DID THIS BECAUSE WE WERE DOING OTHER HOME IMPROVEMENTS AT SAME TIME
- 6 RECOMMENDED BY FRIEND OR RELATIVE
- 7 RECOMMENDED BY PROFESSIONAL ENERGY ADVISOR (ENERGY AUDITOR OR EXPERT)
- 8 HEARD OR READ ABOUT BENEFITS (ON RADIO OR TV, MAGAZINE OR NEWSPAPER)
- 9 REPLACEMENT OF BROKEN OR DEFECTIVE ITEM
- 10 OTHER REASON (SPECIFY)

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 14

CONTINUE IF ONE-FAMILY HOUSE OR MOBILE HOME. IF 2 OR MORE UNITS IN BUILDING, SKIP TO Q. 75

HAND RESPONDENT EXHIBIT 64

64. Please look at this list and as I read each item tell me which, if any, have been added or installed in your home since September 1, 1980. (SEE INSTRUCTIONS AT BOTTOM OF FACING PAGE.)

	Q. 64	Q. 65	Q. 66 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT									
			1	2	3	4	5	6	7	8	9	10 (SPECIFY):
a. An automatic set-back or clock thermostat	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 180 <input type="checkbox"/> IN PROCESS	455-459 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
b. Flame retention head burner for furnace (fuel oil)	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 180 <input type="checkbox"/> IN PROCESS	465-469 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
c. Automatic flue door (vent damper)	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 170 <input type="checkbox"/> IN PROCESS	475-479 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
d. Electrical or mechanical furnace ignition system (spark ignition)	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 507-508-05 <input type="checkbox"/> IN PROCESS 511 <input type="checkbox"/> IN PROCESS	515-520 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
e. Insulation around heating and/or cooling ducts	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 521 <input type="checkbox"/> IN PROCESS	526-530 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
f. Insulation around the hot water and/or cooling pipes	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 532 <input type="checkbox"/> IN PROCESS	536-540 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									
g. Insulation around the hot water heater	1 <input type="checkbox"/> YES 0 <input type="checkbox"/> NO 2 <input type="checkbox"/> IN PROCESS	MONTH: _____ YEAR: 198_____ 541 <input type="checkbox"/> IN PROCESS	548-550 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____									

Q. 64-66 ARE CONTINUED ON FACING PAGE

FOR EACH "YES," ASK:

65. In what month and year was the work completed?  
(SEE INSTRUCTION AT BOTTOM OF FACING PAGE.)

TURN TO EXHIBIT 66

66. Which of these were most important in your decision to add or install (TYPE OF ITEM ADDED OR INSTALLED)?  
CIRCLE NUMBERS FOR ALL REASONS THAT APPLY

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 15

CONTINUED FROM PAGE 14

	Q. 64	Q. 65	Q. 66 CIRCLE NUMBERS FOR REASONS SELECTED BY RESPONDENT
h. Closeable shutters, insulating drapes, reflective film	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS <small>561</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>562-565</small>	558-580 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
i. Plastic sheets (over windows or other openings)	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS <small>567</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>563-565</small>	568-570 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
j. Caulking	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS <small>571</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>572-575</small>	576-580 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
k. Weather stripping around any windows or doors to the outside	<input type="checkbox"/> YES <small>507-</small> <input type="checkbox"/> NO <small>508-</small> <input type="checkbox"/> IN PROCESS <small>511</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>512-515</small>	519-522 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
l. Heat pump	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS <small>522</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>523-525</small>	526-530 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____
m. Wood-burning stove	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> IN PROCESS <small>532</small>	MONTH: _____ YEAR: 198_____ <input type="checkbox"/> IN PROCESS <small>533-535</small>	536-540 1 2 3 4 5 6 7 8 9 10 (SPECIFY): _____

FOR EACH "YES," ASK:

65. In what month and year was the work completed  
(SEE INSTRUCTION BELOW.)

TURN TO EXHIBIT 66

66.\* Which of these were most important in your decision to add or install (TYPE OF ITEM ADDED OR INSTALLED)?  
CIRCLE NUMBERS FOR ALL REASONS THAT APPLY

TAKE BACK EXHIBIT 66

**INTERVIEWER INSTRUCTIONS:**

Q. 64 -- Mark "Yes," "No," or "In Process" for each item. Count as "In Process" any work started but not yet completed. Do not count any changes made before this household moved in.

Q. 65 -- If household has done item more than once, write down the most recent date.

**REASONS FOR Q. 66**

- 1 FOR COMFORT
- 2 TO SAVE HEATING AND/OR COOLING COSTS
- 3 TO TAKE THE COST AS A CREDIT ON INCOME TAX RETURN
- 4 TO TAKE ADVANTAGE OF GOVERNMENT MONEY OR LOW-COST GOVERNMENT LOANS FOR IMPROVEMENTS
- 5 DID THIS BECAUSE WE WERE DOING OTHER HOME IMPROVEMENTS AT SAME TIME
- 6 RECOMMENDED BY FRIEND OR RELATIVE
- 7 RECOMMENDED BY PROFESSIONAL ENERGY ADVISOR (ENERGY AUDITOR OR EXPERT)
- 8 HEARD OR READ ABOUT BENEFITS (ON RADIO OR TV, MAGAZINE OR NEWSPAPER)
- 9 REPLACEMENT OF BROKEN OR DEFECTIVE ITEM
- 10 OTHER REASON (SPECIFY)

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 16

**ASK EVERYONE**

75. Do you have a refrigerator in your home that you use regularly or occasionally?

YES

NO -- SKIP TO Q. 79

656

**IF "YES," ASK:**

76. Do you have one refrigerator or more than one that is presently in use? (How many altogether?)

ONE

TWO

657

THREE OR MORE

**ASK ABOUT EACH REFRIGERATOR -- FIRST ASK ABOUT REFRIGERATOR USED MOST: (SEE INSTRUCTION BELOW.)**

77. Is it electric or gas?

**REFRIGERATOR #1**

ELECTRIC

GAS

**REFRIGERATOR #2**

ELECTRIC

GAS

660

ONE

ONE

661

TWO

TWO

THREE

THREE

FOUR

FOUR

**TAKE BACK EXHIBIT 78**

**INTERVIEWER INSTRUCTIONS:**

Q. 77-78 -- If respondent has more than two refrigerators, ask about two used most.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 17

79. Do you have a home freezer -- one that is a separate appliance from the refrigerator -- that is presently in use?

YES  
 NO -- SKIP TO Q. 83

582

IF "YES," ASK:

80. Do you have one freezer or more than one that is presently in use? (How many altogether?)

1  ONE  
2  TWO  
3  THREE OR MORE

583

ASK ABOUT EACH FREEZER -- ASK FIRST ABOUT FREEZER USED MOST: (SEE INSTRUCTION BELOW.)

81. Is it electric or gas?

FREEZER #1	FREEZER #2
<input type="checkbox"/> ELECTRIC	<input type="checkbox"/> ELECTRIC
2 <input type="checkbox"/> GAS	2 <input type="checkbox"/> GAS
<input type="checkbox"/> FROST-FREE	<input type="checkbox"/> FROST-FREE
2 <input type="checkbox"/> MUST DEFROST	2 <input type="checkbox"/> MUST DEFROST

584 585 586 587

82. Is it a frost-free freezer or must it be defrosted?

**INTERVIEWER INSTRUCTIONS:**

Q. 81-82 -- If respondent has more than two freezers (that are appliances separate from refrigerators), ask about two used most.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 18

HAND RESPONDENT EXHIBIT 33

83. Thinking of all the different kinds of cooking done here, including cooking in the oven, on a range, and with small appliances, which fuel is used most?

- 01 [ ] GAS FROM UNDERGROUND PIPES SERVING THE NEIGHBORHOOD  
02 [ ] LPG GAS (BOTTLED OR TANK GAS)  
03 [ ] FUEL OIL  
04 [ ] KEROSENE OR COAL OIL 568-569  
05 [ ] ELECTRICITY  
06 [ ] COAL OR COKE  
07 [ ] WOOD  
22 [ ] OTHER (SPECIFY): \_\_\_\_\_  
00 [ ] NO COOKING DONE -- SKIP TO Q. 38

TAKE BACK EXHIBIT 33

94. Does your household use an oven of any type, including microwave or convection ovens, for cooking at least occasionally?

- 1 [ ] YES 670  
0 [ ] NO -- SKIP TO Q. 38

[IF "YES," ASK:

85. Do you have one oven or more than one oven that you presently use? (How many altogether?) (SEE INSTRUCTION BELOW.)

- 1 [ ] ONE  
2 [ ] TWO 671  
3 [ ] THREE OR MORE

ASK ABOUT EACH OVEN -- ASK FIRST ABOUT OVEN USED MOST: (SEE INSTRUCTION BELOW.)

86. Is your oven electric or gas?

[IF "ELECTRIC," ASK:

87. Is it a microwave oven?

OVEN #1	OVEN #2
1 [ ] ELECTRIC	1 [ ] ELECTRIC
2 [ ] GAS 672	2 [ ] GAS 674
1 [ ] YES	1 [ ] YES
0 [ ] NO 573	0 [ ] NO 575

**INTERVIEWER INSTRUCTIONS:**

Q. 85 -- Do NOT count toaster ovens in count of ovens.

Q. 86 -- If respondent has more than two ovens, ask about two used most.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 19

HAND RESPONDENT EXHIBIT 88

207-708:07

88. Please look at this list and, as I read each item, tell me which of these you use here in your (house/apartment)?

ELECTRIC RANGE (STOVE-TOP OR BURNERS)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	711
GAS RANGE (STOVE-TOP OR BURNERS)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	712
OUTDOOR GAS GRILL (USING GAS FROM UNDERGROUND PIPES)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	713
OUTDOOR GAS GRILL (USING LPG--BOTTLED OR TANK GAS)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	714
AUTOMATIC CLOTHES WASHER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	715
WRINGER WASHING MACHINE (ELECTRIC)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	716
ELECTRIC DISHWASHER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	717
ELECTRIC CLOTHES DRYER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	718
GAS CLOTHES DRYER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	719
OUTDOOR GAS LIGHT	<input type="checkbox"/> YES	<input type="checkbox"/> NO	720
ELECTRIC DEHUMIDIFIER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	721
ELECTRIC HUMIDIFIER	<input type="checkbox"/> YES	<input type="checkbox"/> NO	722
EVAPORATIVE COOLER (SWAMP COOLER)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	723
"WHOLE HOUSE" COOLING FAN (IN ATTIC OR ENTRANCE TO ATTIC)	<input type="checkbox"/> YES	<input type="checkbox"/> NO	724
WINDOW OR CEILING FAN	<input type="checkbox"/> YES	<input type="checkbox"/> NO	NUMBER: 725
BLACK AND WHITE TELEVISION SET	<input type="checkbox"/> YES	<input type="checkbox"/> NO	NUMBER: 726
COLOR TELEVISION SET	<input type="checkbox"/> YES	<input type="checkbox"/> NO	NUMBER: 727

IF "YES" FOR WINDOW OR CEILING FAN, ASK:

89. How many window or ceiling fans do you use here in your home? \_\_\_\_\_

IF "YES" FOR BLACK AND WHITE TV SET, ASK:

90. How many black and white television sets do you use here  
in your home? \_\_\_\_\_

IF "YES" FOR COLOR TV SET, ASK:

91.\* How many color television sets do you use here in your home? \_\_\_\_\_

TAKE BACK EXHIBIT 88

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 20

102. Now I have some questions about the people who live here. Please tell me who they are, just in relation to (HOUSEHOLDER). I would also like to know their ages on their last birthdays. Please begin with (HOUSEHOLDER). (SEE INSTRUCTIONS BELOW).

PERSON NUMBER	WHO IS RESPON- DENT?	RELATIONSHIP TO HOUSEHOLDER	SEX		AGE	Q. 107 - EMPLOYMENT (AGE 14+)			361-367
			FEMALE	MALE		FULL TIME	PART TIME	NOT EMPLOYED	
1		HOUSEHOLDER	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	361-367
2			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	371-377
3			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	307-328-33
4			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	321-327
5			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	331-337
6			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	341-347
7			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	351-357
8			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	361-367
9			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	371-377
10			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1007-1308-10
11			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1211-1217
12			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1021-1027
			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1031-1037

I have listed (READ RELATIONSHIPS FROM Q. 102 ABOVE). Have I missed . . . .

103. Any babies or small children?  YES (ADD TO LISTING)  NO
104. Any lodgers, boarders, or persons in your employ who live here?  YES (ADD TO LISTING)  NO
105. Anyone who usually lives here but is away traveling or in the hospital? (SEE INSTRUCTION BELOW.)  YES (ADD TO LISTING)  NO
106. Anyone else staying here who does not have a regular residence elsewhere?  YES (ADD TO LISTING)  NO

FOR OFFICE USE ONLY:

1039-1039

FOR EACH PERSON AGED 14 YEARS OR OLDER, ASK:

107. Is he/she employed full-time (30 hours or more per week), part-time, or not employed?

**INTERVIEWER INSTRUCTIONS:**

In general, the householder is the person (or one of the persons) in whose name the home is owned or rented.

For questions on this and the following pages, where the term "HOUSEHOLDER" is inserted, use the appropriate designation -- you, your husband, wife, partner -- depending on who is the householder and whom you are interviewing.

Q. 102 -- Be sure to list relationships, not names. Include members of a second family that share the housing unit. Check box to indicate which household member is the respondent.

Q. 105 -- Persons who are normally members of the household but who are now living away from home (e.g., college students or members of the Armed Forces) should not be listed.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 21

108a. Does another family share your home with you?  YES (SEE INSTRUCTION BELOW.) :040  
 NO

108b. Thinking back to 1981, about how many people were in your household at that time? NUMBER IN HOUSEHOLD  
IN 1981:

INTERVIEWER: MARK ANSWER. ASK, IF NECESSARY.

HOUSEHOLDER'S MARITAL STATUS 109. Which of the following best describes (HOUSEHOLDER): now married, widowed, divorced or separated, or never married? :041  
 NOW MARRIED  
 WIDOWED  
 DIVORCED OR SEPARATED  
 NEVER MARRIED

HAND RESPONDENT EXHIBIT 110

110. Which of the groups on this exhibit best describes (HOUSEHOLDER)?  
1 WHITE  
2 BLACK OR NEGRO  
3 AMERICAN INDIAN, ALASKAN NATIVE :042  
4 ASIAN, PACIFIC ISLANDER  
5 OTHER (SPECIFY): \_\_\_\_\_

TAKE BACK EXHIBIT 110

111. Is (HOUSEHOLDER) of Spanish or Hispanic origin or descent?  YES :043  
 NO

**INTERVIEWER INSTRUCTIONS:**

Q. 108a -- If answer is "YES," check whether the additional family (or unrelated individual) has a separate room or apartment that is defined by our rules as separate living quarters. Separate living quarters are those in which the occupants (1) live and eat separately from other persons in building, and (2) have direct access from outside the building or through a common hall.

If the second family's space does meet the rules for separate living quarters, that space should be excluded from the information obtained in this interview. Go back over this interview to make corrections if necessary.

If the second family's space does not meet the definition of separate living quarters, be sure that the members of the second family are included in the list of household members in Q. 102.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 22

I have just a few questions for background statistical purposes.

112. What is the highest grade (or year) (HOUSEHOLDER) attended in school?  NEVER ATTENDED SCHOOL -- SKIP TO Q. 114
- |                                 |                                   |
|---------------------------------|-----------------------------------|
| <input type="checkbox"/> FIRST  | <input type="checkbox"/> SEVENTH  |
| <input type="checkbox"/> SECOND | <input type="checkbox"/> EIGHTH   |
| <input type="checkbox"/> THIRD  | <input type="checkbox"/> NINTH    |
| <input type="checkbox"/> FOURTH | <input type="checkbox"/> TENTH    |
| <input type="checkbox"/> FIFTH  | <input type="checkbox"/> ELEVENTH |
| <input type="checkbox"/> SIXTH  | <input type="checkbox"/> TWELFTH  |
- 1044-  
1045

COLLEGE (ACADEMIC YEARS)

- |                             |                                     |
|-----------------------------|-------------------------------------|
| <input type="checkbox"/> C1 | <input type="checkbox"/> C4         |
| <input type="checkbox"/> C2 | <input type="checkbox"/> C5         |
| <input type="checkbox"/> C3 | <input type="checkbox"/> C6 OR MORE |

113. Did (HOUSEHOLDER) finish that grade (or year)?  YES 1048  
 NO

HAND RESPONDENT EXHIBIT 114

114. In 1981 did you or any member of your family living here receive any income or benefits from:  
(INTERVIEWER: READ AND MARK "YES," OR "NO," FOR EACH ITEM.)

- a. Wages or salaries . . . . .  YES  NO 1047
- b. Self employment from business or farm . . . . .  YES  NO 1048
- c. Aid to Families with Dependent Children (AFDC) . . . . .  YES  NO 1049
- d. Supplemental Security Income (SSI) . . . . .  YES  NO 1050
- e. General Assistance or other public assistance . . . . .  YES  NO 1051
- f. Food Stamps . . . . .  YES  NO 1052
- g. Social Security or Railroad Retirement . . . . .  YES  NO 1053
- h. Unemployment compensation . . . . .  YES  NO 1054

TAKE BACK EXHIBIT 114

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 23

HAND RESPONDENT EXHIBIT 115

115. Now let's look at this list of income groups. Please tell me which group letter best describes the total combined income in 1981 of all members of your family living here, from all sources -- wages, dividends, Social Security, and so forth -- before taxes and deductions. (Family includes all related persons living in this household.)

CIRCLE LETTER FOR INCOME GROUP

01 A LESS THAN \$ 3,000	20 J \$11,000 - \$11,999	19 S \$27,500 - \$29,999	
02 B \$ 3,000 - \$ 3,999	21 K \$12,000 - \$12,999	20 T \$30,000 - \$32,499	
03 C \$ 4,000 - \$ 4,999	22 L \$13,000 - \$13,999	21 U \$32,500 - \$34,999	
04 D \$ 5,000 - \$ 5,999	23 M \$14,000 - \$14,999	22 V \$35,000 - \$39,999	
05 E \$ 6,000 - \$ 6,999	24 N \$15,000 - \$17,499	23 W \$40,000 - \$49,999	1055-
06 F \$ 7,000 - \$ 7,999	25 O \$17,500 - \$19,999	24 X \$50,000 - \$74,999	1056
07 G \$ 8,000 - \$ 8,999	26 P \$20,000 - \$22,499	25 Y \$75,000 OR OVER	
08 H \$ 9,000 - \$ 9,999	27 Q \$22,500 - \$24,999	96 [ ] DON'T KNOW	
09 I \$10,000 - \$10,999	28 R \$25,000 - \$27,499	97 [ ] REFUSED	

TURN TO EXHIBIT 116

116. Since January 1980, has your household received any of the following services free or at reduced cost, from the federal, state, or local government? (INTERVIEWER: READ AND MARK "YES" OR "NO" FOR EACH ITEM.)

- a. Insulation in the attic, outside wall, or basement/crawl space below the floor of the house . . . . .  YES  NO 1057
- b. Insulation around the hot water heater . . . . .  YES  NO 1058
- c. Repair of broken windows or doors to keep out the cold or hot weather . . . . .  YES  NO 1059
- d. Weather stripping or caulking around any windows or doors to the outside . . . . .  YES  NO 1060
- e. Storm doors or windows added . . . . .  YES  NO 1061
- f. Repair of broken furnace . . . . .  YES  NO 1062
- g. Furnace tuneup and/or modifications . . . . .  YES  NO 1063
- h. Other home energy-saving devices  
(Specify): \_\_\_\_\_  YES  NO 1064

TAKE BACK EXHIBIT 116

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 24

117. The government has an energy assistance program that helps pay heating and cooling costs. This assistance can be received directly by the household or it can be paid directly to the electric or gas company, fuel dealer, or landlord.

Between October 1, 1981 and September 30, 1982 did your household receive assistance of this type for home cooling from the federal, state, or local government?  YES  NO 1065

118. Between October 1, 1981 and September 30, 1982 did your household receive assistance of this type for home heating from the federal, state, or local government?  YES  NO 1066

IF "YES," ON Q. 118, HAND RESPONDENT EXHIBIT 119 AND ASK:

119. Were heating assistance payments made in the form of checks, coupons, or vouchers sent to this household or were the payments sent directly to the utility company, fuel dealer, or landlord? (MARK "YES," OR "NO," FOR EACH ITEM.)

- a. Check to household . . . . .  YES  NO 1067  
b. Coupon/voucher to household . . . . .  YES  NO 1068  
c. Assistance sent directly to electric or gas company, fuel dealer, or landlord . . . . .  YES  NO 1069

TAKE BACK EXHIBIT 119

120. Altogether, how much government energy assistance to help pay heating costs has been provided directly to this household and/or provided on behalf of this household to a utility company, fuel dealer, or landlord between October 1, 1981 and September 30, 1982? (PROBE FOR BEST ESTIMATE)

1070-1073

NUMBER OF  
DOLLARS \$ \_\_\_\_\_.00

ASK EVERYONE

121. Do you or members of your household own your home or do you rent?

- OWN (BUYING)  
 RENT -- SKIP TO Q. 123 1074  
 OCCUPIED WITHOUT PAYMENT OF RENT -- SKIP TO Q. 124

IF "OWN (BUYING)," ASK:

122. Is this (house/apartment) part of a condominium or cooperative?

- YES, CONDOMINIUM  
 YES, COOPERATIVE 1075  
 NO

IF "RENT," ASK:

123. What is the monthly rent of your (house/apartment)?

1076-1079  
\$ \_\_\_\_\_.00 PER MONTH

IF RENT IS NOT PAID BY THE MONTH, NOTE IN THE SPACE BELOW THE TIME PERIOD COVERED AND THE AMOUNT PAID PER TIME PERIOD.

TIME PERIOD COVERED: \_\_\_\_\_

AMOUNT PAID PER TIME PERIOD: \$ \_\_\_\_\_.00

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 25

HAND RESPONDENT EXHIBIT 124

124. We may have covered some of these points before, but just to be sure, please look at this exhibit and tell me whether these fuels are used for these purposes in your household.

1107-1108:12

	USED	NOT USED	PAID BY HOUSEHOLD	INCLUDED IN RENT	OTHER (SPECIFY)
<u>ELECTRICITY</u>					
a. FOR HOT WATER	1[]	0[]	1[]	2[]	5[] _____
b. FOR HEATING YOUR HOME	1[]	0[]	1[]	2[]	5[] _____
c. FOR AIR-CONDITIONING (CENTRAL OR WINDOW/WALL UNITS)	1[]	0[]	1[]	2[]	5[] _____
d. FOR COOKING	1[]	0[]	1[]	2[]	5[] _____
e. FOR LIGHTING AND OTHER APPLIANCES	1[]	0[]	1[]	2[]	5[] _____
<u>GAS FROM UNDERGROUND PIPES SERVING YOUR NEIGHBORHOOD</u>					
f. FOR HOT WATER	1[]	0[]	1[]	2[]	5[] _____
g. FOR HEATING YOUR HOME	1[]	0[]	1[]	2[]	5[] _____
h. FOR CENTRAL AIR-CONDITIONING	1[]	0[]	1[]	2[]	5[] _____
i. FOR COOKING INSIDE HOME	1[]	0[]	1[]	2[]	5[] _____
j. FOR COOKING ON OUTDOOR GRILL	1[]	0[]	1[]	2[]	5[] _____
k. FOR OTHER APPLIANCES (INCLUDE OUTSIDE GAS LIGHT HERE)	1[]	0[]	1[]	2[]	5[] _____
<u>LPG GAS (BOTTLED OR TANK GAS)</u>					
l. FOR HOT WATER	1[]	0[]	1[]	2[]	5[] _____
m. FOR HEATING YOUR HOME	1[]	0[]	1[]	2[]	5[] _____
n. FOR CENTRAL AIR-CONDITIONING	1[]	0[]	1[]	2[]	5[] _____
o. FOR COOKING INSIDE HOME	1[]	0[]	1[]	2[]	5[] _____
p. FOR COOKING ON OUTDOOR GRILL	1[]	0[]	1[]	2[]	5[] _____
q. FOR OTHER APPLIANCES (INCLUDE OUTSIDE GAS LIGHT HERE)	1[]	0[]	1[]	2[]	5[] _____
<u>FUEL OIL OR KEROSENE</u>					
r. FOR HOT WATER	1[]	0[]	1[]	2[]	5[] _____
s. FOR HEATING YOUR HOME	1[]	0[]	1[]	2[]	5[] _____
t. FOR COOKING	1[]	0[]	1[]	2[]	5[] _____

FOR EACH USE OF EACH FUEL, ASK:

125.\* Is that paid for by your household, included in your rent, or do you get it some other way?

TAKE BACK EXHIBIT 124

IF NONE OF FUEL BILLS ARE "PAID BY HOUSEHOLD," SKIP TO INSTRUCTION FOR Q. 144 ON PAGE 35  
OTHERWISE, CONTINUE WITH Q. 127 ON NEXT PAGE.

\*Question 126 is omitted.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 26

IF HOUSEHOLD USES AND PAYS FOR ELECTRICITY, GAS (FROM UNDERGROUND PIPES OR LPG), OR FUEL OIL/KEROSENE IN Q. 125, ASK Q. 127ff. OTHERWISE, SKIP TO INSTRUCTION FOR Q. 144.

HAND RESPONDENT EXHIBIT 127

127. Do any of your household fuel bills include charges for fuel used for purposes other than for your own living quarters, such as farm buildings or machinery, the house or apartment of another household, a business or office, or anything else?

YES  
 NO -- TAKE BACK EXHIBIT 127; SKIP TO INSTRUCTION FOR Q. 133 1152

IF "YES," ASK:

128. Which fuel bills include charges for fuel used for purposes other than your own living quarters? (MARK AS MANY AS APPLY.)

ELECTRICITY 1153  
 GAS FROM UNDERGROUND PIPES 1154  
 LPG GAS (BOTTLED OR TANK GAS) 1155  
 FUEL OIL OR KEROSENE 1156

TURN TO EXHIBIT 129-132

IF "ELECTRICITY" ON Q. 128, ASK:

129. About how much of your household's electricity bill is used for non-household uses such as farm buildings or machinery, the house or apartment of another household, a business or office, or anything else?

VERY LITTLE (LESS THAN 5%)  
 1/4 (5 - 33%)  
 1/2 (34 - 66%) 1157  
 3/4 (67 - 95%)

IF "GAS FROM UNDERGROUND PIPES" ON Q. 128, ASK:

130. About how much of your household's gas bill is used for non-household uses such as farm buildings or machinery, the house or apartment of another household, a business or office, or anything else?

VERY LITTLE (LESS THAN 5%)  
 1/4 (5 - 33%)  
 1/2 (34 - 66%) 1158  
 3/4 (67 - 95%)

IF "LPG GAS" ON Q. 128, ASK:

131. About how much of your household's LPG bill is used for non-household uses such as farm buildings or machinery, the house or apartment of another household, a business or office, or anything else?

VERY LITTLE (LESS THAN 5%)  
 1/4 (5 - 33%)  
 1/2 (34 - 66%) 1159  
 3/4 (67 - 95%)

IF "FUEL OIL OR KEROSENE" ON Q. 128, ASK:

132. About how much of your household's fuel oil/kerosene bill is used for non-household uses such as farm buildings or machinery, the house or apartment of another household, a business or office, or anything else?

VERY LITTLE (LESS THAN 5%)  
 1/4 (5 - 33%)  
 1/2 (34 - 66%) 1160  
 3/4 (67 - 95%)

TAKE BACK EXHIBIT 129-132

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 27

IF HOUSEHOLD USES AND PAYS FOR LPG GAS (SEE QUESTIONS 124-125, PARTS 1-4), ASK Q. 133ff.  
OTHERWISE, SKIP TO INSTRUCTION FOR Q. 136.

133. About how many deliveries of LPG does your household usually get in a year? NUMBER OF DELIVERIES:   I162-I162

CASH AND CARRY, PICK UP AT STORE  
 LIVED HERE LESS THAN 1 YEAR

134. Since January 1980, did you buy LPG for this (house/apartment) from one company or from more than one company? I163

ONE COMPANY  
 MORE THAN ONE COMPANY

IF "MORE THAN ONE COMPANY," ASK:

135. How many different companies? I164

TWO  
 THREE  
 FOUR OR MORE

IF HOUSEHOLD USES AND PAYS FOR FUEL OIL OR KEROSENE (SEE QUESTIONS 124-125, PARTS 5-6), ASK Q. 136ff. OTHERWISE, SKIP TO Q. 140.

136. About how many deliveries of fuel oil/kerosene does your household usually get in a year? NUMBER OF DELIVERIES:   I165-I166

CASH AND CARRY, PICK UP AT STORE  
 LIVED HERE LESS THAN 1 YEAR

137. Since January 1980, did you buy fuel oil/kerosene for this (house/apartment) from one company or from more than one company? I167

ONE COMPANY  
 MORE THAN ONE COMPANY

IF "MORE THAN ONE," ASK:

138. How many different companies? I168

TWO  
 THREE  
 FOUR OR MORE

HAND RESPONDENT EXHIBIT 139

139. About how much fuel oil/kerosene does your household use in a year -- which of these groups would it be, just approximately?  
PROBE FOR BEST ESTIMATE.

LESS THAN 100 GALLONS PER YEAR  
 100-499 GALLONS PER YEAR  
 500-999 GALLONS PER YEAR I169  
 1000 OR MORE GALLONS PER YEAR

TAKE BACK EXHIBIT 139

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 28

CONTINUE IF ANY ELECTRIC, GAS (FROM UNDERGROUND PIPES OR LPG), OR FUEL OIL/KEROSENE BILLS ARE PAID BY HOUSEHOLD. OTHERWISE, SKIP TO INSTRUCTION FOR Q. 144

140. In addition to the types of fuel you use, we are interested in the quantities used and in the amount that people pay for electricity, gas, fuel oil, or kerosene in different parts of the United States.

I have a form that would authorize the companies that supply your household to provide that information to Response Analysis Corporation. The authorization applies to the period from January 1980 through April 1983.

Since this study is being done nationwide, it will give a good picture of the differences in fuel cost and usage all over the country. The information is needed to help establish important national energy policies.

INTERVIEWER: REMOVE THE AUTHORIZATION FORM FROM THE QUESTIONNAIRE AND HAND TO RESPONDENT. EITHER YOU OR RESPONDENT SHOULD FILL IN THE NAME(S) OF COMPANIES. IF MORE THAN ONE LPG OR FUEL OIL OR KEROSENE COMPANY HAS BEEN USED SINCE JANUARY 1, 1980, FILL IN ADDITIONAL COMPANY NAMES ON OTHER SIDE OF FORM. PLEASE PRINT.

- [ ] AUTHORIZATION FORM SIGNED 1170  
 [ ] AUTHORIZATION FORM NOT SIGNED -- INTERVIEWER, EXPLAIN BELOW:

IF AUTHORIZATION FORM IS SIGNED, ASK Q. 141ff. OTHERWISE, SKIP TO INSTRUCTION FOR Q. 144.

141. Do your fuel bills come addressed to (NAME OF SIGNATURE ON AUTHORIZATION FORM),  
or are they in another name?  [ ] SAME NAME -- SKIP TO  
Q. 143. 1171  
 [ ] ANOTHER NAME

IF BILL IS IN ANOTHER NAME, ASK:

142. What is that name and address:

BILLING NAME: \_\_\_\_\_

STREET ADDRESS: \_\_\_\_\_

CITY AND STATE: \_\_\_\_\_

ZIP CODE: \_\_\_\_\_

143. Would it be possible for you to give me your customer number at your electric/gas company?  
This number is on your bills from the company.

ELECTRIC COMPANY -- CUSTOMER NUMBER: \_\_\_\_\_ 1172

[ ] NOT AVAILABLE/REFUSED

GAS (FROM UNDERGROUND PIPES) -- CUSTOMER NUMBER: \_\_\_\_\_ 1173

[ ] NOT AVAILABLE/REFUSED

W

--	--



**U.S. DEPARTMENT OF ENERGY SURVEY**

**Authorization Form for  
Residential Energy Consumption Survey**

I hereby give permission to the company (companies) below to provide information to Response Analysis Corporation (or other designee of the U.S. Department of Energy) for confidential use in connection with their survey for the U.S. Department of Energy.

This authorization covers use of fuels (electricity, natural gas or LPG, fuel oil or kerosene) by my household from January 1, 1980 through April 30, 1983 including:

- 1) the total amount of fuels used by my household.
- 2) the total price charged for fuels by my household.

Companies are authorized to provide this information by monthly periods or by delivery date, whichever applies.

A photocopy of this authorization may be accepted with the same authority as the original.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

PLEASE  
PRINT

YOUR NAME

APT. NO.

ADDRESS

CITY OR POST OFFICE

STATE

ZIP CODE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

PLEASE COMPLETE ONE BLOCK BELOW FOR EACH FUEL USED BY YOUR HOUSEHOLD  
(IF MORE THAN ONE SUPPLIER OF A PARTICULAR FUEL USE THE OTHER SIDE OF THIS SHEET)

ELECTRICITY —————

PRINT FULL NAME OF ELECTRIC COMPANY

LOCATION OF COMPANY (IF KNOWN) — CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

GAS —————

from underground pipes  
or LPG (bottled or tank gas)

PRINT FULL NAME OF GAS COMPANY

LOCATION OF COMPANY (IF KNOWN) — CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

FUEL OIL —————

or KEROSENE

PRINT FULL NAME OF OIL COMPANY

LOCATION OF COMPANY (IF KNOWN) — CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 30

GAS \_\_\_\_\_

LPG (bottled  
or tank gas)

SECOND GAS COMPANY

PRINT FULL NAME OF GAS COMPANY

LOCATION OF COMPANY (IF KNOWN) - CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

FUEL OIL \_\_\_\_\_

OR KEROSENE

SECOND FUEL OIL/KEROSENE COMPANY

PRINT FULL NAME OF OIL COMPANY

LOCATION OF COMPANY (IF KNOWN) - CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

THIRD FUEL OIL/KEROSENE COMPANY

PRINT FULL NAME OF OIL COMPANY

LOCATION OF COMPANY (IF KNOWN) - CITY AND STATE

TELEPHONE  
AREA CODE: \_\_\_\_\_ NUMBER: \_\_\_\_\_

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 31

IF HOUSEHOLD HAS ONE OR MORE FUELS "INCLUDED IN RENT" OR "OTHER" (SEE Q. 125 ON PAGE 29.) ASK  
Q. 144. OTHERWISE, SKIP TO Q. 145.

144. We may be needing some additional information about fuels used in this building (house).  
May I have the name of the person or company to whom you pay rent or who is responsible  
for paying the fuel bills for this building (house)?

NAME: \_\_\_\_\_ 1174

TELEPHONE NUMBER: (AREA CODE: \_\_\_\_\_)

STREET ADDRESS: \_\_\_\_\_

CITY OR TOWN/STATE/ZIP CODE: \_\_\_\_\_

ASK EVERYONE

145. For interview verification purposes, may I have your name, phone number, and mailing  
address please?

RESPONDENT'S NAME: \_\_\_\_\_

TELEPHONE NUMBER: (AREA CODE: \_\_\_\_\_)

STREET ADDRESS: \_\_\_\_\_

CITY OR TOWN/STATE/ZIP CODE: \_\_\_\_\_

1207-1208:12

146. [INTERVIEWER:  
MARK TYPE OF HOUSING UNIT]

MOBILE HOME OR TRAILER

ONE-FAMILY HOUSE

ONE STORY

TWO STORY

THREE STORY

SPLIT-LEVEL

OTHER (SPECIFY): \_\_\_\_\_

{ IF ONE-FAMILY  
HOUSE, MARK STYLE  
BASED ON GENERAL  
APPEARANCE FROM  
OUTSIDE

1211-  
1212

HOUSE OR BUILDING WITH 2 TO 4 UNITS

APARTMENT BUILDING OR OTHER  
STRUCTURE WITH 5 OR MORE UNITS

[IF THIS IS A MOBILE HOME OR A BUILDING WITH 5 OR MORE HOUSING UNITS, SKIP TO Q. 153.]

[IF THIS IS A BUILDING WITH 2 TO 4 HOUSING UNITS, SKIP TO Q. 150.]

[IF THIS IS A ONE-FAMILY HOUSE, CONTINUE WITH Q. 147.]

HAND RESPONDENT EXHIBIT 147

147. Does this house have a basement, an enclosed crawl space, a crawl space open to the outside, a concrete slab, or a combination of these?

BASEMENT

CRAWL SPACE -- ENCLOSED

1213

CRAWL SPACE -- OPEN TO THE OUTSIDE

CONCRETE SLAB -- SKIP TO Q. 153

COMBINATION (MARK ALL THAT APPLY.)

BASEMENT

1214

CRAWL SPACE -- ENCLOSED

1215

CRAWL SPACE -- OPEN TO THE OUTSIDE

1216

CONCRETE SLAB

1217

TAKE BACK EXHIBIT 147

[IF "BASEMENT," "CRAWL SPACE," OR "COMBINATION," ASK:]

148. Is all, part, or none of the basement or crawl space heated?

ALL -- SKIP TO Q. 153

1218

PART

NONE

[IF RESPONDENT ASKS, A BASEMENT IS CONSIDERED HEATED  
IF IT IS A COMFORTABLE PLACE TO SIT, WORK, OR PLAY,  
ETC., YEAR-ROUND]

[IF "PART," OR "NONE" IS HEATED, HAND RESPONDENT EXHIBIT 149 AND ASK:]

149. About how much of the floor area above the unheated basement or crawl space is insulated?

NONE, VERY LITTLE (LESS THAN 4%)

1/4 (5 - 33%)

1/2 (34 - 66%)

3/4 (67 - 95%)

ALL (96 - 100%)

DON'T KNOW

1219

TAKE BACK EXHIBIT 149; SKIP TO Q. 153

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 33

**IF THIS IS A BUILDING WITH 2 TO 4 HOUSING UNITS, ASK Q. 150. OTHERWISE, SKIP TO Q. 153.**

150. Does this building have a basement?       YES      1220  
     NO

**IF "YES," ASK:**

151. Is any part of the basement for the exclusive or primary use of your household?       YES      1221  
     NO

**IF "YES," ASK:**

152. Thinking of the basement space used by your household -- is all, part, or none of that space heated?       ALL      1222  
     PART  
     NONE

**IF RESPONDENT ASKS, A BASEMENT IS CONSIDERED HEATED IF IT IS A COMFORTABLE PLACE TO SIT, WORK, OR PLAY, ETC., YEAR-ROUND.**

**ASK EVERYONE**

**HAND RESPONDENT EXHIBIT 153**

153. Since September 1980, have any of the kinds of things listed on this exhibit been done to your home -- that is, anything that has either increased or decreased the total number of square feet of space, or that has changed the number of square feet of heated space?       YES      1223  
     NO

**IF "YES", TO Q. 153**

154. Did the total number of square feet of space increase, decrease, or remain the same?       INCREASED      1224  
     DECREASED  
     REMAINED THE SAME

155. Did the amount of heated space increase, decrease, or remain the same?       INCREASED      1225  
     DECREASED  
     REMAINED THE SAME

156. Please give me a description of the work that was done.      1226-  
    1227

157. In what month and year was the work completed?      MONTH: \_\_\_\_\_ 1228-  
    YEAR: 198 \_\_\_\_\_ 1229

**TAKE BACK EXHIBIT 153**

158. So far, we've been talking about things in your household that affect your energy use. What we need also is a measure of your year-round living space.

With your permission, I would like to measure your home. I can do it from the inside or the outside. With your home, I think it would be most accurate to do it on the (inside/outside).

#### INTERVIEWER INSTRUCTIONS:

In general, measure all parts of the housing unit enclosed from the weather.

##### Basements or cellars

Include basements or cellars in one-family houses.

Include basement space in buildings with 2 to 4 housing units, if it is for the exclusive or primary use of household for this interview. See Q. 151.

Exclude basements and cellars in buildings with 5 or more units.

Exclude crawl spaces.

##### Attics

Include attics if heated or finished.

Exclude attics if unheated and also unfinished.

##### Garages, sheds, or barns

Include garages if attached to house and enclosed from the weather.

Exclude garages, sheds, or barns if not attached to house or if open to the weather.

##### Porches

Include porches if enclosed from the weather.

Exclude porches if open to the weather.

Buildings with 2 or more housing units: Measure only the space used by household for this interview (do not measure the entire building).

Unheated areas: Within the housing unit that you measure, indicate unheated area(s) in the diagrams with lines. Give dimensions of unheated area(s).

Indicate unheated  
areas this way →



USE BACKS OF MEASUREMENT PAGES FOR ADDITIONAL SPACE AS NEEDED, FOR SKETCHES AND MEASUREMENTS.

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 35

START HERE

if this household has a basement or cellar (see instruction on facing page for basements and cellars)

RECORD MEASUREMENTS ON DIAGRAM TO NEAREST FOOT

BASEMENT MEASUREMENTS		<input type="checkbox"/> FULL BASEMENT <input type="checkbox"/> HALF BASEMENT
RECTANGULAR SHAPE		DRAW DIAGRAM, IF OTHER THAN RECTANGULAR

INTERVIEWER: HAVE YOU MARKED WITH LINES AND GIVEN DIMENSIONS OF UNHEATED AREAS IN DIAGRAM ABOVE?

START HERE

if this household does not have a basement or cellar

FIRST STORY MEASUREMENTS		<input type="checkbox"/> FULL STORY <input type="checkbox"/> HALF STORY
RECTANGULAR SHAPE		DRAW DIAGRAM, IF OTHER THAN RECTANGULAR

INTERVIEWER: HAVE YOU MARKED WITH LINES AND GIVEN DIMENSIONS OF UNHEATED AREAS IN DIAGRAM ABOVE?

CONTINUE ON PAGE 41  
FOR SECOND AND THIRD STORIES

FOR OFFICE USE ONLY

FIR Codes	Unit A			Unit B			Unit C			Unit D			% of Units		
1232	33	34	35	36-37	38-39	40	41-42	43-44	45	46-47	48-49	50	51-52	53-54	55
B															
1238	57	58	59	60-61	62-63	64	65-66	67-68	69	70-71	72-73	74	75-76	77-78	79
1															

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 36

**IF NO SECOND OR THIRD STORY TO MEASURE, GO TO Q. 159**

RECORD MEASUREMENTS ON DIAGRAM TO NEAREST FOOT

SECOND STORY MEASUREMENTS		<input type="checkbox"/> FULL STORY <input type="checkbox"/> HALF STORY
RECTANGULAR SHAPE	DRAW DIAGRAM, IF OTHER THAN RECTANGULAR	
[ ]		
[ ]		

INTERVIEWER: HAVE YOU MARKED WITH LINES AND GIVEN DIMENSIONS OF UNHEATED AREAS IN DIAGRAM ABOVE?

THIRD STORY MEASUREMENTS		<input type="checkbox"/> FULL STORY <input type="checkbox"/> HALF STORY
RECTANGULAR SHAPE	DRAW DIAGRAM, IF OTHER THAN RECTANGULAR	
[ ]		
[ ]		

INTERVIEWER: HAVE YOU MARKED WITH LINES AND GIVEN DIMENSIONS OF UNHEATED AREAS IN DIAGRAM ABOVE?

FOR OFFICE USE ONLY

1307-1308:13

Fir Codes	Unit A	Unit B			Unit C			Unit D			# of Units	
1333	13	13	14	15-16	17-18	19	20-21	22-23	24	25-26	27-28	29
2												
1335	38	37	38	39-40	41-42	43	44-45	46-47	48	49-50	51-52	53
3												

Heated	Unheated	DK Htd/Unhtd
1350-1363	1364-1368	1369-1373

TOTALS		
H	UH	DK
74	75	76

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 37

159. One part of my task is to mark on my diagram any parts of your home that are not heated during the heating season.

TELL RESPONDENT WHAT PARTS OF HOME, IF ANY, YOU HAVE MARKED AS NOT HEATED DURING HEATING SEASON. THEN ASK:

Is that correct -- have I missed any unheated areas?

REVISE SKETCHES AS NECESSARY;  
THEN MARK APPROPRIATE BOX AT  
RIGHT

- 01[] NO UNHEATED AREAS  
 02[] ALL UNHEATED AREAS HAVE BEEN  
MARKED WITH LINES   
 03[] ENTIRE UNIT IS UNHEATED (NO  
HEATING EQUIPMENT)

1374

160. INTERVIEWER:

MARK BOX TO INDICATE HOW MEASUREMENTS  
WERE OBTAINED FOR (HOUSE/APARTMENT)

- 01[] MEASURED INSIDE  
 02[] MEASURED OUTSIDE  
 03[] COMBINATION OF INSIDE AND  
OUTSIDE MEASUREMENTS  
 04[] RESPONDENT GAVE TOTAL  
SQUARE FEET FROM PLAN  
 05[] RESPONDENT'S ESTIMATES  
 06[] OTHER MEASUREMENT  
PROCEDURE (SPECIFY): \_\_\_\_\_

1375-  
1376

TURN PAGE TO COMPLETE INTERVIEW

FOR OFFICE  
USE ONLY

FL	LOT

1377-  
1379

ITEM 4. HOUSEHOLD SURVEY MATERIALS  
Household questionnaire -- page 38

INTERVIEWER REPORT ON MEASUREMENT OF YEAR-ROUND LIVING SPACE

161. WHAT PROBLEMS, IF ANY, DID YOU HAVE IN MEASURING THIS (HOUSE/APARTMENT)?

162. WHAT EFFECT, IF ANY, DID THESE PROBLEMS HAVE ON THE ACCURACY OF YOUR MEASUREMENTS?

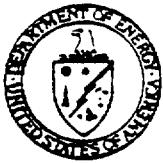
1407-1408:14

TIME INTERVIEW COMPLETED:	AM	PM	LENGTH OF INTERVIEW:	MINUTES	1412- 1413
INTERVIEWER'S SIGNATURE			DATE:		1414- 1419
INTERVIEWER'S I.D. #:					

FOR OFFICE USE ONLY

Q.8a				1420
Q.8b				1421- 1424
Q.8c				1425- 1426
Q.31a				1427
Q.31b				1428- 1431
Q.31c				1432- 1433

Q.37a				1434
Q.37b				1435- 1438
Q.37c				1439
Q.37d				1440
Q.37e				1441- 1444
Q.108b				1445 1446



OMB NO. 1905-0092  
(Expires 8/31/83)  
EIA-4F7E F-4450

**U.S. DEPARTMENT OF ENERGY**

**NATIONAL SURVEY OF HOUSEHOLDS RECEIVING  
LOW-INCOME WEATHERIZATION ASSISTANCE**

Conducted by  
RESPONSE ANALYSIS CORPORATION  
Research Park, Route 206  
P.O. Box 158  
Princeton, New Jersey 08540

**ELECTRICITY**

**BILLING RECORD**

These data will be combined with similar data throughout the U.S. in an analysis of use of energy by homes receiving low-income weatherization assistance.

This research is being conducted by Response Analysis Corporation under U.S. Department of Energy Contract Number DE-AC01-82EI-11557. This survey is mandatory as authorized by the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended by the Energy Conservation and Production Act (Public Law 94-385).

Information about specific households will be kept confidential in accordance with the provisions of the Privacy Act of 1974. The data will be summarized within large groupings for statistical purposes.

ITEM 9. UTILITY SURVEY MATERIALS  
Electricity reporting form -- page 2

2

HOUSEHOLD:

If the customer account number is not shown, please enter it.

If you have any questions, please call collect to Ms. Luci Raam at (609) 921-3333

CUSTOMER  
ACCOUNT #:

ELECTRICITY USAGE FROM JANUARY 1, 1980, THROUGH DECEMBER 31, 1982

Time Period	Consumption Period		Number of kWh used	(Circle One) kWh are:			Total Dollar Amount
	Beginning Date	Ending Date		A - Actual	E - Estimate	R - Read by Customer	
1				A	E	R	
2				A	E	R	
3				A	E	R	
4				A	E	R	
5				A	E	R	
6				A	E	R	
7				A	E	R	
8				A	E	R	
9				A	E	R	
10				A	E	R	
11				A	E	R	
12				A	E	R	
13				A	E	R	
14				A	E	R	
15				A	E	R	
16				A	E	R	
17				A	E	R	
18				A	E	R	

\*Please include state and local taxes. Exclude merchandise, repair, and service charges. If the household is on the budget plan, do not provide the budgeted bill; provide instead the dollar amount that is the cost of the actual consumption in the period.

ITEM 9. UTILITY SURVEY MATERIALS  
Electricity reporting form -- page 3

3

Time Period	Consumption Period		Number of kWh Used	(Circle One) kWh are:			Total Dollar Amount
	Beginning Date	Ending Date		A - Actual	E - Estimate	R - Read by Customer	
19				A	E	R	
20				A	E	R	
21				A	E	R	
22				A	E	R	
23				A	E	R	
24				A	E	R	
25				A	E	R	
26				A	E	R	
27				A	E	R	
28				A	E	R	
29				A	E	R	
30				A	E	R	
31				A	E	R	
32				A	E	R	
33				A	E	R	
34				A	E	R	
35				A	E	R	
36				A	E	R	
37				A	E	R	
38				A	E	R	
39				A	E	R	
40				A	E	R	

Form completed by \_\_\_\_\_  
(Name) \_\_\_\_\_  
(Telephone Number) \_\_\_\_\_  
(Date) \_\_\_\_\_



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## U.S. DEPARTMENT OF ENERGY

### NATIONAL SURVEY OF HOUSEHOLDS RECEIVING LOW-INCOME WEATHERIZATION ASSISTANCE

Conducted by  
RESPONSE ANALYSIS CORPORATION  
Research Park, Route 206  
P.O. Box 158  
Princeton, New Jersey 08540

UTILITY GAS

BILLING RECORD

These data will be combined with similar data throughout the U.S. in an analysis of use of energy by homes receiving low-income weatherization assistance.

This research is being conducted by Response Analysis Corporation under U.S. Department of Energy Contract Number DE-AC01-82EI-11557. This survey is mandatory as authorized by the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended by the Energy Conservation and Production Act (Public Law 94-385).

Information about specific households will be kept confidential in accordance with the provisions of the Privacy Act of 1974. The data will be summarized within large groupings for statistical purposes.

ITEM 10. UTILITY SURVEY MATERIALS  
Utility gas reporting form -- page 2

2

HOUSEHOLD:

If the customer account number is not shown, please enter it.

If you have any questions, please call collect to Ms. Luci Raauw at (609) 921-3333

CUSTOMER  
ACCOUNT #:

Information about specific households will be kept strictly confidential. The data will be summarized within large groupings for statistical purposes.

UTILITY GAS USAGE FROM JANUARY 1, 1980, THROUGH DECEMBER 31, 1982							
Time Period	Consumption Period		Quantity Used*	(Circle One) Quantities are:			Total Dollars Amount
	Beginning Date	Ending Date		A - Actual	E - Estimate	R - Read by Customer	
1				A	E	R	
2				A	E	R	
3				A	E	R	
4				A	E	R	
5				A	E	R	
6				A	E	R	
7				A	E	R	
8				A	E	R	
9				A	E	R	
10				A	E	R	
11				A	E	R	
12				A	E	R	
13				A	E	R	
14				A	E	R	
15				A	E	R	
16	-			A	E	R	
17				A	E	R	
18				A	E	R	

\*The quantity used is expressed in terms of: (Mark one)

- Therms
- Cubic Feet
- Hundreds of Cubic Feet (CCF)
- Thousands of Cubic Feet (MCF)
- Other (Please specify): \_\_\_\_\_

\*\*Please include state and local taxes. Exclude merchandise, repairs, and service charges. If the household is on the budget plan, do not provide the budgeted bill; provide instead the dollar amount that is the cost of the actual consumption in the period.

ITEM 10. UTILITY SURVEY MATERIALS  
Utility gas reporting form -- page 3

3

Time Period	Consumption Period		Quality Used*	(Circle One) Quantities are: A - Actual E - Estimates R - Read by Customer	Total Dollar** Amount
	Beginning Date	Ending Date			
19				A E R	
20				A E R	
21				A E R	
22				A E R	
23				A E R	
24				A E R	
25				A E R	
26				A E R	
27				A E R	
28				A E R	
29				A E R	
30				A E R	
31				A E R	
32				A E R	
33				A E R	
34				A E R	
35				A E R	
36				A E R	
37				A E R	
38				A E R	
39				A E R	
40				A E R	

Form completed by \_\_\_\_\_ (Name) \_\_\_\_\_ (Telephone Number) \_\_\_\_\_ (Date)



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U.S. DEPARTMENT OF ENERGY

NATIONAL SURVEY OF HOUSEHOLDS  
RECEIVING WEATHERIZATION ASSISTANCE

Conducted by  
RESPONSE ANALYSIS CORPORATION  
Research Park, Route 206  
P.O. Box 158  
Princeton, New Jersey 08540

FUEL OIL OR KEROSENE  
HOUSEHOLD  
DELIVERY/PURCHASE RECORD

These data will be combined with similar data throughout the U.S. in an analysis of use of energy by homes receiving low-income weatherization assistance.

This research is being conducted by Response Analysis Corporation under U.S. Department of Energy Contract Number DE-AC01-82EI-11557. This survey is mandatory as authorized by the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended by the Energy Conservation and Production Act (Public Law 94-385).

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## ITEM 11. UTILITY SURVEY MATERIALS

Fuel oil or kerosene reporting form -- page 2

2

## HOUSEHOLD:

If you have any questions, please  
call collect to Lucy Radium at  
(609) 921-3333.

FUEL OIL AND KEROSENE USAGE

Please provide information on all deliveries to this household from January 1, 1980, through December 30, 1982. If information is available only for a shorter period, just report deliveries for that shorter period.

Del. #	Date of Delivery	Column 2	Column 3	Column 4	Column 5	Column 6
		Fuel Sold Was:	Gallons Delivered	Price per Gallon	Total Dollar Amount*	Was tank completely filled: Yes      No      Don't Know (OK) (Circle one)
1		1 2 X 0				YES NO OK
2		1 2 X 0				YES NO OK
3		1 2 X 0				YES NO OK
4		1 2 X 0				YES NO OK
5		1 2 X 0				YES NO OK
6		1 2 X 0				YES NO OK
7		1 2 X 0				YES NO OK
8		1 2 X 0				YES NO OK
9		1 2 X 0				YES NO OK
10		1 2 X 0				YES NO OK
11		1 2 X 0				YES NO OK
12		1 2 X 0				YES NO OK
13		1 2 X 0				YES NO OK
14		1 2 X 0				YES NO OK
15		1 2 X 0				YES NO OK
16		1 2 X 0				YES NO OK
17		1 2 X 0				YES NO OK
18		1 2 X 0				YES NO OK

PLEASE CONTINUE ON PAGE 4 IF NECESSARY.

\*Please include state and local sales taxes, where applicable. Exclude merchandise, repairs, or service charges.

ITEM II. UTILITY SURVEY MATERIALS  
Fuel oil or kerosene reporting form -- page 3

3

FUEL OIL AND KEROSENE

1. If "Other" has been circled for type of fuel in Column 2 (page 2 or page 4), please specify what fuel was sold:

\_\_\_\_\_

NOT APPLICABLE

2. What was the capacity of this household's storage tank as of December 31, 1982?

CAPACITY: \_\_\_\_\_ GALLONS

3. Was this household your customer as of January 1, 1980?

YES

NO

[If "NO," approximately when did this household become a customer of your company?]

APPROXIMATE DATE: \_\_\_\_\_

DON'T KNOW

NEVER A CUSTOMER

4. Was this household your customer as of December 31, 1982?

YES

NO

[If "NO," approximately when did this household stop being a customer of your company?]

APPROXIMATE DATE: \_\_\_\_\_

DON'T KNOW

NEVER A CUSTOMER

5. As far as you know, was your company the only supplier of fuel oil and/or kerosene to this household during the period specified above (from January 1, 1980, to December 31, 1982, unless other dates have been entered in answers to questions 3 and 4)?

THIS COMPANY WAS THE ONLY SUPPLIER  
 THE HOUSEHOLD WAS ALSO SUPPLIED BY OTHER COMPANIES  
 NOT SURE

6. The information presented here is from:

COMPANY RECORDS  
 AN ESTIMATE MADE BY A COMPANY REPRESENTATIVE  
 INFORMATION SECURED FROM THE CUSTOMER

7. This information has been supplied by:

(Name)

(Company)

(Telephone)

(Date)

ITEM 11. UTILITY SURVEY MATERIALS  
Fuel oil or kerosene reporting form -- page 4

4

FUEL OIL AND KEROSENE

Del. #	Date of Delivery	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
		(Circle one)	Fuel Sold Was:	Gallons Delivered	Price per Gallon	Total Dollar Amount*	Was tank completely filled?
19		I 2 K 0					YES NO OK
20		I 2 K 0					YES NO OK
21		I 2 K 0					YES NO OK
22		I 2 K 0					YES NO OK
23		I 2 K 0					YES NO OK
24		I 2 K 0					YES NO OK
25		I 2 K 0					YES NO OK
26		I 2 K 0					YES NO OK
27		I 2 K 0					YES NO OK
28		I 2 K 0					YES NO OK
29		I 2 K 0					YES NO OK
30		I 2 K 0					YES NO OK
31		I 2 K 0					YES NO OK
32		I 2 K 0					YES NO OK
33		I 2 K 0					YES NO OK
34		I 2 K 0					YES NO OK
35		I 2 K 0					YES NO OK
36		I 2 K 0					YES NO OK
37		I 2 K 0					YES NO OK
38		I 2 K 0					YES NO OK
39		I 2 K 0					YES NO OK
40		I 2 K 0					YES NO OK

\*Please include state and local sales taxes, where applicable. Exclude merchandise, repairs, or service charges.

PLEASE CHECK THAT THE QUESTIONS ON PAGE THREE HAVE BEEN ANSWERED.



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U.S. DEPARTMENT OF ENERGY

NATIONAL SURVEY OF HOUSEHOLDS RECEIVING  
LOW-INCOME WEATHERIZATION ASSISTANCE

Conducted by  
RESPONSE ANALYSIS CORPORATION  
Research Park, Route 206  
P.O. Box 158  
Princeton, New Jersey 08540

LIQUEFIED PETROLEUM GAS (LP-GAS)  
HOUSEHOLD  
DELIVERY/PURCHASE RECORD

These data will be combined with similar data throughout the U.S. in an analysis of use of energy by homes receiving low-income weatherization assistance.

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Information about specific households will be kept confidential in accordance with the provisions of the Privacy Act of 1974. The data will be summarized within large groupings for statistical purposes.

ITEM 12. UTILITY SURVEY MATERIALS  
Liquefied petroleum gas reporting form -- page 2

2

LIQUEFIED PETROLEUM GAS (LPG)

Qnty. #	Date of Delivery	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
		Fuel Sold Was:	(Circle one)	Quantity Delivered	Price per Unit	Total Dollar Amount*	Was tank/cylinder completely filled? Yes      No      Don't Know (OK) (Circle one)
19		P	B	0			YES NO OK
20		P	B	0			YES NO OK
21		P	B	0			YES NO OK
22		P	B	0			YES NO OK
23		P	B	0			YES NO OK
24		P	B	0			YES NO OK
25		P	B	0			YES NO OK
26		P	B	0			YES NO OK
27		P	B	0			YES NO OK
28		P	B	0			YES NO OK
29		P	B	0			YES NO OK
30		P	B	0			YES NO OK
31		P	B	0			YES NO OK
32		P	B	0			YES NO OK
33		P	B	0			YES NO OK
34		P	B	0			YES NO OK
35		P	B	0			YES NO OK
36		P	B	0			YES NO OK
37		P	B	0			YES NO OK
38		P	B	0			YES NO OK
39		P	B	0			YES NO OK
40		P	B	0			YES NO OK

\*Please include state and local sales taxes, where applicable. Exclude merchandise, repairs, or service charges.

PLEASE CHECK THAT THE QUESTIONS ON PAGE THREE HAVE BEEN ANSWERED.

ITEM 12. UTILITY SURVEY MATERIALS  
Liquefied petroleum gas reporting form -- page 3

3

LIQUEFIED PETROLEUM GAS (LPG)

1. If "Other" has been circled for type of fuel in Column 2 (page 2 or page 4), please specify what fuel was sold?

NOT APPLICABLE

2. Please mark unit of measure for deliveries reported on page 2.

POUNDS       CUBIC METERS  
 GALLONS       DECATHERMS  
 CUBIC FEET       OTHER (Please specify):

3. What was the capacity of this household's storage tank(s) as of December 31, 1982?

Capacity was \_\_\_\_\_, measured  
in number of:

POUNDS  
 GALLONS  
 OTHER UNIT (please specify):

4. Were you supplying this household on January 1, 1980?

YES  
 NO

IF "NO," approximately when did this household become a customer of your company?

APPROXIMATE DATE \_\_\_\_\_

DON'T KNOW  
 NEVER A CUSTOMER

5. Was this household your customer as of December 31, 1982?

YES  
 NO

IF "NO," when did this household stop being a customer of your company?

APPROXIMATE DATE \_\_\_\_\_

DON'T KNOW  
 NEVER A CUSTOMER

6. As far as you know, was your company the only supplier of fuel oil and/or kerosene to this household during the period specified above (from January 1, 1980, to December 31, 1982, unless other dates have been entered in answers to questions 4 and 5)?

THIS COMPANY WAS THE ONLY SUPPLIER  
 THE HOUSEHOLD WAS ALSO SUPPLIED BY OTHER COMPANIES  
 NOT SURE

7. The information reported here is from:

COMPANY RECORDS  
 AN ESTIMATE MADE BY A COMPANY REPRESENTATIVE  
 INFORMATION SECURED FROM THE CUSTOMER

8. This information has been supplied by:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

ITEM 12. UTILITY SURVEY MATERIALS  
Liquefied petroleum gas reporting form -- page 4

4

LIQUEFIED PETROLEUM GAS (LPG)

Del. #	Date of Delivery	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
		Fuel Sold Was:	Propane P Butane B Other O (Circle one)	Quantity Delivered	Price per Unit	Total Dollar Amount*	Was tank/cylinder completely filled? Yes No Don't Know (OK) (Circle one)
19		P B O					YES NO OK
20		P B O					YES NO OK
21		P B O					YES NO OK
22		P B O					YES NO OK
23		P B O					YES NO OK
24		P B O					YES NO OK
25		P B O					YES NO OK
26		P B O					YES NO OK
27		P B O					YES NO OK
28		P B O					YES NO OK
29		P B O					YES NO OK
30		P B O					YES NO OK
31		P B O					YES NO OK
32		P B O					YES NO OK
33		P B O					YES NO OK
34		P B O					YES NO OK
35		P B O					YES NO OK
36		P B O					YES NO OK
37		P B O					YES NO OK
38		P B O					YES NO OK
39		P B O					YES NO OK
40		P B O					YES NO OK

\*Please include state and local sales taxes, where applicable. Exclude merchandise, repairs, or service charges.

PLEASE CHECK THAT THE QUESTIONS ON PAGE THREE HAVE BEEN ANSWERED.



